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Waste Isolation. February 1985. 590 refs. DOE/TIC-3388 (Suppl.1) (DE85003092).

This publication is available as DE94014096

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THE OFFICE OF TECHNOLOGY DEVELOPMENT TECHNICAL REPORTS

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ABOUT THIS BIBLIOGRAPHY

The U.S. Department of Energy's Office of Technology Development (OTD) within the Office of Environmental Management was established in 1989 to conduct an aggressive national program of applied research, development, demonstration, testing, and evaluation (RDDT&E) for innovative environmental cleanup solutions that are safer and more time- and cost-effective than those currently available. In many cases, the development of new technology presents the best hope for ensuring a substantive reduction in risk to the environment and improved worker/public safety within realistic financial constraints. Five major remediation and waste management problem areas have been identified to date within the DOE weapons complex: Contaminant Plume Containment and Remediation; Mixed Waste Characterization, Treatment, and Disposal; High-Level Waste Tank Remediation; Landfill Stabilization; and Facility Transitioning, Decommissioning, and Final Disposition. New technologies to address these problem areas are demonstrated to the point that they are proven to work and that they can be transferred to the private sector end-users.

This bibliography contains information on scientific and technical reports sponsored by the Office of Environmental Management from its inception in 1989 through June 1994. Future issues contain reports from Technology Development activities and will be published biannually.

Questions pertaining to the technical contents of this bibliography should be addressed to Lana Nichols (301) 903-8493, who coordinated this publication.

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Technology Development Technical Reports

CONTAMINANT PLUME CONTAINMENT AND REMEDIATION

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1 (ANL-94/9) Surveillance of Site A and Plot M - report for 1993. Golchert, N.W. Argonne National Lab., IL (United States). May 1994. 48p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE94012403. Source: OSTI; NTIS; INIS; GPO Dep.

The results of the environmental surveillance program conducted at Site A/Plot M in the Palos Forest Preserve area for CY 1993 are presented. The surveillance program is the ongoing remedial action that resulted from the 1976-1978 radiological characterization of the site. That study determined that very low levels of hydrogen-3 (as tritiated water) had migrated from the burial ground and were present in two nearby hand-pumped picnic wells. The current program consists of sample collection and analysis of air, surface and subsurface water, and bottom sediment. The results of the analyses are used to (1) determine the migration pathway of water from the burial ground (Plot M) to the hand-pumped picnic wells, (2) establish if buried radionuclides other than hydrogen-3 have migrated, and (3) generally characterize the radiological environment of the area. Hydrogen-3 in the Red Gate Woods picnic wells was still detected this year, but the average and maximum concentrations were significantly less than found earlier. Tritiated water continues to be detected in a number of wells, boreholes, dolomite holes, and a surface stream. For many years it was the only radionuclide found to have migrated in measurable quantities. Analyses since 1984 have indicated the presence of low levels of strontium-90 in water from a number of boreholes next to Plot M. The available data does not allow a firm conclusion as to whether the presence of this nuclide represents recent migration or movement that may have occurred before Plot M was capped. The results of the surveillance program continue to indicate that the radioactivity remaining at Site A/Plot M does not endanger the health or safety of the public visiting the site, using the picnic area, or living in the vicinity.

2 (ANL/CMT/CP-79321) Preliminary results from the investigation of thermal effects in electrokinetics soil remediation. Krause, T.R.; Tarman, B. Argonne National Lab., IL (United States). [1993]. 19p. Sponsored by

USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9309146-3: 5. annual American Chemical Society (ACS) Industrial and Engineering Chemistry (I&EC) Division special symposium on emerging technologies for hazardous waste management, Atlanta, GA (United States), 27-29 Sep 1993). Order Number DE94000443. Source: OSTI; NTIS; INIS; GPO Dep.

Electrokinetics is an emerging soil remediation technology. Contaminants are extracted from the soil as a result of a complex set of phenomena that occur when an electric gradient is imposed across a soil-water system. The primary phenomena include electroosmosis, electromigration, and electrophoresis. Secondary phenomena, such as changes in solubility or speciation of various chemical components, may occur as a result of electrically induced changes in the chemical environment of the system. Numerous factors, such as temperature, may affect each of these phenomena and, consequently, the overall process efficiency. We have begun an investigation of thermal effects in the extraction of potassium dichromate from kaolinite soils under conditions of constant saturation and dewatering. Preliminary results suggest that increasing the soil temperature from 21 to 55°C may decrease the processing time under saturated conditions. However, increasing the soil temperature under dewatering, conditions causes soil cracking, which reduces the overall process efficiency.

3 (ANL/CMT/CP-79523) Applications of microwave radiation environmental remediation technologies. Krause, T.R.; Helt, J.E. Argonne National Lab., IL (United States). Chemical Technology Div. [1993]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930438-12: 95. annual meeting of the American Ceramic Society, Cincinnati, OH (United States), 18-22 Apr 1993). Order Number DE93012903. Source: OSTI; NTIS; INIS; GPO Dep.

A growing number of environmental remediation technologies (e.g., drying, melting, or sintering) utilize microwave radiation as an integral part of the process. An increasing number of novel applications, such as sustaining low-temperature plasmas or enhancing chemical reactivity, are also being developed. An overview of such technologies being developed by the Department of Energy is presented. A specific example being developed at Argonne National Laboratory, microwave-induced plasma reactors for the destruction of volatile organic compounds, is discussed in more detail.

4 (ANL/CMT/CP-80310) Innovative environmental restoration and waste management technologies at Argonne National Laboratory. Helt, J.E. Argonne National Lab., IL (United States). [1993]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9310179-1: CONEC '93: conference on environmental commerce, Chattanooga, TN (United States), 17-20 Oct 1993). Order Number DE93041171. Source: OSTI; NTIS; INIS; GPO Dep.

Cleanup of contaminated sites and management of wastes have become major efforts of the US Department of

Energy. Argonne National Laboratory (ANL) is developing several new technologies to meet the needs of this national effort. Some of these efforts are being done in collaboration with private sector firms. An overview of the ANL and private sector efforts will be presented. The following four specific technologies will be discussed in detail: (1) a minimum additive waste stabilization (MAWS) system for treating actinide-contaminated soil and groundwater; (2) a magnetic separation system, also for cleanup of actinide-contaminated soil and groundwater; (3) a mobile evaporator/concentrator system for processing aqueous radioactive and mixed waste; and (4) a continuous emission monitor for ensuring that waste incineration meets environmental goals.

5 (ANL/CMT/CP-80618) Management of radioactive waste from nuclear power plants. Argonne National Lab., IL (United States); Atomic Energy of Canada Ltd., Pinawa, MB (Canada). Whiteshell Labs. [1993]. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9308152-3: ICRP-60: International Atomic Energy Agency interregional training course on management of radioactive waste from nuclear power plants, Argonne, IL (United States), 23 Aug - 17 Sep 1993). Order Number DE93040274. Source: OSTI; NTIS; INIS; GPO Dep.

Even though risk assessment is an essential consideration in all projects involving radioactive or hazardous waste, its public role is often unclear, and it is not fully utilized in the decision-making process for public acceptance of such facilities. Risk assessment should be an integral part of such projects and should play an important role from beginning to end, i.e., from planning stages to the closing of a disposal facility. A conceptual model that incorporates all potential pathways of exposure and is based on site-specific conditions is key to a successful risk assessment. A baseline comparison with existing standards determines, along with other factors, whether the disposal site is safe. Risk assessment also plays a role in setting priorities between sites during cleanup actions and in setting cleanup standards for certain contaminants at a site. The applicable technologies and waste disposal designs can be screened through risk assessment.

6 (ANL/CMT/CP-80854) Supporting soil remediation at Fernald by electron beam methods. Buck, E.C.; Brown, N.R.; Dietz, N.L.; Cunnane, J.C. Argonne National Lab., IL (United States). [1994]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940225-34: Waste management '94, Tucson, AZ (United States), 27 Feb - 3 Mar 1994). Order Number DE94006831. Source: OSTI; NTIS; INIS; GPO Dep.

Electron beam techniques have been used to characterize uranium-contaminated soils at the Fernald Site, Ohio. The major uranium phases have been identified by analytical electron microscopy (AEM) as uranyl phosphate (autunite), uranium oxide (uraninite), and uranium phosphite [$U(PO_3)_4$]. Luminescence and X-ray absorption spectroscopy incorrectly identified uranium oxide hydrate (schoepite) as the major phase in Fernald soils. The solubilities of schoepite and autunite are very different, so a solubility-dependent remediation method selected for schoepite will not be effective for removing autunite. AEM is the only technique capable of precisely identifying unknown submicron phases. The uranium phosphite has been found predominantly at the incinerator site at Fernald. This phase has not been removed

successfully by any of the chemical remediation technologies. We suggest that an alternative physical extraction procedure be applied to remove this phase.

7 (ANL/CP-72668) SOILD: A computer model for calculating the effective dose equivalent from external exposure to distributed gamma sources in soil. Chen, S.Y. (Argonne National Lab., IL (United States)); LePore, D.; Yu, C.; Schafetz, S.; Mehta, P. Argonne National Lab., IL (United States). [1991]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-910981-4: Environmental remediation '91 conference, Pasco, WA (United States), 8-11 Sep 1991). Order Number DE91018544. Source: OSTI; NTIS; INIS; GPO Dep.

The SOLID computer model was developed for calculating the effective dose equivalent from external exposure to distributed gamma sources in soil. It is designed to assess external doses under various exposure scenarios that may be encountered in environmental restoration programs. The model has four major functional features address (1) dose versus source depth in soil, (2) shielding of clean cover soil, (3) area of contamination, and (4) nonuniform distribution of sources. The model is also capable of adjusting doses when there are variations in soil densities for both source and cover soils. The model is supported by a data base of approximately 500 radionuclides. 4 refs.

8 (ANL/CP-72946) Taking interim actions: Integrating CERCLA and NEPA to move ahead with site cleanup. MacDonell, M.M. (Argonne National Lab., IL (United States)); Peterson, J.M.; Valett, G.L.; McCracken, S.H. Argonne National Lab., IL (United States). [1991]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-910981-47: Environmental remediation '91 conference, Pasco, WA (United States), 8-11 Sep 1991). Order Number DE92003450. Source: OSTI; NTIS; INIS; GPO Dep.

The cleanup of contaminated sites can be expedited by using interim response actions in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). In fact, a major portion of some Superfund sites can be cleaned up using interim actions. For CERCLA sites being remediated by the US Department of Energy (DOE), such actions must also comply with the National Environmental Policy Act (NEPA) because the DOE has established a policy for integrating CERCLA and NEPA requirements. A strategy for the integrated documentation with implementation of interim actions has been applied successfully at the Weldon Spring site, and major cleanup projects are currently underway. This paper discusses some of the issues associated with integrating CERCLA and NEPA for interim actions and summarizes those actions that have been identified for the Weldon Spring site.

9 (ANL/CP-73172) Ultrasonic process for detoxification of groundwater. Wu, Jiann M.; Huang, H.S.; Livengood, C.D. Argonne National Lab., IL (United States). [1991]. 33p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-911133-8: American Institute of Chemical Engineers (AIChE) annual meeting, Los Angeles, CA (United States), 17-22 Nov 1991). Order Number DE92004142. Source: OSTI; NTIS; INIS; GPO Dep.

In this paper, we present the results of an investigation of the ultrasonic irradiation of carbon tetrachloride at various pH values, temperatures, and power intensities. Kinetic data and selected chemical mechanism are discussed and proposed. To study oxidant efficiency, chemical oxidants, such as hydrogen peroxide, are also considered. This work is part of a project entitled "Ultrasonic Process for Detoxification of Groundwater and Soil," sponsored by the US Department of Energy, Office of Technology Development, to develop an innovative process for the effective destruction of chlorinated organics in soil and groundwater.

10 (ANL/CP-75634) Effects of solution pH and complexing reagents on uranium and thorium desorption under saturated equilibrium conditions. Wang, Yug-Yea; Yu, C. Argonne National Lab., IL (United States). [1992]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-920851-56: Spectrum '92: nuclear and hazardous waste management international topical meeting, Boise, ID (United States), 23-27 Aug 1992). Order Number DE92017092. Source: OSTI; NTIS; INIS; GPO Dep.

Three contaminated bulk surface soils were used for investigating the effect of solution pH and complexing reagents on uranium and thorium desorption. At a low solution pH, the major chemical species of uranium and thorium, uranyl UO_2^{+2} , thorium dihydroxide $\text{Th}(\text{OH})_2^{+2}$, and thorium hydroxide $\text{Th}(\text{OH})^{+3}$, tend to form complexes with acetates in the solution phase, which increases the fractions of uranium and thorium desorbed into this phase. At a high solution pH, important uranium and thorium species such as uranyl tricarbonate complex $\text{UO}_2(\text{CO}_3)_3^{-4}$ and thorium tetrahydroxide complex $\text{Th}(\text{OH})_4$ tend to resist complexation with acetates. The presence of complexing reagents in solution can release radionuclides such as uranium and/or thorium from the soil to the solution by forming soluble complexes. Sodium bicarbonate (NaHCO_3) and diethylenetriaminepentaacetic acid (DTPA) are strong complex formers that released 38% to 62% of total uranium activity and 78% to 86% of total thorium activity, respectively, from the soil samples investigated. Solutions of 0.1 molar sodium nitrate (NaNO_3) and 0.1 molar sodium sulfate (Na_2SO_4) were not effective complex formers with uranium and thorium under the experimental conditions. Fractions of uranium and thorium desorbed by 0.15g/200ml humic acid ranged from 4.62% to 6.17% and 1.59% to 7.09%, respectively. This work demonstrates the importance of a knowledge of solution chemistry in investigating the desorption of radionuclides.

11 (ANL/CP-75814) Effects of solution pH and complexing reagents on the desorption of radionuclides in soil. Wang, Yug-Yea; Yu, C. Argonne National Lab., IL (United States). [1992]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9205148-1: Mid-America Chinese professional annual convention, Itasca, IL (United States), 29-31 May 1992). Order Number DE92013062. Source: OSTI; NTIS; GPO Dep.

In contaminated soils, radionuclides such as uranium and/or thorium may be associated with different chemical species on soil surfaces or inside soil grains with consequent differences in leachability and mobility. Chemical species in contacting solutions can react with soil contaminants by dissolution, ion exchange, or complexation to release contaminants from the soil to the solution. It is important to understand the effect of chemical species in solution for investigating the distribution of uranium and thorium between

the soil and the solution under desorption conditions. In this work, the effects of the solution pH and the complexing reagents on the desorption of uranium and thorium under saturated equilibrium conditions were investigated.

12 (ANL/CP-76005) Evaluation of surface water treatment and discharge options for the Weldon Spring Site Remedial Action Project. Goyette, M.L.; MacDonell, M.M. Argonne National Lab., IL (United States). [1992]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-921029-6: Annual Department of Energy model conference on waste management and environmental restoration, Oak Ridge, TN (United States), 19-22 Oct 1992). Order Number DE92041105. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy (DOE), under its Environmental Restoration and Waste Management Program, is responsible for conducting response actions at the Weldon Spring site in St. Charles County, Missouri. The site consists of two noncontiguous areas: (1) the chemical plant area, which includes four raffinate pits and two small ponds, and (2) a 3.6-ha (9-acre) quarry located about 6.4 km (4 mi) southwest of the chemical plant area. Both of these areas became chemically and radioactively contaminated as a result of processing and disposal activities that took place from the 1940s through 1960s. The Weldon Spring site, located about 48 km (30 mi) west of St. Louis, is listed on the National Priorities List of the US Environmental Protection Agency. Nitroaromatic explosives were processed by the Army at the chemical plant area during the 1940s, and radioactive materials were processed by DOE's predecessor agency (the Atomic Energy Commission) during the 1950s and 1960s. Overall remediation of the Weldon Spring site is being addressed through the Weldon Spring Site Remedial Action Project, and it consists of several components. One component is the management of radioactively and chemically contaminated surface water impoundments at the chemical plant area - i.e., the four raffinate pits, Frog Pond, and Ash Pond which was addressed under a separate action and documented in an engineering evaluation/cost analysis report. This report discusses the evaluation of surface water treatment at the Weldon Spring site.

13 (ANL/EA/CP-79950) Estimating baseline risks from biouptake and food ingestion at a contaminated site. MacDonell, M.; Woytowich, K.; Blunt, D.; Picel, M. Argonne National Lab., IL (United States). [1993]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-931095-65: Department of Energy environmental remediation conference, Augusta, GA (United States), 24-28 Oct 1993). Order Number DE94003218. Source: OSTI; NTIS; INIS; GPO Dep.

Biouptake of contaminants and subsequent human exposure via food ingestion represents a public concern at many contaminated sites. Site-specific measurements from plant and animal studies are usually quite limited, so this exposure pathway is often modeled to assess the potential for adverse health effects. A modeling tool was applied to evaluate baseline risks at a contaminated site in Missouri, and the results were used to confirm that ingestion of fish and game animals from the site area do not pose a human health threat. Results were also used to support the development of cleanup criteria for site soil.

14 (ANL/EAIS-8) Data collection handbook to support modeling the impacts of radioactive material in

soil. Yu, C. (Argonne National Lab., IL (United States). Environmental Assessment and Information Sciences Div.); Cheng, J.J.; Jones, L.G.; Wang, Y.Y.; Faillace, E.; Loureiro, C.; Chia, Y.P. Argonne National Lab., IL (United States). Environmental Assessment and Information Sciences Div. Apr 1993. 152p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93015606. Source: OSTI; NTIS; INIS; GPO Dep.

A pathway analysis computer code called RESRAD has been developed for implementing US Department of Energy Residual Radioactive Material Guidelines. Hydrogeological, meteorological, geochemical, geometrical (size, area, depth), and material-related (soil, concrete) parameters are used in the RESRAD code. This handbook discusses parameter definitions, typical ranges, variations, measurement methodologies, and input screen locations. Although this handbook was developed primarily to support the application of RESRAD, the discussions and values are valid for other model applications.

15 (ANL/EAIS/CP-78705) **RESRAD update.** Yu, C. (Argonne National Lab., IL (United States)); Cheng, J.J.; Zielen, A.J.; Jones, L.G.; LePoire, D.J.; Wang, Y.Y.; Yuan, Y.C.; Loureiro, C.O.; Wallo, A. III; Peterson, H. Argonne National Lab., IL (United States). Environmental Assessment and Information Sciences Div. [1993]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930601-16: American Nuclear Society (ANS) annual meeting, San Diego, CA (United States), 20-24 Jun 1993). Order Number DE93012892. Source: OSTI; NTIS; INIS; GPO Dep.

A microcomputer program called RESRAD, which implements a pathway analysis method for radiological risk assessment, was developed by Argonne National Laboratory (ANL) in 1989. This program is used to derive allowable residual concentrations of radionuclides in soil and to predict effective dose equivalents and excess cancer incidence risks incurred by an individual exposed to radioactive materials. Since its development, the RESRAD code has been adopted by DOE in Order 5400.5 for the derivation of soil cleanup criteria and dose calculations, and it has been used widely by DOE, other agencies, and their contractors. The original models used by ANL to develop RESRAD were initially developed as part of a DOE effort that began in the early 1980s and involved most of the national laboratories and DOE program offices. The RESRAD code is continuously improved and updated to incorporate comments from users and new features that ease the interaction with users and increase the code's capability and flexibility. The DOE Offices of Environmental Guidance and Environmental Restoration also provide periodic guidance regarding any significant changes to the code. The RESRAD update, Version 5.0, has substantial improvements in many aspects compared with the last version released in 1989.

16 (ANL/EAIS/CP-79173) **A Bayesian approach to contaminant plume delineation.** Johnson, R.L. Argonne National Lab., IL (United States). Environmental Assessment and Information Sciences Div. [1993]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9306158-2: 1993 groundwater modeling conference, Boulder, CO (United States), 6-12 Jun 1993). Order Number DE93012909. Source: OSTI; NTIS; GPO Dep.

Fundamental to accurate modeling of groundwater contaminant transport is an understanding of the initial extent of

contamination. The initial location of contamination must typically be inferred from relatively little "hard" sampling data, and related "soft" information. A combination of Bayesian analysis and spatial statistics is used to generate initial estimates of contamination based both on "soft" information (i.e., prior modeling results, past experience, etc.) and "hard" data (i.e., sampling results). A Beta distribution is used to represent the probability that contamination is present for at any grid node. For every node, prior Beta probability density functions are revised into posterior distributions as additional data become available. The result is a node by node probabilistic representation of plume extent that can be updated as new information is generated, that indicates where additional sampling would have the greatest impact on the uncertainty associated with plume extent, and that can serve as the basis for Monte Carlo analysis of contaminant transport. This approach is demonstrated with information from a subsurface chromium plume beneath the chemical waste landfill at Sandia National Laboratory, Albuquerque, New Mexico.

17 (ANL/EAIS/TM-77) **Modeling vertical and horizontal solute transport for the Weldon Spring Site Remedial Action Project.** Tomasko, D. Argonne National Lab., IL (United States). Environmental Assessment and Information Sciences Div. Nov 1992. 32p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE93005781. Source: OSTI; NTIS; GPO Dep.

This technical memorandum presents a one-dimensional model to simulate the transport of a contaminant that originates as a liquid release, moves vertically downward through a vadose zone, mixes with initially clean groundwater in an unconfined aquifer, and ends at a downgradient extraction well. Vertical and horizontal segments of the contaminant pathway are coupled by assuming that the breakthrough curve of the contaminant at the water table acts as a contaminant source for the unconfined aquifer. For simplicity, this source is assumed to be a time-shifted unit square wave having an amplitude equal to the peak breakthrough concentration at the water table and a duration equal to the full width of the breakthrough curve at the half-maximum concentration value. The effects of dilution at the water-table interface are evaluated with a simple mass-balance equation. Comparing the model results for the chemical plant area of the Weldon Spring site near St. Louis, Missouri, and the Envirocare facility located near Salt Lake City, Utah, with those obtained from a solution formulated with the real and imaginary parts of a Fourier series in Laplace space indicates that the model provides a conservative estimate of the contaminant breakthrough curve at the receptor.

18 (ANL/EAIS/TM-79) **Modeling groundwater flow at the chemical plant area of the Weldon Spring Site.** Durham, L.A. Argonne National Lab., IL (United States). Environmental Assessment and Information Sciences Div. Oct 1992. 72p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE93009610. Source: OSTI; NTIS; INIS; GPO Dep.

Groundwater flow in the shallow unconfined aquifer at the chemical plant area of the Weldon Spring site, St. Charles County, Missouri, was modeled with the Coupled Fluid, Energy, and Solute Transport (CFEST) groundwater flow and contaminant transport computer code. The modeling was performed in support of a hydrogeological characterization effort that is part of the remedial investigation/feasibility study-environmental impact statement process being carried

out by the US Department of Energy at the site. This report presents the results of model development and calibration. In the calibration procedure, the range of field-measured hydrogeological parameters was tested to obtain the best match between model-predicted and measured groundwater elevations. After calibration, the model was used to evaluate whether the presence of an on-site disposal cell would impact the ability to remediate contaminated groundwater beneath the cell. The results of the numerical modeling, which were based on an evaluation of steady-state groundwater flow velocity plots, indicated that groundwater would flow beneath the disposal cell along natural gradients. The presence of a disposal cell would not significantly affect remediation capability for groundwater contamination.

19 (ANL/EA/RP-80447) Recommended management practices for operation and closure of shallow injection wells at DOE facilities. Argonne National Lab., IL (United States); Ground Water Protection Council, Oklahoma City, OK (United States). Jul 1993. 143p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE93019531. Source: OSTI; NTIS; INIS; GPO Dep.

The Safe Drinking Water Act established the Underground Injection Control (UIC) program to ensure that underground injection of wastes does not endanger an underground source of drinking water. Under UIC regulations, an injection well is a hole in the ground, deeper than it is wide, that receives wastes or other fluid substances. Types of injection wells range from deep cased wells to shallow sumps, dry-wells, and drainfields. The report describes the five classes of UIC wells and summarizes relevant regulations for each class of wells and for the UIC program. The main focus of the report is Class IV and V shallow injection wells. Class IV wells are prohibited and should be closed when they are identified. Class V wells are generally authorized by rule, but EPA or a delegated state may require a permit for a Class V well. This report provides recommendations on sound operating and closure practices for shallow injection wells. In addition the report contains copies of several relevant EPA documents that provide additional information on well operation and closure. Another appendix contains information on the UIC programs in 21 states in which there are DOE facilities discharging to injection wells. The appendix includes the name of the responsible regulatory agency and contact person, a summary of differences between the state's regulations and Federal regulations, and any closure guidelines for Class IV and V wells.

20 (ANL/ES/CP-79581) Ultrasonic process for destruction of chlorinated organic compounds in aqueous solution. Wu, Jiann M.; Huang, Hann S. Argonne National Lab., IL (United States). [1993]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930796-1: 1993 Chinese American Academic and Professional convention, Chicago, IL (United States), 2-5 Jul 1993). Order Number DE93015551. Source: OSTI; NTIS; INIS; GPO Dep.

Laboratory investigations of the ultrasonic process for destruction of low concentrations of carbon tetrachloride (CCl_4) into nonhazardous end products were carried out in a bench-scale batch reactor, equipped with a 600-W ultrasonic power supply. Process parameters studied included irradiation time, concentration, steady-state operating temperature, pH, and the intensity of applied ultrasonic-wave energy. High destruction efficiencies of greater than 99% were achieved through this process, and the irradiation time and

the intensity of applied energy were identified to be the most important process parameters. The irradiation time required for a given degree of destruction decreased with increasing intensity of the applied ultrasonic energy. In addition, a detailed chemical reaction mechanism for the destruction of CCl_4 in water was formulated. The agreement between the model and experimental results is generally good.

21 (ANL/ES/CP-81712) Electrochemical iron generation: The ideal process for simultaneous removal of heavy metals from contaminated groundwater. Brewster, M.D. (Andco Environmental Processes, Inc., Buffalo, NY (United States)). Argonne National Lab., IL (United States). [1993]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-931136-2: 6. conference on gas, oil and environmental biotechnology, Colorado Springs, CO (United States), 29 Nov - 1 dec 1993). Order Number DE94005484. Source: OSTI; NTIS; GPO Dep.

At most Superfund sites, many heavy metals must be removed from contaminated groundwater. Simultaneous extraction is complicated due to the various chemical properties that metals exhibit. A comprehensive understanding of solubilities, oxidation states, and adsorptive mechanisms is needed to accomplish treatment objectives. This paper uses data from treatability tests conducted on groundwater from the King of Prussia Technical Corporation Site to discuss the electrochemical iron generation process developed by Andco Environmental Processes, Inc. Electrical current and sacrificial steel electrodes were used to put ferrous ions into solution. The chemistry was properly manipulated to provide adsorption and coprecipitation conditions capable of simultaneously removing beryllium, cadmium, chromium, copper, iron, manganese, mercury, nickel, and zinc. Strict cleanup levels were required since the site is located within Pinelands National Reserve and adjacent to New Jersey's Winslow Wildlife Refuge. System design, operating costs, and sludge production rate are also discussed.

22 (ANL/ESD/TM-32) Development of an ultrasonic process for detoxifying groundwater and soil: Laboratory research: Annual report for fiscal year 1991. Wu, J.M.; Huang, H.S.; Livengood, C.D. Argonne National Lab., IL (United States). Energy Systems Div. Jan 1992. 33p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE93002117. Source: OSTI; NTIS; GPO Dep.

Argonne National Laboratory is conducting laboratory research to study the effectiveness of a new technique in which ultrasonic energy is used to convert chlorinated organic compounds into nonhazardous end products. Destruction efficiencies of greater than 99% were achieved for the organic compounds in aqueous solution. Key process parameters, such as solution pH values, steady-state temperatures under operating conditions, ultrasonic-power intensities, and oxidant concentrations, were investigated. In addition, a detailed chemical-kinetic mechanism for the destruction of the organic compounds under an ultrasonic field was developed and incorporated into a computational model. The agreement between the model and experimental results is generally good.

23 (BNL-48749) Regulatory issues and assumptions associated with barriers in the vadose zone surrounding buried waste. Siskind, B.; Heiser, J. Brookhaven National Lab., Upton, NY (United States). Feb 1993. 34p. Sponsored by USDOE, Washington, DC (United

States). DOE Contract AC02-76CH00016. Order Number DE93019471. Source: OSTI; NTIS; INIS; GPO Dep.

One of the options for control of contaminant migration from buried waste sites is the construction of a subsurface barrier that consists of a wall of low permeability material. The barrier material should be compatible with soil and waste conditions specific to the site and have as low an effective diffusivity as is reasonably achievable to minimize or inhibit transport of moisture and contaminants. This report addresses the regulatory issues associated with the use of non-traditional organic polymer barriers as well as the use of soil-bentonite or cement-bentonite mixtures for such barriers, considering barriers constructed from these latter materials to be a regulatory baseline. The regulatory issues fall into two categories. The first category consists of issues associated with the acceptability of such barriers to the EPA as a method for achieving site or performance improvement. The second category encompasses those regulatory issues concerning health, safety and the environment which must be addressed regarding barrier installation and performance, especially if non-traditional materials are to be used.

24 (BNL-48776) Pilot study risk assessment for selected problems at the Savannah River Site (SRS). Hamilton, L.D. (Brookhaven National Lab., Upton, NY (United States)); Holtzman, S.; Meinhold, A.; Morris, S.C.; Pardi, R.; Sun, C.; Daniels, J.I.; Layton, D.; McKone, T.E.; Straume, T.; Anspaugh, L. Brookhaven National Lab., Upton, NY (United States); Lawrence Livermore National Lab., CA (United States). Mar 1993. 82p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE93012520. Source: OSTI; NTIS; INIS; GPO Dep.

An assessment of the health risks was made for releases of tritium and ¹³⁷Cs from the Savannah River Site (SRS) at water-receptor locations downriver. Although reactor operations were shut down at the SRS in 1989, liquid wastes continue to be released to the Savannah River either by direct discharges into onsite surface waters or by groundwater transport into surface waters from waste facilities. Existing state mandates will cause the liquid waste streams from future operations to go directly into surface waters. Two drinking water processing plants take water from the river approximately 129 km downriver from the SRS. Potential incremental risks of cancer fatality to individuals and each population were analyzed for either no further reactor operations or resumption of operation of one specific reactor.

25 (CONF-8909163-15) Structural relations within the Paleozoic basement of the mine mountain block; Implications for interpretation of gravity data in Yucca Flat, Nevada Test Site. Cole, J.C.; Wahl, R.R.; Hudson, M.R. Geological Survey, Denver, CO (United States). [1989]. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AI08-86NV10583. From 5. symposium on containment of underground nuclear explosions; Santa Barbara, CA (United States); 19-21 Sep 1989. Order Number DE92004281. Source: OSTI; NTIS; GPO Dep.

Detailed geological mapping in the Mine Mountain block between Yucca Flat and Mid Valley demonstrates that most of the low-angle fault contacts between various Paleozoic rock units are the result of Tertiary near-surface block sliding, contrary to the long-held notion that the principal structural control derives from late Mesozoic thrusting during the Sevier orogeny. When structural and stratigraphic features of the hangingwall rocks above these low-angle faults are compared to similar data for the footwall rocks beneath,

no evidence is found for the systematic patterns and three-dimensional relationships that characterize thrust terranes of the Sevier in southern Nevada. If the exposed relations at Mine Mountain are extrapolated as a general structural model for the Paleozoic rocks of the area, then the distribution of rock types in the subsurface is much less predictable than with the Mesozoic thrust model. Disconnected and stratigraphically unrelated sheets of diverse Paleozoic rocks may overlie the Eleana eastward to the Carpetbag fault, and possibly beyond. The traditional interpretation of Yucca Flat gravity data is that local gradients correspond to scarps (elevation discontinuities) in the buried top of the Paleozoic basement. The conservative approach for containment considerations requires that these scarps be inferred to mark the traces of high-angle faults. The Mine Mountain model, however, allows that lateral gravity gradients may be due to lateral density variations in Paleozoic rocks (resulting from the mid-Tertiary sliding), and may have no tectonic significance for the overlying volcanic and alluvial materials. Model calculations show that realistic assumptions for slide-sheet thickness and density contrast can account for observed gravity gradients for a range of burial depths. 33 refs., 10 figs.

26 (CONF-8909163-16) The Delamar fracture zone: Recognition of unmapped zones of weakness on Pahute Mesa, Nevada Test Site. Covington, H.R. Geological Survey, Mercury, NV (United States). [1989]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AI08-86NV10583. From 5. symposium on containment of underground nuclear explosions; Santa Barbara, CA (United States); 19-21 Sep 1989. Order Number DE92004280. Source: OSTI; NTIS; GPO Dep.

The Delamar underground nuclear test, conducted at Pahute Mesa, Nevada Test Site, formed extensive fracture zones. The orientation, extent (more than 500 m north and south of surface ground zero), and linear distribution of the fractures suggest the presence of two preexisting zones of weakness. Because these zones had not been identified prior to the test, studies were initiated to determine that nature of these zones and to define methods to identify similar zones in the future. The methods selected to characterize the fracture zones were mapping surface effects on low-altitude aerial photographs, (2) trenching, (3) exploratory drilling, and (4) surface magnetic surveys. Preliminary results of these investigations show that the two fracture zones occurred along preexisting zones of weakness. The studies also determined that previously unrecognized zones of weakness may be identified using surface mapping techniques. The primary surface features that can be used in the recognition of such zones are (1) a linear feature or an albedo change across a linear feature, on aerial photographs, (2) a linear break between areas of very little and abundant caliche clasts in the surface soil, (3) a linear disruption of rock varnish, and (4) a linear distribution of chalcedony clasts in the surface soil. The recognition of these zones of weakness during pre-drill field investigation at future sites will allow an early assessment of the possible impact of these structures on containment, and provide data for possible relocation of the site.

27 (CONF-8909163-17) Paleostress Investigation near Rainier Mesa, Nevada Test Site. Minor, S.A. Geological Survey, Denver, CO (United States). [1989]. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AI08-86NV10583. From 5. symposium on

containment of underground nuclear explosions; Santa Barbara, CA (United States); 19-21 Sep 1989. Order Number DE92004279. Source: OSTI; NTIS; GPO Dep.

Knowledge of the fault-kinematic and paleostress histories in the Rainier Mesa/Yucca Flat region can be beneficial to containment scientists in understanding the effects of natural faults on containment of nuclear detonations. Fault-slip data were collected from 444 small-displacement (0.1–10 m) faults cutting 16-11 Ma tuffs and tuffaceous sedimentary rocks in nine areas mainly along the south, east, and north-east flanks of Rainier Mesa to investigate the faulting and paleostress history in the region. Two of the faults appear to have been test-reactivated as tension cracks and may have also experienced renewed shear displacement. One to three different stress solutions were computed from data collected in seven of the measurement areas. From cross-cutting relations of faults and faulted stratigraphic units, the relative age of many of the computed stress regimes and associated faults were determined. Using stratigraphic constraints and similarities in stress results, a relative stress-regime and faulting sequence was constructed for the study region. Fracturing observed after nuclear explosions is influenced by the structural arrangement of pre-existing faults and joints and by the current regional stress field.

28 (CONF-8909163-18) **Paleomagnetic evaluation of the Yucca-Frenchman Flexure, southern Nevada.** Hudson, M.R. Geological Survey, Denver, CO (United States). [1989]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AI08-86NV10583. From 5. symposium on containment of underground nuclear explosions; Santa Barbara, CA (United States); 19-21 Sep 1989. Order Number DE92004278. Source: OSTI; NTIS; GPO Dep.

The eastern margin of the Yucca Flat basin, southern Nevada, is bounded by north-northwest-striking tilted fault blocks of the Halfpint Range that curve as much as 90° clockwise into east-northeast strikes in the French Peak-Massachusetts Mountain (FPMM) area. This pattern of arcuate structures was termed the Yucca Frenchman flexure by previous workers who attributed the arcuate pattern to clockwise drag along a proposed northwest-trending, right-lateral shear zone. The flexure model implies that rocks within the FPMM area have been rotated strongly clockwise about a vertical axis. Paleomagnetic data indicate no systematic vertical-axis rotation in the FPMM area and disprove the flexure model. After tilt correction, declinations of 30 site means obtained from the three ash-flow sheets in the FPMM area are more dispersed, but not systematically different than declinations of 12 site means from the Halfpint Range or declinations of 10 site means from little deformed reference areas to the west (Rainier and Pahute Mesas, Shoshone and northern Yucca Mountains). Paleomagnetic data indicate that structures in the FPMM area initiated with arcuate trends; not as originally straight elements that were rotated by right-lateral drag. The structures must have formed under the influence of locally different orientations and (or) ratios of principal stresses. The French Peak-Massachusetts Mountain area lies in an accommodation zone between domains of predominantly west- and east-tilted Miocene and Pliocene extensional fault blocks to the north and south, respectively. I suggest that local interaction between stress fields associated with fault zones that simultaneously propagated from north and south into the accommodation zone may have been responsible for the arcuate structures in the FPMM area.

29 (CONF-900210-Vol.1) **Waste management '90: Working towards a cleaner environment: Waste processing, transportation, storage and disposal, technical programs and public education: Volume 1, Overview and general waste management: Proceedings.** Post, R.G. (ed.) (Arizona Univ., Tucson, AZ (USA)). American Nuclear Society (United States). Fuel Cycle and Waste Management Div.; American Society of Mechanical Engineers, New York, NY (United States); USDOE, Washington, DC (United States); Arizona Univ., Tucson, AZ (United States). Coll. of Engineering and Mines. ©1990. 813p. Sponsored by American Nuclear Society; University of Arizona; USDOE, Washington, DC (United States). From Waste management '90: working towards a cleaner environment: waste processing, transportation, storage and disposal, technical programs and public education; Tucson, AZ (United States); 25 Feb - 1 mar 1990. Source: Arizona Board of Regents, University of Arizona, Tucson, AZ 85721.

This volume contains about 123 papers on waste management. Topics include international waste management programs, environmental restoration plans, transportation of nuclear waste concepts, remedial action, regulations and policy. Individual papers will be indexed and entered on the database separately. (KGD)

30 (CONF-9004181-Vol.1) **Remedial Action Program annual conference: Proceedings: Volume 1, Remedial action under the Environmental Restoration and Waste Management Five-Year Plan.** USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). Office of Environmental Restoration. [1990]. 651p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-82AL14086. From DOE remedial action under the environmental restoration and waste management five-year plan; Albuquerque, NM (United States); 16-19 Apr 1990. Order Number DE91000103. Source: OSTI; NTIS; INIS; GPO Dep.

Within the DOE's Office of Environmental Restoration & Waste Management, the Office of Environmental Restoration manages a number of programs whose purposes are to complete remedial actions at DOE facilities and sites located throughout the United States. The programs include the Surplus Facilities Management Program, the Formerly Utilized Sites Remedial Action Program, the Uranium Mill Tailings Remedial Action Program, and the West Valley Demonstration Project. These programs involve the decontamination and decommissioning of radioactively-contaminated structures and equipment, the disposal of uranium mill tailings, and the cleanup or restoration of soils and ground water that have been contaminated with radioactive or hazardous substances. Each year the DOE and DOE-contractor staff who conduct these programs meet to exchange information and experience in common technical areas. This year's meeting was hosted by the Uranium Mill Tailings Remedial Action Project, DOE-AL, and was held in Albuquerque, NM. This volume of proceedings is the record of that conference. The proceedings consist of abstracts, summaries, or actual text for each presentation made and any visual aids used by the speakers.

31 (CONF-9004181-Vol.2) **Department of Energy remedial action program annual conference: Proceedings: Volume 2, Remedial action under the environmental restoration and waste management five-year plan.** USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). Office of Environmental Restoration. [1990]. 272p. Sponsored by

USDOE, Washington, DC (United States). DOE Contract AC04-82AL14086. From DOE remedial action under the environmental restoration and waste management five-year plan; Albuquerque, NM (United States); 16-19 Apr 1990. Order Number DE91000104. Source: OSTI; NTIS; INIS; GPO Dep.

The Office of Environmental Restoration manages a number of programs whose purposes are to complete remedial action at Department of Energy (DOE) facilities and sites located throughout the United States. This volume contains 18 papers on the topics environmental restoration and hazardous/mixed waste characterization and remediation. Individual papers are indexed separately on the Energy Database. (KJD)

32 (CONF-9010166-) DOE model conference on waste management and environmental restoration: Proceedings. USDOE, Washington, DC (United States). [1990]. 343p. Sponsored by USDOE, Washington, DC (USA). From 6. annual Department of Energy model conference on waste management and environmental restoration; Oak Ridge, TN (United States); 29 Oct - 2 Nov 1990. Order Number DE91010951. Source: OSTI; NTIS; INIS; GPO Dep.

Reports dealing with current topics in waste management and environmental restoration were presented at this conference in six sessions. Session 1 covered the "Hot Topics" including regulations and risk assessment. Session 2 dealt with waste reduction and minimization; session 3 dealt with waste treatment and disposal. Session 4 covered site characterization and analysis. Environmental restoration and associated technologies were discussed in session 5 and 6. Individual papers have been cataloged separately.

33 (CONF-901286-1-Vugraphs) Groundwater monitoring challenges on the Oak Ridge Reservation. Huff, D.D. Oak Ridge National Lab., TN (United States). [1990]. 21p. Sponsored by USDOE, Washington, DC (USA). DOE Contract AC05-84OR21400. From U.S. Department of Energy (DOE)/Environmental Protection Agency (EPA) workshop on methods for siting ground-water monitoring wells; Las Vegas, NV (United States); 11-13 Dec 1990. Order Number DE91010132. Source: OSTI; NTIS; GPO Dep.

The Oak Ridge Reservation (ORR) is located in the humid southeastern United States in close proximity to Oak Ridge, Tennessee. There are three Department of Energy (DOE) facilities on the reservation, and all of them have comprehensive ground-water monitoring programs in conjunction with compliance and environmental restoration activities. Because of the costs associated with installation, maintenance, sampling and reporting, and eventual plugging and abandonment of wells, choosing the numbers and locations of monitoring wells is a major concern. Decisions must be based on a thorough understanding of site geology, hydrologic variables, and the nature and location of potential sources of contaminant releases.

34 (CONF-9103114-3) Effects of diverse organic contaminants on trichloroethylene degradation by methanotrophic bacteria and methane-utilizing consortia. Palumbo, A.V. (Oak Ridge National Lab., TN (USA). Environmental Sciences Div.); Boerman, P.A.; Herbes, S.E.; Eng, W.; Strandberg, G.W.; Donaldson, T.L. Oak Ridge National Lab., TN (United States). [1991]. 20p. Sponsored by USDOE, Washington, DC (USA). DOE Contract AC05-84OR21400. From In situ and on-site bioreclamation: an international symposium; San Diego, CA (United States);

19-21 Mar 1991. Order Number DE91010778. Source: OSTI; NTIS; GPO Dep.

Groundwater contaminated with organic compounds, especially solvents such as benzene, trichloroethylene (TCE), perchloroethene (PCE), carbon tetrachloride, and chlorinated ethanes, is a problem at many US Department of Energy facilities including the Oak Ridge National Laboratory (ORNL). Regulations require consideration of alternatives for remediation of these sites. A demonstration project was initiated in the spring of 1990 that will permit evaluation of two cometabolic approaches to remediation of groundwater and may lead to remediation alternatives that prove both more effective and less costly than traditional methods. More generally, the demonstration will provide valuable information on the applicability of bioremediation to a groundwater contamination problem at numerous DOE sites. The purpose of this research is to examine the effects of contaminants commonly found in association with TCE at DOE sites and to determine the conditions required for maximizing TCE degradation rates. This study focuses on compounds found in a seep at the ORNL K-25 site. The research presented here details initial experiments on TCE degradation by methanotrophs conducted in the presence of a synthetic medium, TCE, and one or more contaminants found at the K-25 site. Formate has been reported to increase the rate of TCE degradation by pure cultures but had not been tested with mixed cultures. As part of the effort to maximize TCE degradation rates, we examined the effect of formate on degradation by a mixed culture. 5 figs., 1 tab.

35 (CONF-910981-) Environmental remediation 1991: "Cleaning up the environment for the 21st Century": Proceedings. Wood, D.E. (ed.) (Westinghouse Hanford Co., Richland, WA (United States)). USDOE Assistant Secretary for Environmental Restoration and Waste Management, Washington, DC (United States). Office of Environmental Restoration. 1991. 896p. Sponsored by USDOE, Washington, DC (United States). From Environmental remediation '91 conference; Pasco, WA (United States); 8-11 Sep 1991. Order Number DE93010652. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents discussions given at a conference on environmental remediation, September 8-11, Pasco, Washington. Topics include: public confidence; education; in-situ remediation; Hanford tank operations; risk assessments; field experiences; standards; site characterization and monitoring; technology discussions; regulatory issues; compliance; and the UMTRA project. Individual projects are processed separately for the data bases.

36 (CONF-910981-9) A co-metabolic approach to groundwater remediation. Palumbo, A.V. (Oak Ridge National Lab., TN (United States)); Boerman, P.A.; Strandberg, G.W.; Donaldson, T.L.; Jennings, H.L.; Lucero, A.J.; Herbes, S.E.; Phelps, T.J.; White, D.C. Oak Ridge National Lab., TN (United States). [1991]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Environmental remediation '91 conference; Pasco, WA (United States); 8-11 Sep 1991. Order Number DE92000063. Source: OSTI; NTIS; INIS; GPO Dep.

In support of the US Department of Energy's (DOE) Integrated Demonstration (Cleanup of Organics in Soils and Groundwater at Non-arid Sites) at the Savannah River Site (SRS), Oak Ridge National Laboratory (ORNL) and the University of Tennessee (UT) are involved in demonstrations of the use of methanotrophs in bioreactors for remediation of

contaminated groundwater. In preparation for a field demonstration at ORNL's K-25 Site in Oak Ridge, Tennessee, ORNL is conducting batch experiments, is operating a number of bench-scale bioreactors, has designed pretreatment systems, and has modified a field-scale bioreactor provided by the Air Force Engineering and Services Center for use at the site. UT is operating bench-scale bioreactors with the goal of determining the stability of a trichloroethylene-degrading methanotrophic consortia during shifts in operating conditions (e.g. pH, nutrient inputs, and contaminant mixtures). These activities are all aimed at providing the knowledge base necessary for successful treatment of contaminated groundwater at the SRS and K-25 sites as well as other DOE sites. 18 refs., 1 fig., 1 tab.

37 (CONF-9109234-2) Determination of sediment accumulation and mixing rates using ^{137}Cs and $^{210}\text{Pb}_{\text{xs}}$ in Watts Bar Reservoir. Brenkert, A.L. (Oak Ridge National Lab., TN (United States)); Cook, R.B.; Rose, K.A.; Brandt, C.C.; Olsen, C.R. Oak Ridge National Lab., TN (United States). [1991]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 4. Tennessee water resources symposium; Knoxville, TN (United States); 24-26 Sep 1991. Order Number DE91016282. Source: OSTI; NTIS; INIS; GPO Dep.

Activities at the Department of Energy's facilities on the Oak Ridge Reservation over the past 50 years have released contaminants to local streams and consequently to the Clinch River and Watts Bar Reservoir. More than 60 sediment cores were collected in Watts Bar Reservoir and analyzed for the vertical distribution of ^{137}Cs ; seven of the cores were also analyzed for the vertical distribution of unsupported ^{210}Pb . The objective of this work was to examine the processes responsible for the vertical distribution of ^{137}Cs and $^{210}\text{Pb}_{\text{xs}}$ in the sediments by using a numerical model of sediment accumulation, mixing, decay and molecular diffusion. Analysis of both ^{137}Cs and $^{210}\text{Pb}_{\text{xs}}$ permits comparison of model predictions of both point- (Cs) and non-point source (Pb) contaminants. 6 refs., 4 figs., 1 tab.

38 (CONF-9109234-5) Transport of contaminated sediment during floods in White Oak Creek near Oak Ridge, Tennessee. Fontaine, T.A. Oak Ridge National Lab., TN (United States). [1991]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 4. Tennessee water resources symposium; Knoxville, TN (United States); 24-26 Sep 1991. Order Number DE91018936. Source: OSTI; NTIS; GPO Dep.

Parts of the White Oak Creek (WOC) watershed have become contaminated during the last 47 years of operation of Oak Ridge National Laboratory (ORNL). The 16 sq. km. catchment consists of a short embayment between White Oak Dam and the Clinch River, a small lake (7 ha), and two main tributaries (Melton Branch and White Oak Tributary) which converge 1 km upstream of the lake. The contaminants presenting the highest risk to human health and the environment are particle reactive and are associated with the soils and sediments in the floodplains and channels of WOC and in White Oak Lake (WOL). During floods, the erosion and resuspension of these sediments can result in the transport of contaminants within the catchment and out of WOL into the Clinch River. It is not possible to predict the transport of contaminated sediment during storms because the existing database and monitoring program were not developed to address this issue. In order to evaluate the probability of contaminated sediment transport during floods,

and to develop strategies for controlling off-site transport, a data collection program and a modeling investigation have been initiated. The data collection program is required to establish a conceptual model of contaminated sediment transport in WOC, to provide the data required to calibrate and apply the computer model, and to generate a database that will be used in the future to evaluate the effectiveness of completed clean up activities. The computer model will be used to simulate the transport of contaminated sediments during floods up to the 100-year event with existing and future land use conditions. 1 ref., 1 fig.

39 (CONF-9109234-6) Patterns of sediment accumulation in Watts Bar Reservoir based on ^{137}Cs . Brandt, C.C.; Rose, K.A.; Cook, R.B.; Dearstone, K.C.; Brenkert, A.L.; Olsen, C.R. Oak Ridge National Lab., TN (United States). [1991]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 4. Tennessee water resources symposium; Knoxville, TN (United States); 24-26 Sep 1991. Order Number DE92000067. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy has recently undertaken an environmental restoration program designed to achieve remediation of hazardous materials released from the Oak Ridge Reservation (ORR). The distribution of ^{137}Cs was investigated in sediments from Watts Bar Reservoir and the Clinch River as a possible marker for other contaminants released from the ORR. We have performed additional analyses on the data gathered for this study to investigate possible relationships between ^{137}Cs accumulation and reservoir characteristics. We found that ^{137}Cs deposition correlates with sedimentation rate, and soft mud layers of cores have higher ^{137}Cs levels than sandy mud or eroded soils. No correlation was found with water depth, distance from shore or distance from release source, but it is important to note the data were not collected to test for these effects. We estimate Watts Bar Reservoir contains 267 Ci of ^{137}Cs , with 7% of this total in the top 16 cm of sediment, and potentially available for biological accumulation. 2 refs. (MHB)

40 (CONF-9109234-7) Use of electromagnetic borehole flowmeter to delineate groundwater producing fractures. Nyquist, J.E. (Oak Ridge National Lab., TN (United States)); Moore, G.K.; Clapp, R.B.; Young, S.C. Oak Ridge National Lab., TN (United States). [1991]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 4. Tennessee water resources symposium; Knoxville, TN (United States); 24-26 Sep 1991. Order Number DE92003559. Source: OSTI; NTIS; GPO Dep.

Ground water flow on the Oak Ridge Reservation (ORR) is dominated by permeable fractures within the relatively impermeable rocks. It is possible to detect the fractures which intersect a borehole using conventional logging tools (electrical, sonic, acoustic televiewer, caliper, temperature), but not with any certainty which of these fractures are permeable and are part of a connected network. This poses a problem for the groundwater modeler. Should all known fractures be included in the model? Only major fractures?

41 (CONF-911133-4) Design of zeolite ion-exchange columns for wastewater treatment. Robinson, S.M.; Arnold, W.D.; Byers, C.H. Oak Ridge National Lab., TN (United States). [1991]. 35p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From American Institute of Chemical Engineers (AIChE) annual meeting; Los Angeles, CA (United

States); 17-22 Nov 1991. Order Number DE92001959. Source: OSTI; NTIS; INIS; GPO Dep.

Oak Ridge National Laboratory plans to use chabazite zeolites for decontamination of wastewater containing parts-per-billion levels of ^{90}Sr and ^{137}Cs . Treatability studies indicate that such zeolites can remove trace amounts of ^{90}Sr and ^{137}Cs from wastewater containing high concentrations of calcium and magnesium. These studies show that zeolite system efficiency is dependent on column design and operating conditions. Previous results with bench-scale, pilot-scale, and near-full-scale columns indicate that optimized design of full-scale columns could reduce the volume of spent solids generation by one-half. The data indicate that shortcut scale-up methods cannot be used to design columns to minimize secondary waste generation. Since the secondary waste generation rate is a primary influence on process cost effectiveness, a predictive mathematical model for column design is being developed. Equilibrium models and mass-transfer mechanisms are being experimentally determined for isothermal multicomponent ion exchange (Ca, Mg, Na, Cs, and Sr). Mathematical models of these data to determine the breakthrough curves for different column configurations and operating conditions will be used to optimize the final design of full-scale treatment plant. 32 refs., 6 figs., 3 tabs.

42 (CONF-911133-13) Obtaining representative soil water samples with a hydraulically installed suction lysimeter. Chaimberg, M. (Institute of Gas Technology, Chicago, IL (United States)); Carty, R.H.; Scroppo, J.A. Institute of Gas Technology, Chicago, IL (United States). [1991]. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. From American Institute of Chemical Engineers (AIChE) annual meeting; Los Angeles, CA (United States); 17-22 Nov 1991. Order Number DE93005393. Source: OSTI; NTIS; INIS; GPO Dep.

The construction of wells for soil water sampling is expensive due to the high cost of drilling and may contribute to the possible spread of pollutants by cross contamination. In this study, a novel small diameter suction lysimeter with a porous ceramic section was designed and tested. The stainless steel ram-tipped lysimeter was constructed so that it could be installed into the ground using a hydraulic ram without the need of predrilling a bore hole. The operating range of the hydraulically-installed lysimeter was compared to that of a lysimeter installed using the standard silica slurry packing technique. The decrease in sample volume uptake due to plugging in the pores of the ceramic section was investigated for the lysimeters installed both hydraulically and with the silica slurry packing, in three types of soil: medium sand, silty clay, and a topsoil clay-sand blend. The operating range for the lysimeters was ascertained in a test chamber filled with a blend of topsoil clay and sand. An investigation of the effect of sampling on the concentration of solutes was performed with aqueous solutions of two hydrocarbon test compounds.

43 (CONF-920307-7) Cometary biotreatment of TCE-contaminated groundwater: Laboratory and bench-scale development studies. Donaldson, T.L.; Jennings, H.L.; Lucero, A.J.; Strandberg, G.W.; Morris, M.I.; Palumbo, A.V.; Boerman, P.A.; Tyndall, R.L. Oak Ridge National Lab., TN (United States). [1992]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Waste management '92; Tucson, AZ (United States); 1-5 Mar 1992. Order Number DE92007252. Source: OSTI; NTIS; INIS; GPO Dep.

The Oak Ridge National Laboratory is conducting a demonstration of two cometary technologies for biotreatment of groundwater contaminated with trichloroethylene (TCE) and other organics. Technologies based on methanotrophic (methane-utilizing) and toluene-degrading microorganisms will be compared side-by-side on the same groundwater stream. Laboratory and bench-scale bioreactor studies have been conducted to guide selection of microbial cultures and operating conditions for the field demonstration. This report presents the results of the laboratory and bench-scale studies for the methanotrophic system.

44 (CONF-9205121-2) Technology transfer and application of SERS continuous monitor for trace organic compounds. Swindle, D.W. Jr.; Vo-Dinh, T.; Yalcintas, M.G. Oak Ridge National Lab., TN (United States). [1992]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Mediterranean conference on environmental geotechnology; Cesme (Turkey); 25-27 May 1992. Order Number DE92008900. Source: OSTI; NTIS; INIS; GPO Dep.

An in situ-enhanced Raman Scattering (SERS) continuous monitoring system was developed for exciting and collecting SERS signals generated on silver-coated microparticles deposited on a continuously rotating filter-paper support. SERS measurements were successfully conducted for several organic compounds. An in situ SERS fiber-optic system was also developed for exciting and collecting SERS signals generated from a sensing tip having silver-coated microparticles deposited on a glass-plate support. These devices will be very useful in remote identification of unknown chemicals from hazardous waste sites. This patented technology has been licensed from Oak Ridge National Laboratory to an analytical instrumentation firm which is in the process of completing development and marketing these detectors. Advantages to using this technology range from increased safety and sensitivity for detecting hazardous compounds to better statistics and reliable results. During this presentation, efforts of the Environmental Restoration Program to evaluate and support development of this technology will be described.

45 (CONF-9206116-5) The Cell Analytical-Numerical (CAN) method for the solution of the Richards equation. Elnawawy, O.A. (Indiana Univ.-Purdue Univ., Indianapolis, IN (United States)); Azmy, Y.Y. Oak Ridge National Lab., TN (United States). [1992]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 9. international conference on computational methods in water resources; Denver, CO (United States); 9-12 Jun 1992. Order Number DE93015433. Source: OSTI; NTIS; INIS; GPO Dep.

In this paper, we develop and describe implementation of the Cell Analytical-Numerical (CAN) method for solution of the one-dimensional Richards equation. The CAN method incorporates the local analytical solution and the continuity of the soil moisture flux across computational element boundaries to construct an algebraic relationship between the values of the dependent variable on the boundaries of adjacent elements. The time derivative is approximated by a fully implicit scheme. Assembling all the elements together produces a tridiagonal matrix equation which is efficiently solved via the Thomas algorithm. This system of nonlinear algebraic equations is solved iteratively via an implicit linearization scheme. Accuracy is assessed by comparison to semi-analytical and Finite Element solutions. The results indicate CAN's high accuracy over a wide range of soil types.

46 (CONF-920851-19) **Rapid characterization and monitoring by direct sampling ion trap mass spectrometry.** Guerin, M.R.; Wise, M.B.; Thompson, C.V.; Buchanan, M.V. Oak Ridge National Lab., TN (United States). [1992]. 5p. Sponsored by USDOE, Washington, DC (United States); Department of Defense, Washington, DC (United States). DOE Contract AC05-84OR21400. From Spectrum '92: nuclear and hazardous waste management international topical meeting; Boise, ID (United States); 23-27 Aug 1992. Order Number DE92014800. Source: OSTI; NTIS; INIS; GPO Dep.

Direct Sampling Ion Trap Mass Spectrometry (DSITMS) has been developed for the rapid determination of organic chemicals in water, soil, and air. The technology is unique in that it involves the direct introduction of the analytes into the instrument without prior sample preparation or gas chromatographic separation. Volatile organics such as solvents and fuels are purged from water or soil/water slurries with helium and the purged material is routed directly into the Ion Trap Mass Spectrometer (ITMS). Semivolatile organics are determined by collecting the sample on a solid substrate and thermally desorbing the analytes into the instrument. Airborne organics are sampled directly into the ITMS. In each case, the analytes are monitored on a near-continuous basis by the ITMS as they are being introduced. Visual results are available almost immediately and sufficient data is acquired for the quantitation of organics in water and soil in five minutes or less. Results for airborne organics are generated in realtime. Detection limits for the 34 USEPA Contract Laboratory Program Target Compound List volatile organics in water are currently in the range of 1-10 ppb depending on the analyte. Detection limits for continuous air monitoring range from 5-50 ppbv for most analytes tested to date.

47 (CONF-920883-1) **Contaminated sediment transport during floods.** Fontaine, T.A. Oak Ridge National Lab., TN (United States). [1992]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Water Forum '92: American Society of Civil Engineers (ASCE) national conference; Baltimore, MD (United States); 3-5 Aug 1992. Order Number DE92013865. Source: OSTI; NTIS; INIS; GPO Dep.

Over the past 48 years, operations and waste disposal activities at Oak Ridge National Laboratory have resulted in the contamination of parts of the White Oak Creek catchment. The contaminants presenting the highest risk to human health and the environment are particle reactive and are associated with the soils and sediments in the White Oak Creek drainage system. The erosion of these sediments during floods can result in the transport of contaminants both within the catchment and off-site into the Clinch River. A data collection program and a modeling investigation are being used to evaluate the probability of contaminated sediment transport during floods and to develop strategies for controlling off-site transport under present and future conditions.

48 (CONF-921029-10) **White Oak Creek embayment sediment retention structure: The Oak Ridge model in action.** Van Hoesen, S.D. (Oak Ridge National Lab., TN (United States)); Kimmel, B.L.; Page, D.G.; Hudson, G.R.; Wilkerson, R.B.; Zocolla, M.; Kauschinger, J.L. Oak Ridge National Lab., TN (United States). [1992]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Annual Department of Energy model conference on waste management and environmental restoration; Oak Ridge, TN (United States);

19-22 Oct 1992. Order Number DE93001717. Source: OSTI; NTIS; INIS; GPO Dep.

White Oak Creek is the major surface-water drainage through the Department of Energy (DOE) Oak Ridge National Laboratory (ORNL). Samples taken from the lower portion of the creek revealed high levels of Cesium-137, and lower levels of Cobalt-60 in near-surface sediment. Other contaminants present in the sediment included: lead, mercury, chromium, and PCBS. In October 1990, DOE, US Environmental Protection Agency (EPA), and Tennessee Department of Environment and Conservation (DEC) agreed to initiate a time-critical removal action in accordance with Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) to prevent transport of the contaminated sediments into the Clinch River system. This paper discusses the environmental, regulatory, design, and construction issues that were encountered in conducting the remediation work.

49 (CONF-921137-7) **Modeling the transport and fate of radioactive noble gases in very dry desert alluvium: Realistic scenarios.** Lindstrom, F.T.; Cawfield, D.E.; Donahue, M.E.; Emer, D.F.; Shott, G.J. Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV (United States). Environmental Restoration and Technology Development Dept. [1992]. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC08-89NV10630. From 14. low-level radioactive waste management conference; Phoenix, AZ (United States); 18-20 Nov 1992. Order Number DE93004789. Source: OSTI; NTIS; INIS; GPO Dep.

US DOE Order 5820.2A (1988) requires that a performance assessment of all new and existing low-level radioactive waste management sites be made. An integral part of every performance assessment is the mathematical modeling of the transport and fate of noble gas radionuclides in the gas phase. Current in depth site characterization of the high desert alluvium in Area 5 of the Nevada Test Site (NTS) is showing that the alluvium is very dry all the way to the water table (240 meters below land surface). The potential for radioactive noble gas (e.g. Rn-220 and Rn-222) transport to the atmosphere from shallow land burial of Thorium and Uranium waste is very high. Objectives of this modeling effort include: Construct a physics based site specific noble gas transport model; Include induced advection due to barometric pressure changes at the atmospheric boundary layer (thin) - dry desert alluvium interface; User selected option for use of NOAA barometric pressure or a "home brewed" barometric pressure wave made up of up to 15 sinusoids and cosinusoids; Use the model to help make engineering decisions on the design of the burial pits and associated closure caps.

50 (CONF-930160-15) **Removal of uranium by biosorption.** Faison, B.D. (Oak Ridge National Lab., TN (US)); Bonner, J.D.; Munroe, N.D.; Bloomingburg, G.F. Oak Ridge National Lab., TN (United States). [1993]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 2. semi-annual Office of Technology Development (OTD) information meeting; Houston, TX (United States); 26-28 Jan 1993. Order Number DE93015445. Source: OSTI; NTIS; INIS; GPO Dep.

The technology developed here will exploit the ability of microorganisms to remove dissolved metals from aqueous solutions. Microbial sorbents for uranium will be immobilized biosorbents will be deployed ex situ within flow-through reactors for the continuous or semicontinuous treatment of

recovered wastewaters. The proposed technology will primarily be applied within a pump-and-treat process using immobilized biosorbents for the large-scale, long-term remediation of uranium-laden surface water or groundwater impoundments (environmental restoration). The technology may be equally useful as an "end-of-pipe" treatment of process effluents (waste management). Successful operation of this process will achieve immobilization of the targeted waste and accompanying volume reduction.

51 (CONF-930205-73) Training and qualification of waste management and remedial action personnel at the Oak Ridge National Laboratory. Frederick, A.F. Oak Ridge National Lab., TN (United States). [1993]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Waste management '93; Tucson, AZ (United States); 28 Feb - 4 mar 1993. Order Number DE93015482. Source: OSTI; NTIS; GPO Dep.

A document, Waste Management and Remedial Action Division Training Plan, has been developed by the WMRAD Training Department at Oak Ridge National Laboratory. This plan identifies and defines training requirements for different waste operations and support groups within the division and, in addition, identifies individual training requirements within each group based on job-specific tasks. This training consists of three independent areas: environmental, safety, and health (ES&H) training; performance-based training on standard operating procedures; and division training requirements. To ensure that personnel have completed all training and retraining requirements, the WMRAD Training Department has also developed, and currently maintains, several data base systems. A data base systems manager generates daily, weekly, and monthly reports for review by operations supervision to ensure that only qualified personnel operate and maintain the waste management facilities.

52 (CONF-9306100-1) Treatment of contaminated wastewater at Oak Ridge National Laboratory. Robinson, S.M.; Kent, T.E.; Arnold, W.D. Oak Ridge National Lab., TN (United States). [1993]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Zeolite 93: 4th international conference on the occurrence, properties, and utilization of natural zeolites; Boise, ID (United States); 20-28 Jun 1993. Order Number DE93006622. Source: OSTI; NTIS; INIS; GPO Dep.

Oak Ridge National Laboratory (ORNL), an energy research and radioisotope production facility, operates two centralized liquid waste treatment systems, one for liquid low-level waste (LLLW) system and the other for process waste (PW). New regulatory and waste minimization requirements have led ORNL to consider zeolite ion exchangers for removing cesium and strontium from LLLW and PW streams for their economic advantages, selective molecular sieve properties, and ease of disposal. Natural and synthetic zeolites have been compared with inorganic and organic ion exchangers for these applications.

53 (CONF-931043-7) Secondary wastes and treatment of effluents from leaching of uranium from soils. Ally, M.R.; Wilson, J.H.; Francis, C.W. Oak Ridge National Lab., TN (United States). [1993]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 8. symposium on separation science and technology for energy applications; Knoxville, TN (United States); 24-28 Oct 1993. Order Number DE94004245. Source: OSTI; NTIS; INIS; GPO Dep.

The Department of Energy's Feed Materials and Production Center at Fernald, Ohio has over two million cubic meters of soil contaminated with Uranium which must be cleaned. Soil characterization studies show that Uranium is unevenly distributed between the clay, sand and silt fractions. This paper examines the option of using leaching agents to remove Uranium from the soil and the treatment of secondary wastes. Results of the effects of various leachants in removing Uranium and the complications of co-leaching minerals/organic matter that are important for maintaining soil integrity and structure shall be discussed. Candidate leachants must remove the Uranium level below 35pCi/g of soil and produce a secondary waste that is amenable to on-site treatment at reasonable cost.

54 (CONF-931136-3) Biosurfactants and increased bioavailability of sorbed organic contaminants: Measurements using a biosensor. Strong-Gunderson, J.M. (Oak Ridge National Lab., TN (United States)); Palumbo, A.V.; Applegate, B.; Saylor, G.S. Martin Marietta Energy Systems, Inc., Oak Ridge, TN (United States); Tennessee Univ., Knoxville, TN (United States). [1993]. 9p. Sponsored by USDOE, Washington, DC (United States); Department of Defense, Washington, DC (United States). DOE Contract AC05-84OR21400 ; FG05-91ER61193. F4962092-J-0147. From 6. conference on gas, oil and environmental biotechnology; Colorado Springs, CO (United States); 29 Nov - 1 dec 1993. Order Number DE94009161. Source: OSTI; NTIS; INIS; GPO Dep.

Bioremediation of sites contaminated with hydrophobic materials that sorb onto the soil matrix is very difficult due to reduced microbial (bio)availability. Following biosurfactant addition, we have measured an increase in contaminant bioavailability by using a lux biosensor. Direct microbial bioavailability was determined by using a genetically engineered microbial bioreporter strain of *Pseudomonas putida*. This strain was engineered so the lux genes, which code for light production, are transcriptionally fused with genes that code for contaminant degradation and are thus induced in the presence of specific compounds. By using a bioreporter we can quantify the actual microbial bioavailability of the contaminants and compare it to concentrations measured by other analytical methods (e.g. gas chromatograph). It is possible that these values are not equal to each other. Thus, bioremediation rates may not be accurately predicted if bioavailability is not considered.

55 (CONF-940159-1) Adsorption and desorption of contaminants. Palumbo, A.V. (Oak Ridge National Lab., TN (United States)); Strong-Gunderson, J.M.; DeFlaun, M.; Ensley, B. Oak Ridge National Lab., TN (United States). [1994]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Joint 40/50 industry outreach meeting; Seattle, WA (United States); 25-27 Jan 1994. Order Number DE94006549. Source: OSTI; NTIS; INIS; GPO Dep.

The microbial remediation of sites Contaminated with organics is well documented, however, there are some significant problems that remain to be solved in the areas of contaminants sorbed to soils and non-aqueous phase liquid (NAPL) contamination. Methods of in situ bioremediation techniques employ either the stimulation of indigenous populations by nutrient addition, or the addition of prepared bacterial cultures to the subsurface environment. Problems of contaminant sorption and NAPL's are related in that both encompass reduced contaminant bioavailability. Non-aqueous phase liquids have been identified as a priority

area for research in the In situ Program due to their presence at DOE sites and the lack of adequate technology to effectively treat this contamination. Bioremediation technologies developed as a result of this project are easily transferred to industry.

56 (CONF-940225-76) Statistical evaluation of newly acquired environmental chemical analysis data as a validation tool for the Uranium Mill Tailings Action (UMTRA) Project. Smith, K. (Weston (Roy F.), Inc. (United States)); Zietz, P.; Minter, M. USDOE Albuquerque Field Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. [1994]. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. From Waste management '94; Tucson, AZ (United States); 27 Feb - 3 Mar 1994. Order Number DE94008606. Source: OSTI; NTIS; GPO Dep.

A statistical comparison of new data with existing data is being used as an effective tool to augment standard data validation practices on the Department of Energy Uranium Mill Tailings Remedial Action (UMTRA) Project. The automated system allows rapid and reliable detection of anomalies in newly acquired chemical analysis data. Three separate statistical methods have been combined to meet the demanding requirements of environmental chemical data, including age-weighted trend analysis, downweighting of historical anomalies, and iterative recalculation of substitute values for below-detection data.

57 (CONF-940225-109) Risk assessment applications for determining cleanup limits for uranium in treated and untreated soils. Armstrong, A.Q. (Oak Ridge National Lab., TN (United States)); Layton, D.W.; Rutz, E.E. Oak Ridge National Lab., TN (United States). [1994]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Waste management '94; Tucson, AZ (United States); 27 Feb - 3 Mar 1994. Order Number DE94012322. Source: OSTI; NTIS; INIS; GPO Dep.

Uranium-contaminated soils are present at various locations across the US where uranium was processed for nuclear fuels or atomic weapons. Important issues relative to such contamination include the assessment of potential health risks associated with human exposures to the residual uranium and the determination of safe levels of uranium in soils that have been treated by a given technology. This paper discusses various risk assessment considerations that must be dealt with when developing cleanup limits for uranium in treated and untreated soils. Key issues addressed include alternative land use scenarios, potential exposure pathways, characterization of the bioavailability of uranium compounds in food and water, a brief overview of health risks associated with uranium and its daughter products as well as a summary of considerations for development of risk-based cleanup limits for uranium in soils.

58 (CONF-9403102-1) Defining the role of risk assessment in the comprehensive environmental response compensation and liability act remedial investigation process at the DOE-OR. Miller, P.D. (Oak Ridge National Lab., TN (United States)); McGinn, C.W.; White, R.K.; Purucker, S.T.; Redfearn, A. Oak Ridge National Lab., TN (United States). 8 Mar 1994. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Human health risk assessment strategy for the Oak Ridge Reservation; Knoxville, TN (United States); 8 Mar 1994. Order Number DE94010131. Source: OSTI; NTIS; GPO Dep.

Cleanup of hazardous waste sites under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) is a complicated and painstaking process, particularly at facilities with a multitude of individual hazardous waste sites, each having a multitude of chemicals and radonulides. The US Department of Energy-Oak Ridge, Environmental Restoration Division (DOE-OR/ERD) administers five such facilities which are undergoing environmental cleanup under the CERCLA Remedial Investigation and Feasibility Study (RI/FS) process or the Resource Conservation and Recovery Act (RCRA) investigation process. The nature of the wastes treated, stored, or disposed of at the US DOE-OR sites is heterogeneous and often unknown. The amount of environmental sampling, chemical analysis, and document preparation and review required to support a baseline risk assessment alone at each facility often requires years before arriving at a final Record of Decision. Therefore, there is clearly a need to streamline the investigative and decision processes in order to realize the US Environmental Protection Agency's (EPA) goal of reducing contaminant levels to those that are protective human health and the environment in a timely and cost-effective manner.

59 (DOE/AL/62350-20F) Technical approach to groundwater restoration: Final report. Jacobs Engineering Group, Inc., Albuquerque, NM (United States). 1 Nov 1993. 44p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94003069. Source: OSTI; NTIS; INIS; GPO Dep.

The Technical Approach to Groundwater Restoration (TAGR) provides general technical guidance to implement the groundwater restoration phase of the Uranium Mill Tailings Remedial Action (UMTRA) Project. The TAGR includes a brief overview of the surface remediation and groundwater restoration phases of the UMTRA Project and describes the regulatory requirements, the National Environmental Policy Act (NEPA) process, and regulatory compliance. A section on program strategy discusses program optimization, the role of risk assessment, the observational approach, strategies for meeting groundwater cleanup standards, and remedial action decision-making. A section on data requirements for groundwater restoration evaluates the data quality objectives (DQO) and minimum data required to implement the options and comply with the standards. A section on site implementation explores the development of a conceptual site model, approaches to site characterization, development of remedial action alternatives, selection of the groundwater restoration method, and remedial design and implementation in the context of site-specific documentation in the site observational work plan (SOWP) and the remedial action plan (RAP). Finally, the TAGR elaborates on groundwater monitoring necessary to evaluate compliance with the groundwater cleanup standards and protection of human health and the environment, and outlines licensing procedures.

60 (DOE/AL/62350-21D) Remedial action plan and site design for stabilization of the inactive uranium mill tailings sites at Slick Rock, Colorado: Remedial action selection report, Appendix B. USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office; Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Jul 1993. 93p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350 ; FC04-82AL16257. Order Number DE93041030. Source: OSTI; NTIS; INIS; GPO Dep.

The Slick Rock uranium mill tailings sites are located near the small town of Slick Rock, in San Miguel County, Colorado. There are two designated UMTRA sites at Slick Rock, the Union Carbide (UC) site and the North Continent (NC) site. Both sites are adjacent to the Dolores River. The UC site is approximately 1 mile (mi) [2 kilometers (km)] downstream of the NC site. Contaminated materials cover an estimated 55 acres (ac) [22 hectares (ha)] at the UC site and 12 ac (4.9 ha) at the NC site. The sites contain former mill building concrete foundations, tailings piles, demolition debris, and areas contaminated by windblown and water-borne radioactive materials. The total estimated volume of contaminated materials is approximately 620,000 cubic yards (yd³) [470,000 cubic meters (m³)]. In addition to the contamination at the two processing site areas, four vicinity properties were contaminated. Contamination associated with the UC and NC sites has leached into groundwater.

61 (DOE/AL/62350-32D) Programmatic Environmental Impact Statement for the Uranium Mill Tailings Remedial Action Ground Water Project. USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Sep 1993. 207p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94001509. Source: OSTI; NTIS; INIS; GPO Dep.

Public concern regarding the potential human health and environmental effects from uranium mill tailings led Congress to pass the Uranium Mill Tailings Radiation Control Act (UMTRCA) (Public Law 95-604) in 1978. In the UMTRCA, Congress acknowledged the potentially harmful health effects associated with uranium mill tailings at 24 abandoned uranium mill processing sites needing remedial action. Uranium processing activities at most of the 24 mill processing sites resulted in the formation of contaminated ground water beneath and, in some cases, downgradient of the sites. This contaminated ground water often has elevated levels of hazardous constituents such as uranium and nitrate. The purpose of the Ground Water Project is to protect human health and the environment by meeting EPA-proposed standards in areas where ground water has been contaminated with constituents from UMTRA Project sites. A major first step in the UMTRA Ground Water Project is the preparation of this Programmatic Environmental Impact Statement (PEIS). This document analyzes potential impacts of the alternatives, including the proposed action. These alternatives are programmatic in that they are plans for conducting the UMTRA Ground Water Project. The alternatives do not address site-specific ground water compliance. This PEIS is a planning document that will provide a framework for conducting the Ground Water Project; assess the potential programmatic and environmental impacts of conducting the UMTRA Ground Water Project; provide a method for determining the site-specific ground water compliance strategies; and provide data and information that can be used to prepare site-specific environmental impacts analyses documents more efficiently.

62 (DOE/AL/62350-38F) Technical assistance contractor Management Plan: Final [report]. Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Sep 1993. 63p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94001478. Source: OSTI; NTIS; INIS; GPO Dep.

The Technical Assistance Contractor (TAC) for the Uranium Mill Tailings Remedial Action (UMTRA) Project

comprises Jacobs Engineering Group Inc. (JEG) and its major teaming partners [Roy F. Weston, Inc. (RFW), Sergeant, Hauskins & Beckwith Agra, Inc. (SHB Agra), and Geraghty & Miller, Inc. (G&M)]. The first three companies have worked together effectively on the UMTRA Project for more than 10 years. With the initiation of the UMTRA Groundwater Project in April 1991, a need arose to increase the TAC's groundwater technical breadth and depth, so G&M was brought in to augment the team's capabilities. The TAC contract's scope is to provide technical, analytical, environmental, engineering, design, inspection, and management support services to the US Department of Energy (DOE) for both surface and groundwater projects. The TAC team continues to support the DOE in completing surface remedial actions and initiating groundwater remediation work for start-up, characterization, design, construction oversight, and remedial operations. A key feature of the TAC's management approach is the extensive set of communication systems implemented for the UMTRA Project. These systems assist all functional disciplines in performing UMTRA Project tasks associated with management, technical support, administrative support, and financial/project controls.

63 (DOE/AL/62350-43D) Baseline risk assessment for groundwater contamination at the uranium mill tailings site near Monument Valley, Arizona: Draft. Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Sep 1993. 127p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94001510. Source: OSTI; NTIS; INIS; GPO Dep.

This baseline risk assessment evaluates potential impact to public health or the environment resulting from groundwater contamination at the former uranium mill processing site near Monument Valley, Arizona. The tailings and other contaminated material at this site are being relocated and stabilized in a disposal cell at Mexican Hat, Utah, through the US Department of Energy (DOE) Uranium Mill Tailings Remedial Action (UMTRA) Project. The tailings removal is planned for completion by spring 1994. After the tailings are removed, groundwater contamination at the site will continue to be evaluated. This risk assessment is the first document specific to this site for the Groundwater Project. It will be used to assist in determining what remedial action is needed for contaminated groundwater at the site.

64 (DOE/AL/62350-48D) Baseline risk assessment of groundwater contamination at the uranium mill tailings site near Shiprock, New Mexico: Draft. Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Sep 1993. 171p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94001513. Source: OSTI; NTIS; INIS; GPO Dep.

This report evaluates potential impact to public health or the environment resulting from groundwater contamination at the former uranium mill processing site. The tailings and other contaminated material at this site were placed in a disposal cell on the site in 1986 by the US Department of Energy's (DOE) Uranium Mill Tailings Remedial Action (UMTRA) Project. Currently, the UMTRA Project is evaluating groundwater contamination. This risk assessment is the first document specific to this site for the Groundwater Project. This risk assessment follows the approach outlined by the US Environmental Protection Agency (EPA). The first step is to evaluate groundwater data collected from monitor wells at the site. Evaluation of these data showed that the main contaminants in the floodplain groundwater are arsenic,

magnesium, manganese, nitrate, sodium, sulfate, and uranium. The complete list of contaminants associated with the terrace groundwater could not be determined due to the lack of the background groundwater quality data. However, uranium, nitrate, and sulfate are evaluated since these chemicals are clearly associated with uranium processing and are highly elevated compared to regional waters. It also could not be determined if the groundwater occurring in the terrace is a usable water resource, since it appears to have originated largely from past milling operations. The next step in the risk assessment is to estimate how much of these contaminants people would be exposed to if a drinking well were installed in the contaminated groundwater or if there were exposure to surface expressions of contaminated water. Potential exposures to surface water include incidental contact with contaminated water or sediments by children playing on the floodplain and consumption of meat and milk from domestic animals grazed and watered on the floodplain.

65 (DOE/AL/62350-48F-Rev.1) Baseline risk assessment of ground water contamination at the Uranium Mill Tailings Site near Shiprock, New Mexico: Revision 1. Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Apr 1994. 175p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94011038. Source: OSTI; NTIS; INIS; GPO Dep.

This baseline risk assessment at the former uranium mill tailings site near Shiprock, New Mexico, evaluates the potential impact to public health or the environment resulting from ground water contamination at the former uranium mill processing site. The tailings and other contaminated material at this site were placed in an on-site disposal cell in 1986 through the US Department of Energy (DOE) Uranium Mill Tailings Remedial Action (UMTRA) Project. Currently, the UMTRA Project is evaluating ground water contamination. This risk assessment is the first document specific to this site for the Ground Water Project. There are no domestic or drinking water wells in the contaminated ground water of the two distinct ground water units: the contaminated ground water in the San Juan River floodplain alluvium below the site and the contaminated ground water in the terrace alluvium area where the disposal cell is located. Because no one is drinking the affected ground water, there are currently no health or environmental risks directly associated with the contaminated ground water. However, there is a potential for humans, domestic animals, and wildlife to be exposed to surface expressions of ground water in the seeps and pools in the area of the San Juan River floodplain below the site. For these reasons, this risk assessment evaluates potential exposure to contaminated surface water and seeps as well as potential future use of contaminated ground water.

66 (DOE/AL/62350-53F) Site-specific analysis of radiological and physical parameters for cobbly soils at the Gunnison, Colorado, processing site. Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Oct 1993. 326p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94001511. Source: OSTI; NTIS; INIS; GPO Dep.

The remedial action at the Gunnison, Colorado, processing site is being performed under the Uranium Mill Tailings Radiation Control Act (UMTRCA) of 1978 [Public Law (PL) 95-604]. Under UMTRCA, the US Environmental Protection Agency (EPA) is charged with the responsibility of developing appropriate and applicable standards for the

cleanup of radiologically contaminated land and buildings at 24 designated sites, including the Gunnison, Colorado, inactive processing site. The remedial action at the processing site will be conducted to remove the tailings and contaminated materials to meet the EPA bulk soil cleanup standards for surface and subsurface soils. The site areas disturbed by remedial action excavation will be either contoured or back-filled with radiologically uncontaminated soil and contoured to restore the site. The final contours will produce a final surface grade that will create positive drainage from the site.

67 (DOE/AL/62350-53F-Rev.1) Site-specific analysis of radiological and physical parameters for cobbly soils at the Gunnison, Colorado, processing site: Revision 1. Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Jan 1994. 326p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94006202. Source: OSTI; NTIS; INIS; GPO Dep.

The remedial action at the Gunnison, Colorado, processing site is being performed under the Uranium Mill Tailings Radiation Control Act (UMTRCA) of 1978. Under UMTRCA, the US Environmental Protection Agency (EPA) is charged with the responsibility of developing appropriate and applicable standards for the cleanup of radiologically contaminated land and buildings at 24 designated sites, including the Gunnison, Colorado, inactive processing site. Section 108 of Public Law 95-604 states that the US Department of Energy (DOE) shall "select and perform remedial actions at the designated processing sites and disposal sites in accordance with the general standards" prescribed by the EPA. Regulations governing the required remedial action at inactive uranium processing sites were promulgated by the EPA in 1983 and are contained in 40 CFR Part 192 (1993), Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings. This document describes the radiological and physical parameters for the remedial action of the soil.

68 (DOE/AL/62350-54D) UMTRA water sampling and analysis plan, Tuba City, Arizona: Draft. Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Sep 1993. 48p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94001508. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this document is to provide background, guidance, and justification for fiscal year (FY) 1994 water sampling activities for the uranium mill tailings site at Tuba City, Arizona. This sampling and analysis plan will form the basis for groundwater sampling and analysis work orders to be implemented in FY94.

69 (DOE/AL/62350-56-Rev.4) UMTRA technical assistance contractor Quality Assurance Program Plan: Revision 4. Pehrson, P. USDOE Albuquerque Field Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. 12 Oct 1993. 79p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94003071. Source: OSTI; NTIS; INIS; GPO Dep.

This report supersedes DOE/UMTRA-400325.

This Quality Assurance Program Plan (QAPP) provides the primary requirements for the integration of quality functions into all Technical Assistance Contractor (TAC) Project organization activities. The QAPP is the written directive authorized by the TAC Program Manager to accomplish this task and to implement procedures that provide the controls

and sound management practices needed to ensure TAC contractual obligations are met. The QA program is designed to use monitoring, audit, and surveillance functions as management tools to ensure that all Project organization functions are executed in a manner that will protect public health and safety, promote the success of the Project, and meet or exceed contract requirements. The key to ensuring compliance with this directive is a two-step professional approach: utilize the quality system in all areas of activity, and generate a personal commitment from all personnel to provide quality service. The quality staff will be experienced, trained professionals capable of providing maximum flexibility to Project goal attainment. Such flexibility will enable the staff to be more cost effective and to further improve communication and coordination. To provide control details, this QAPP will be supplemented by approved standard operating procedures that provide requirements for performing the various TAC quality-related activities. These procedures shall describe applicable design input and document control activities and documentation.

70 (DOE/AL/62350-57D) Baseline risk assessment of groundwater contamination at the Uranium Mill Tailings Site near Gunnison, Colorado. Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Dec 1993. 147p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94004831. Source: OSTI; NTIS; INIS; GPO Dep.

This Baseline Risk Assessment of Groundwater Contamination at the Uranium Mill Tailings Site Near Gunnison, Colorado evaluates potential impacts to public health or the environment resulting from groundwater contamination at the former uranium mill processing site. The tailings and other contaminated material at this site are being placed in an off-site disposal cell by the US Department of Energy's (DOE) Uranium Mill Tailings Remedial Action (UMTRA) Project. Currently, the UMTRA Project is evaluating groundwater contamination. This is the second risk assessment of groundwater contamination at this site. The first risk assessment was performed primarily to evaluate existing domestic wells. This risk assessment evaluates the most contaminated monitor wells at the processing site. It will be used to assist in determining what remedial action is needed for contaminated groundwater at the site after the tailings are relocated. This risk assessment follows an approach outlined by the US Environmental Protection Agency (EPA). The first step is to evaluate groundwater data collected from monitor wells at the site. Evaluation of these data showed that the main contaminants in the groundwater are cadmium, cobalt, iron, manganese, sulfate, uranium, and some of the products of radioactive decay of uranium.

71 (DOE/AL/62350-57D-Rev.1) Baseline risk assessment of groundwater contamination at the Uranium Mill Tailings Site near Gunnison, Colorado: Revision 1. Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Apr 1994. 157p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94011033. Source: OSTI; NTIS; INIS; GPO Dep.

This report evaluates potential impacts to public health or the environment resulting from groundwater contamination at the former uranium mill processing site. The tailings and other contaminated material at this site are being placed in an off-site disposal cell by the US Department of Energy's (DOE) Uranium Mill Tailings Remedial Action (UMTRA)

Project. Currently, the UMTRA Project is evaluating groundwater contamination. This is the second risk assessment of groundwater contamination at this site. The first risk assessment was performed primarily to evaluate existing domestic wells to determine the potential for immediate human health and environmental impacts. This risk assessment evaluates the most contaminated groundwater that flows beneath the processing site towards the Gunnison River. The monitor wells that have consistently shown the highest concentration of most contaminants are used in this risk assessment. This risk assessment will be used in conjunction with additional activities and documents to assist in determining what remedial action is needed for contaminated groundwater at the site after the tailings are relocated. This risk assessment follows an approach outlined by the US Environmental Protection Agency (EPA). The first step is to evaluate groundwater data collected from monitor wells at the site. Evaluation of these data showed that the main contaminants in the groundwater are cadmium, cobalt, iron, manganese, sulfate, uranium, and some of the products of radioactive decay of uranium.

72 (DOE/AL/62350-59) Uranium Mill Tailings Remedial Action 1993 Roadmap. Jacobs Engineering Group, Inc., Albuquerque, NM (United States). 18 Oct 1993. 103p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94003072. Source: OSTI; NTIS; INIS; GPO Dep.

The 1993 Roadmap for the Uranium Mill Tailings Remedial Action (UMTRA) Project office is a tool to assess and resolve issues. The US Department of Energy (DOE) UMTRA Project Office uses the nine-step roadmapping process as a basis for Surface and Groundwater Project planning. This is the second year the Roadmap document has been used to identify key issues and assumptions, develop logic diagrams, and outline milestones. This document is a key element of the DOE planning process. A multi-interest group used the nine-step process to focus on issues, root cause analysis and resolutions. This core group updated and incorporated comments on the basic assumptions, then used these assumptions to identify issues. The list of assumptions was categorized into the following areas: institutional, regulatory compliance, project management, human resource requirements, and other site-specific assumptions. The group identified 10 issues in the analysis phase. All of the issues are ranked according to importance. The number one issue from the 1992 Roadmap, "Lack of sufficient human resources," remained the number one issue in 1993. The issues and their ranking are as follows: Lack of sufficient human resources; increasing regulatory requirements; unresolved groundwater issues; extension of UMTRCA through September 30, 1998; lack of post-UMTRA and post-cell closure policies; unpredictable amounts and timing of Federal funding; lack of regulatory compliance agreements; problem with states providing their share of remedial action costs; different interests and priorities among participants; and technology development/transfer. The issues are outlined and analyzed in detail in Section 8.0, with a schedule for resolution of these issues in Section 9.0.

73 (DOE/AL/62350-61) US Department of Energy Uranium Mill Tailings Remedial Action ground water Project: Revision 1, Version 1: Final project plan. Jacobs Engineering Group, Inc., Albuquerque, NM (United States). 21 Dec 1993. 57p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94004833. Source: OSTI; NTIS; INIS; GPO Dep.

The scope of the Project is to develop and implement a ground water compliance strategy for all 24 UMTRA processing sites. The compliance strategy for the processing sites must satisfy requirements of the proposed EPA ground water cleanup standards in 40 CFR Part 192, Subparts B and C (1988). This scope of work will entail the following activities, on a site-specific basis: Development of a compliance strategy based upon modification of the UMTRA Surface Project remedial action plans (RAP) or development of Ground Water Project RAPs with NRC and state or tribal concurrence on the RAP; implementation of the RAP to include establishment of institutional controls, where appropriate; institution of long-term verification monitoring for transfer to a separate DOE program on or before the Project end date; and preparation of completion reports and final licensing on those sites that will be completed prior to the Project end date.

74 (DOE/AL/62350-68F) Surface and subsurface cleanup protocol for radionuclides, Gunnison, Colorado, UMTRA project processing site: Final [report]. Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Sep 1993. 399p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94001512. Source: OSTI; NTIS; INIS; GPO Dep.

Surface and subsurface soil cleanup protocols for the Gunnison, Colorado, processing sites are summarized as follows: In accordance with EPA-promulgated land cleanup standards (40 CFR 192), in situ Ra-226 is to be cleaned up based on bulk concentrations not exceeding 5 and 15 pCi/g in 15-cm surface and subsurface depth increments, averaged over 100-m² grid blocks, where the parent Ra-226 concentrations are greater than, or in secular equilibrium with, the Th-230 parent. A bulk interpretation of these EPA standards has been accepted by the Nuclear Regulatory Commission (NRC), and while the concentration of the finer-sized soil fraction less than a No. 4 mesh sieve contains the higher concentration of radioactivity, the bulk approach in effect integrates the total sample radioactivity over the entire sample mass. In locations where Th-230 has differentially migrated in subsoil relative to Ra-226, a Th-230 cleanup protocol has been developed in accordance with Supplemental Standard provisions of 40 CFR 192 for NRC/Colorado Department of Health (CDH) approval for timely implementation. Detailed elements of the protocol are contained in Appendix A, Generic Protocol from Thorium-230 Cleanup/Verification at UMTRA Project Processing Sites. The cleanup of other radionuclides or nonradiological hazards that pose a significant threat to the public and the environment will be determined and implemented in accordance with pathway analysis to assess impacts and the implications of ALARA specified in 40 CFR 192 relative to supplemental standards.

75 (DOE/AL/62350-68F-Rev.1) Surface and subsurface cleanup protocol for radionuclides, Gunnison, Colorado, UMTRA project processing site: Final report: Revision 1. Gonzales, D. Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Dec 1993. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94004834. Source: OSTI; NTIS; INIS; GPO Dep.

Surface and subsurface soil cleanup protocols for the Gunnison, Colorado, processing site are summarized as follows: In accordance with EPA-promulgated land cleanup standards, in situ Ra-226 is to be cleaned up based on bulk

concentrations not exceeding 5 and 15 pCi/g in 15-cm surface and subsurface depth increments, averaged over 100m² grid blocks, where the parent Ra-226 concentrations are greater than, or in secular equilibrium with, the Th-230 parent. In locations where Th-230 has differentially migrated in subsoil relative to Ra-226, a Th-230 clean up protocol has been developed. The cleanup of other radionuclides or non-radiological hazards that pose a significant threat to the public and the environment will be determined and implemented in accordance with pathway analysis to assess impacts and the implications of ALARA specified in 40 CFR Part 192 relative to supplemental standards.

76 (DOE/AL/62350-68F-Rev.2) Surface and subsurface cleanup protocol for radionuclides, Gunnison, Colorado, UMTRA project processing site: Final: Revision 2. Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Jan 1994. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94006199. Source: OSTI; NTIS; INIS; GPO Dep.

Thorium 230 (Th-230) at the Gunnison, Colorado processing site will require remediation, however, a seasonally fluctuating groundwater table at the site significantly complicates conventional remedial action with respect to cleanup. Therefore, to effectively remediate the site with respect to Radium 226 (Ra-226) and Th-230, the following supplemental standard is proposed: In situ Ra-26 will be remediated to the EPA soil cleanup standards independent of groundwater considerations. In situ Th-230 concentrations will be remediated in the region above the encountered water table so the 1000-year projected Ra-226 concentration complies with the EPA soil cleanup concentration limits. If elevated Th-230 persists to the water table, an additional foot of excavation will be performed and the grid will be backfilled. Excavated grids will be backfilled to the final remedial action grade with clean cobbly soil. Final grid verification that is required below the water table will be performed by extracting and analyzing a single bulk soil sample with the bucket of a backhoe. Modeled surface radon flux values will be estimated and documented. A recommendation will be made that land records should be annotated to identify the presence of residual Th-230.

77 (DOE/AL/62350-69F) UMTRA water sampling and analysis plan, Lakeview, Oregon. Jacobs Engineering Group, Inc., Albuquerque, NM (United States). 29 Sep 1993. 120p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94003073. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this document is to provide background, guidance, and justification for water sampling activities for the Lakeview, Oregon, Uranium Mill Tailings Remedial Action (UMTRA) processing and disposal sites. This water sampling and analysis plan will form the basis for groundwater sampling and analysis work orders (WSAWO) to be implemented during 1993. Monitoring at the former Lakeview processing site is for characterization purposes and in preparation for the risk assessment, scheduled for the fall of 1993. Compliance monitoring was conducted at the disposal site. Details of the sampling plan are discussed in Section 5.0.

78 (DOE/AL/62350-70F) Guidance document for preparing water sampling and analysis plans for UMTRA sites: Final [report]. Jacobs Engineering Group, Inc.,

Albuquerque, NM (United States). Sep 1993. 40p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94001481. Source: OSTI; NTIS; INIS; GPO Dep.

A water sampling and analysis plan (WSAP) is required for each Uranium Mill Tailings Remedial Action (UMTRA) site to provide rationale for groundwater and surface water sampling at disposal sites and former processing sites. The WSAP identifies and justifies the sampling locations, analytical parameters, detection limits, and sampling frequencies for the groundwater and surface water monitoring stations at each site. Section 2.0 of this WSAP Guidance Document describes the WSAP format. Sections 3.0 and 4.0 provide guidance for selecting sampling frequencies and sampling locations, respectively. Section 5.0 contains criteria for selecting analytical parameters. Section 6.0 provides guidance for the contents of each site's WSAP file. Finally, Section 7.0 presents the references used to prepare this document. The purpose of this guidance document is to provide a consistent technical approach for sampling and monitoring activities performed under WSAPs and a consistent format for WSAP documents. This document is designed for use by the Technical Assistance Contractor (TAC) to prepare WSAPs and by the US Department of Energy (DOE), Nuclear Regulatory Commission, state and tribal agencies, regulatory agencies, and the public to evaluate the contents of the WSAPs. This guidance document may be updated periodically based on new or changing regulations.

79 (DOE/AL/62350-72D) UMTRA project technical assistance contractor quality assurance implementation plan. Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Mar 1994. 45p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94011045. Source: OSTI; NTIS; INIS; GPO Dep.

The Uranium Mill Tailings Remedial Action (UMTRA) Project Technical Assistance contractor (TAC) Quality Assurance Implementation Plan (QAIP) outlines the primary requirements for integrating quality functions for TAC technical activities applied to the surface and ground water phases of the UMTRA Project. The QAIP is subordinate to the latest issue of the UMTRA Project TAC Quality Assurance Program Plan (QAPP) (DOE, 1993a), which was developed using US Department of Energy (DOE) Order 5700.6C quality assurance (QA) criteria. The QAIP addresses technical aspects of the TAC UMTRA Project surface and ground water programs. All QA issues in the QAIP shall comply with requirements contained in the TAC QAPP (DOE, 1993a). Because industry standards for data acquisition and data control are not addressed in DOE Order 5700.6C, the QAIP has been formatted to the 14 US Environmental Protection Agency (EPA) Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) QA requirements. DOE Order 5700.6C criteria that are not contained in the CERCLA requirements are added to the QAIP as additional requirements in Sections 15.0 through 18.0. Project documents that contain CERCLA requirements and 5700.6 criteria shall be referenced in this document to avoid duplication. Referenced documents are not included in this QAIP but are available through the UMTRA Project Document Control Center.

80 (DOE/AL/62350-76-Rev.5) UMTRA Project Office Quality Assurance Program Plan: Revision 5. Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Nov 1993. 78p. Sponsored by USDOE, Washington,

DC (United States). DOE Contract AC04-91AL62350. Order Number DE94004836. Source: OSTI; NTIS; INIS; GPO Dep.

The Uranium Mill Tailings Remedial Action (UMTRA) Project was established to accomplish remedial actions at inactive uranium mill tailings sites in accordance with Public Law 95-604, the Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA). The UMTRA Project's mission is to stabilize and control the residual radioactive materials at designated sites in a safe and environmentally sound manner so as to minimize or eliminate radiation health hazards to the public. The US Department of Energy (DOE) UMTRA Project Office directs the overall Project. Because these efforts may involve possible risks to public health and safety, a quality assurance (QA) program that conforms to the applicable criteria (set forth in the reference documents) has been established to control the quality of the work. This document, the Quality Assurance Program Plan (QAPP), brings into one document the essential criteria to be applied on a selective basis, depending upon the nature of the activity being conducted, and describes how those criteria shall be applied to the UMTRA Project. The UMTRA Project Office shall require each Project contractor to prepare and submit for approval a more detailed QAPP that is based on the applicable criteria of this QAPP and the referenced documents. All QAPPs on the UMTRA Project shall fit within the framework of this plan or an industry standard format that has been approved by the DOE Project Office.

81 (DOE/AL/62350-78) UMTRA project water sampling and analysis plan - Shiprock, New Mexico. Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Feb 1994. 42p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94007201. Source: OSTI; NTIS; INIS; GPO Dep.

Water sampling and analysis plan (WSAP) is required for each U.S. Department of Energy (DOE) Uranium Mill Tailings Remedial Action (UMTRA) Project site to provide a basis for ground water and surface water sampling at disposal and former processing sites. This WSAP identifies and justifies the sampling locations, analytical parameters, detection limits, and sampling frequency for the monitoring stations at the Navaho Reservation in Shiprock, New Mexico, UMTRA Project site. The purposes of the water sampling at Shiprock for fiscal year (FY) 1994 are to (1) collect water quality data at new monitoring locations in order to build a defensible statistical data base, (2) monitor plume movement on the terrace and floodplain, and (3) monitor the impact of alluvial ground water discharge into the San Juan River. The third activity is important because the community of Shiprock withdraws water from the San Juan River directly across from the contaminated alluvial floodplain below the abandoned uranium mill tailings processing site.

82 (DOE/AL/62350-79) Uranium Mill Tailings Remedial Action Project Environmental Protection Implementation Plan. Vollmer, A.T. Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Oct 1993. 50p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94003075. Source: OSTI; NTIS; INIS; GPO Dep.

This report supercedes DOE/UMTRA-150128.

The Uranium Mill Tailings Remedial Action (UMTRA) Project Environmental Protection Implementation Plan (EPIP) has been prepared in accordance with the requirements of the US Department of Energy (DOE) Order 5400.1. The UMTRA EPIP covers the time period of November 9, 1993, through November 8, 1994. It will be updated

annually. Its purpose is to provide management direction to ensure that the UMTRA Project is operated and managed in a manner that will protect, maintain, and where necessary, restore environmental quality, minimize potential threats to public health and the environment, and comply with environmental regulations and DOE policies. Contents of this report are: (1) general description of the UMTRA project environmental protection program; (2) notifications; (3) planning and reporting; (4) special programs; (5) environmental monitoring programs; (6) quality assurance and data verification; and (7) references.

83 (DOE/AL/62350-86D) UMTRA water sampling and analysis plan, Green River, Utah. Papusch, R. Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Dec 1993. 45p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94004837. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this water sampling and analysis plan (WSAP) is to provide a basis for groundwater and surface water sampling at the Green River Uranium Mill Tailing Remedial Action (UMTRA) Project site. This WSAP identifies and justifies the sampling locations, analytical parameters, detection limits, and sampling frequency for the monitoring locations.

84 (DOE/AL/62350-87D) UMTRA project water sampling and analysis plan, Durango, Colorado. Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Jan 1994. 60p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94006200. Source: OSTI; NTIS; INIS; GPO Dep.

Surface remedial action has been completed at the Uranium Mill Tailings Remedial Action Project in Durango, Colorado. Contaminated soil and debris have been removed from the former processing site and placed in the Bodo Canyon disposal cell. Ground water at the former uranium mill/tailings site and raffinate pond area has been contaminated by the former milling operations. The ground water at the disposal site was not impacted by the former milling operations at the time of the cell's construction. Activities for fiscal 1994 involve ground water sampling and site characterization of the disposal site.

85 (DOE/AL/62350-88) Colorado economic impact study on the Uranium Mill Tailings Remedial Action Project in Colorado: Colorado state fiscal year 1993. Jacobs Engineering Group, Inc., Albuquerque, NM (United States). 12 Nov 1993. 46p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94004838. Source: OSTI; NTIS; GPO Dep.

The Colorado economic impact study summarizes employment and economic benefits to the state from activities associated with the Uranium Mill Tailings Remedial Action (UMTRA) Project during Colorado state fiscal year (FY) 1993. To capture employment benefits, a questionnaire was distributed to subcontractor employees at the active UMTRA Project sites of Grand Junction, Rifle, and Gunnison, Colorado. An estimated 52 percent of the employees working on the UMTRA Project responded to this information request. Economic data were requested from each prime subcontractor, as well as from the Remedial Action Contractor. The most significant benefits associated with the UMTRA Project in Colorado are: Direct employment was estimated at 894 workers; An estimated 89 percent of all

direct employment was local; Secondary employment resulting from remedial action at the active Colorado UMTRA Project sites and the Grand Junction vicinity property program is estimated at 546 workers. Total employment (direct and secondary) is estimated at 1440 workers for the period of study (July 1, 1992, to June 30, 1993). An estimated \$24.1 million was paid in wages to UMTRA workers in Colorado during FY1993; Direct and secondary wage earnings were estimated at \$39.9 million; Income tax payments to the state of Colorado were estimated at \$843,400 during FY1993; The gross economic impact of UMTRA Project activities in the state of Colorado is estimated at \$70 million during the 1-year study period; and the net economic benefit to the state of Colorado was estimated at \$57.5 million, or \$5.90 per dollar of funding provided by Colorado. This figure includes both direct and secondary benefits but does not include the impact of alternative uses of the state funding.

86 (DOE/AL/62350-88F) Economic impact study of the Uranium Mill Tailings Remedial Action Project in Colorado: Colorado state fiscal year 1993. Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Dec 1993. 47p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94004839. Source: OSTI; NTIS; INIS; GPO Dep.

The Colorado economic impact study summarizes employment and economic benefits to the state from activities associated with the Uranium Mill Tailings Remedial Action (UMTRA) Project during Colorado state fiscal year 1993 (July 1, 1992, through June 30, 1993). To capture employment benefits, a questionnaire was distributed to subcontractor employees at the active UMTRA Project sites of Grand Junction, Rifle, and Gunnison, Colorado. An estimated 52 percent of the employees working on the UMTRA Project responded to this information request. Economic data were requested from each site prime subcontractor, as well as from the Remedial Action Contractor. The most significant benefits associated with the UMTRA Project in Colorado are summarized.

87 (DOE/AL/62350-90D) UMTRA project water sampling and analysis plan, Ambrosia Lake, New Mexico. Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Feb 1994. 45p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94007200. Source: OSTI; NTIS; INIS; GPO Dep.

This water sampling and analysis plan (WSAP) provides the basis for ground water sampling at the Ambrosia Lake Uranium Mill Tailings Remedial Action (UMTRA) Project site during fiscal year 1994. It identifies and justifies the sampling locations, analytical parameters, detection limits, and sampling frequency for the monitoring locations and will be updated annually. The Ambrosia Lake site is in McKinley County, New Mexico, about 40 kilometers (km) (25 miles [mi]) north of Grants, New Mexico, and 1.6 km (1 mi) east of New Mexico Highway 509 (Figure 1.1). The town closest to the tailings pile is San Mateo, about 16 km (10 mi) south-east (Figure 1.2). The former mill and tailings pile are in Section 28, and two holding ponds are in Section 33, Township 14 North, Range 9 West. The site is shown on the US Geological Survey (USGS) map (USGS, 1980). The site is approximately 2100 meters (m) (7000 feet [ft]) above sea level.

88 (DOE/AL/62350-92) Ground water protection management program plan. Jacobs Engineering Group,

Inc., Albuquerque, NM (United States). Feb 1994. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94007198. Source: OSTI; NTIS; INIS; GPO Dep.

U.S. Department of Energy (DOE) Order 5400.1 requires the establishment of a ground water protection management program to ensure compliance with DOE requirements and applicable federal, state, and local laws and regulations. The Uranium Mill Tailings Remedial Action (UMTRA) Project Office was prepared this Ground Water Protection Management Program Plan (ground water protection plan) whose scope and detail reflect the program's significance and address the seven activities required in DOE Order 5400.1, Chapter III, for special program planning. This ground water protection plan highlights the methods designed to preserve, protect, and monitor ground water resources at UMTRA Project processing and disposal sites. The plan includes an overview of the remedial action status at the 24 designated processing sites and identifies technical guidance documents and site-specific documents for the UMTRA Project ground water protection management program. In addition, the plan addresses the general information required to develop a water resources protection strategy at the permanent disposal sites. Finally, the plan describes ongoing activities that are in various stages of development at UMTRA Project sites.

89 (DOE/AL/62350-95D) UMTRA Project water sampling and analysis plan: Canonsburg and Burrell, Pennsylvania. Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Mar 1994. 37p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94011046. Source: OSTI; NTIS; INIS; GPO Dep.

Surface remedial action was completed at the Canonsburg and Burrell UMTRA Project sites in southwestern Pennsylvania in 1985 and 1987, respectively. Results of 1993 water sampling indicate ground water flow conditions and ground water quality at both sites have remained relatively consistent with time. Uranium concentrations in ground water continue to exceed the maximum concentration limit (MCL) at the Canonsburg site; no MCLs are exceeded in ground water at the Burrell site. Surface water quality shows no evidence of impact from the sites.

90 (DOE/AL/62350-97D) UMTRA Project water sampling and analysis plan, Falls City, Texas. Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Feb 1994. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94007203. Source: OSTI; NTIS; GPO Dep.

Surface remedial action will be completed at the Falls City, Texas, Uranium Mill Tailings Remedial Action Project site in the spring of 1994. Results of water sampling activity from 1989 to 1993 indicate that ground water contamination occurs primarily in the Deweesville/Conquista aquifer (the uppermost aquifer) and that the contamination migrates along four distinct contaminant plumes. Contaminated ground water from some wells in these regions has significantly elevated levels of aluminum, arsenic, cadmium, manganese, molybdenum, selenium, sulfate, and uranium. Contamination in the Dilworth aquifer was identified in monitor well 977 and in monitor well 833 at the southern edge of former tailings pile 4. There is no evidence that surface water quality in Tordilla and Scared Dog Creeks is impacted by tailings seepage. The following water sampling activities are planned for calendar year 1994: (1) Ground water sampling

from 15 monitor wells to monitor the migration of the four major contaminant plumes within the Deweesville/Conquista aquifer. (2) Ground water sampling from five monitor wells to monitor contaminated and background ground water quality conditions in the Dilworth aquifer. Because of disposal cell construction activities, all plume monitor wells screened in the Dilworth aquifer were abandoned. No surface water locations are proposed for sampling. The monitor well locations provide a representative distribution of sampling points to characterize ground water quality and ground water flow conditions in the Deweesville/Conquista aquifer downgradient of the disposal cell. The list of analytes has been modified with time to reflect constituents currently related to uranium processing activities and natural uranium mineralization. Water sampling is normally conducted biannually in late summer and midwinter.

91 (DOE/AL/62350-109) Technical approach for the management of UMTRA ground water investigation-derived wastes. Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Feb 1994. 63p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94008246. Source: OSTI; NTIS; INIS; GPO Dep.

During characterization, remediation, or monitoring activities of the US Department of Energy's (DOE) Uranium Mill Tailings Remedial Action (UMTRA) Project, ground water samples are collected to assess the extent and amount of waterborne contamination that might have come from the mill tailings. This sampling sometimes occurs in contaminated areas where ground water quality has been degraded. Ground water sampling activities may result in field-generated wastes that must be disposed of in a manner protective of human health and the environment. During ground water sampling, appropriate measures must be taken to dispose of presampling purge water and well development water that is pumped to flush out any newly constructed wells. Additionally, pumping tests may produce thousands of gallons of potentially contaminated ground water that must be properly managed. In addition to the liquid wastes, there is the potential for bringing contaminated soils to the ground surface during the drilling and installation of water wells in areas where the subsurface soils may be contaminated. These soils must be properly managed as well. This paper addresses the general technical approach that the UMTRA Project will follow in managing field-generated wastes from well drilling, development, sampling, and testing. It will provide guidance for the preparation of Technical Assistance Contractor (TAC) Standard Operating Procedures (SOP) for the management and disposal of field-generated wastes from ground water monitoring and remediation activities.

92 (DOE/AL/62350-110) Gunnison, Colorado, subpile study report. Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Mar 1994. 80p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94011043. Source: OSTI; NTIS; INIS; GPO Dep.

To protect human health and the environment, the UMTRA project will remediate the uranium mill tailings site at Gunnison, Colorado. There are explicit requirements (i.e., 40 Part CFR Part 192) for the surface remediation of radiologically contaminated soils on UMTRA sites. The removal of subpile sediment to the depth required by 40 CFR Part 192 will leave in place deeper foundation sediment that is contaminated with hazardous constituents other than

radium-226 and thorium-230. The Department of Energy and the Colorado Department of Health have questioned whether this contaminated soil could potentially act as a continuing source of ground water contamination even after surface remediation based on 40 CFR Part 192 is complete. To evaluate the subpile sediments as a potential source of ground water contamination, the Gunnison subpile study was initiated. This report summarizes the results and findings of this study.

93 (DOE/AL/62350-115) UMTRA project water sampling and analysis plan, Spook, Wyoming. Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Mar 1994. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94011035. Source: OSTI; NTIS; INIS; GPO Dep.

Surface remedial action is complete at the Spook Uranium Mill Tailings Remedial Action Project site in Wyoming. Based on an evaluation of site characterization data, the US Nuclear Regulatory Commission, US Department of Energy, and state of Wyoming have concurred in the determination that a program to monitor ground water is not required because ground water in the uppermost aquifer is Class 3 (limited use) (40 CFR 192.21(g)(1993)).

94 (DOE/AL/62350-117) UMTRA project water sampling and analysis plan, Riverton, Wyoming. Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Mar 1994. 51p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94011040. Source: OSTI; NTIS; INIS; GPO Dep.

Surface remediation was completed at the former uranium mill site in Riverton, Wyoming, in 1990. Residual radioactive materials (contaminated soil and debris) were removed and disposed of at Union Carbide Corporation's (Umetco) nearby Gas Hills Title 2 facility. Ground water in the surficial and semiconfined aquifers (known collectively as the 'uppermost aquifer') below the former mill and tailings site has been contaminated. No contamination has been detected in the deeper, confined sandstone aquifer. The contaminant plume extends off site to the south and east. The plume is constrained by surface wetlands and small streams to the east and west of the site and by the Little Wind River to the south. Fifteen monitor wells installed in 1993 were sampled to better define the contaminant plume and to provide additional water quality data for the baseline risk assessment. Samples also were collected from domestic wells in response to a request by the Wyoming Department of Environmental Quality in January 1994. No contamination attributable to the former uranium milling operations have ever been detected in any of the domestic wells used for potable supplies.

95 (DOE/AL/62350-118) UMTRA project water sampling and analysis plan, Mexican Hat, Utah. Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Apr 1994. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94011039. Source: OSTI; NTIS; INIS; GPO Dep.

The Mexican Hat, Utah, Uranium Mill Tailings Remedial Action (UMTRA) Project site is a former uranium mill that is undergoing surface remediation in the form of on-site tailings stabilization. Contaminated surface materials from the Monument Valley, Arizona, UMTRA Project site have been transported to the Mexican Hat site and are being consolidated with the Mexican Hat tailings. The scheduled completion of the tailings disposal cell is August 1995. Water is found in two geologic units at the site: the Halgaito

Shale Formation and the Honaker Trail Formation. The tailings rest on the Halgaito Shale, and water contained in that unit is a result of milling activities and, to a lesser extent, water released from the tailings from compaction during remedial action construction of the disposal cell. Water in the Halgaito Shale flows through fractures and discharges at seeps along nearby arroyos. Flow from the seeps will diminish as water drains from the unit. Ground water in the lower unit, the Honaker Trail Formation, is protected from contamination by an upward hydraulic gradient. There are no nearby water supply wells because of widespread poor background ground water quality and quantity, and the San Juan River shows no impacts from the site. This water sampling and analysis plan (WSAP) recommends sampling six seeps and one upgradient monitor well compared in the Honaker Trail Formation. Samples will be taken in April 1994 (representative of high group water levels) and September 1994 (representative of low ground water levels). Analyses will be performed on filtered samples for plume indicator parameters.

96 (DOE/AL/62350-122) UMTRA project water sampling and analysis plan, Monument Valley, Arizona. Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Apr 1994. 31p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94011037. Source: OSTI; NTIS; INIS; GPO Dep.

The Monument Valley Uranium Mill Tailings Remedial Action (UMTRA) Project site in Cane Valley is a former uranium mill that has undergone surface remediation in the form of tailings and contaminated materials removal. Contaminated materials from the Monument Valley (Arizona) UMTRA Project site have been transported to the Mexican Hat (Utah) UMTRA Project site for consolidation with the Mexican Hat tailings. Tailings removal was completed in February 1994. Three geologic units at the site contain water: the unconsolidated eolian and alluvial deposits (alluvial aquifer), the Shinarump Conglomerate (Shinarump Member), and the De Chelly Sandstone. Water quality analyses indicate the contaminant plume has migrated north of the site and is mainly in the alluvial aquifer. An upward hydraulic gradient in the De Chelly Sandstone provides some protection to that aquifer. This water sampling and analysis plan recommends sampling domestic wells, monitor wells, and surface water in April and September 1994. The purpose of sampling is to continue periodic monitoring for the surface program, evaluate changes to water quality for site characterization, and provide data for the baseline risk assessment. Samples taken in April will be representative of high ground water levels and samples taken in September will be representative of low ground water levels. Filtered and nonfiltered samples will be analyzed for plume indicator parameters and baseline risk assessment parameters.

97 (DOE/CH-9212) Remediation of groundwater containing radionuclides and heavy metals using ion exchange and the AlgaSORB® biosorbent system: Final report. Feiler, H.D. (Science Applications International Corp., Paramus, NJ (United States)); Darnall, D.W. (Science Applications International Corp., Paramus, NJ (United States)); Bio-Recovery Systems, Inc., Las Cruces, NM (United States). 7 Nov 1991. 97p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE93009532. Source: OSTI; NTIS; INIS; GPO Dep.

Bio-Recovery Systems, Inc. (BRS) studied the application of an immobilized algal biomass, termed AlgaSORB®, which

has high affinity for heavy metal ions to DOE-contaminated groundwaters. The material can be packed into columns similar to commercial ion exchange resins. Dilute solutions containing heavy metals are passed through columns where metals are absorbed by the AlgaSORB® resins. Once saturated, metal ions can be stripped from the resin biomass in a highly concentrated solution. Groundwaters contaminated with heavy metal ions from three different Department of Energy (DOE) sites: Savannah River, Hanford and the Oak Ridge Y-12 Plant were studied. The objective was to perform bench-scale treatability studies to establish treatment protocols and to optimize an AlgaSORB®/ion exchange technology system to remove and recover toxic metal ions from these contaminated groundwaters. The specialty ion exchange/AlgaSORB® resins tested in these studies show promise for selectively removing chromium, mercury and uranium from contaminated groundwater at DOE sites. The data show that effluents which satisfy the allowable metal ion limits are possible and most likely achievable. The use of these highly selective resins also offer advantages in terms of cost/benefit, risk and scheduling. Their high selectivity allows for high capacity and opportunities for recovery of removed constituents due to high pollutant concentration possible (3 to 4 orders of magnitude). Ion exchange is a proven technology which is easily automated and can be cost-effective, depending on the application.

98 (DOE/EA-0339) Environmental assessment of remedial action at the Slick Rock uranium mill tailings sites Slick Rock, Colorado: Draft. USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office; Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Jun 1993. 114p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE93041026. Source: OSTI; NTIS; INIS; GPO Dep.

The Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA) authorized the US Department of Energy (DOE) to clean up two uranium mill tailings processing sites near Slick Rock, Colorado, in San Miguel County. The purpose of the cleanup is to reduce the potential health effects associated with the radioactive materials remaining on the sites and on vicinity properties (VP) associated with the sites. The US Environmental Protection Agency (EPA) promulgated standards for the UMTRCA that contained measures to control the contaminated materials and to protect the groundwater from further degradation. Remedial actions at the Slick Rock sites must be performed in accordance with these standards and with the concurrence of the US Nuclear Regulatory Commission (NRC).

99 (DOE/EIS-0198-Rev.1) Programmatic environmental impact statement for the Uranium Mill Tailings Remedial Action Ground Water Project: Revision 1, Draft. Jacobs Engineering Group, Inc., Albuquerque, NM (United States). 19 Oct 1993. 207p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. (DOE/AL/62350-0198-Rev.1). Order Number DE94003177. Source: OSTI; NTIS; INIS; GPO Dep.

Public concern regarding the potential human health and environmental effects from uranium mill tailings led Congress to pass the Uranium Mill Tailings Radiation Control Act (UMTRCA) (Public Law 95-604) in 1978. In the UMTRCA, Congress acknowledged the potentially harmful health effects associated with uranium mill tailings at 24 abandoned uranium mill processing sites needing remedial action. Pursuant to the UMTRCA, the US Environmental Protection

Agency (EPA) developed standards, which include exposure limits from surface contamination and concentration limits for ground water, to protect the public and the environment from potential radiological and nonradiological hazards from the abandoned mill processing sites. The US Department of Energy (DOE) is responsible for performing remedial action to bring the surface and ground water contaminant levels at the abandoned mill processing sites into compliance with the EPA standards. The DOE is accomplishing this function through the Uranium Mill Tailings Remedial Action (UMTRA) Project. A major first step in the UMTRA Ground Water Project is the preparation of this Programmatic Environmental Impact Statement (PEIS). This document analyzes potential impacts of the alternatives, including the proposed action. These alternatives are programmatic in that they are plans for conducting the UMTRA Ground Water Project. The alternatives do not address site-specific ground water compliance. This PEIS is a planning document that will provide a framework for conducting the Ground Water Project; assess the potential programmatic and environmental impacts of conducting the UMTRA Ground Water Project; provide a method for determining the site-specific ground water compliance strategies; and provide data and information that can be used to prepare site-specific environmental impacts analyses documents more efficiently.

100 (DOE/EIS-0198-Rev.2) Programmatic environmental impact statement for the Uranium Mill Tailings Remedial Action Ground Water Project: Revision 2. Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Mar 1994. 213p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94011044. Source: OSTI; NTIS; INIS; GPO Dep.

Uranium processing activities at most of the 24 inactive mill sites designated for remediation under the Uranium Mill Tailings Radiation Control Act (UMTRCA) resulted in the formation of contaminated ground water beneath and, in some cases, downgradient of the sites. This contaminated ground water often has elevated levels of hazardous constituents such as uranium and nitrate. The purpose of the Uranium Mill Tailings Remedial Action (UMTRA) Ground Water Project is to protect human health and the environment by meeting EPA proposed standards in areas where ground water has been contaminated with constituents from former processing sites. A major first step in the UMTRA Ground Water Project is the preparation of this Programmatic Environmental Impact Statement (PEIS). This document analyzes potential impacts of the alternatives, including the proposed action, which is the DOE's preferred alternative. These alternatives are programmatic in that they are plans for conducting the UMTRA Ground Water Project. The alternatives, which are described in Section 2.0, do not address site-specific ground water compliance. This PEIS is a planning document that will provide a framework for conducting the Ground Water Project; assess the potential programmatic impacts of conducting the UMTRA Ground Water Project; provide a method for determining the site-specific ground water compliance strategies; and provide data and information that can be used to prepare site-specific environmental impacts analyses documents more efficiently.

101 (DOE/EIS-0198-Rev.3) Draft programmatic environmental impact statement for the Uranium Mill Tailings Remedial Action Ground Water Project: Revision 3. Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Apr 1994. 230p. Sponsored by USDOE,

Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94011042. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of the UMTRA Ground Water Project is to protect human health and the environment by meeting the proposed EPA standards in areas where ground water has been contaminated. The first step in the UMTRA Ground Water Project is the preparation of this programmatic environmental impact statement (PEIS). This document analyzes potential impacts of four programmatic alternatives, including the proposed action. The alternatives do not address site-specific ground water compliance. Rather, the PEIS is a planning document that provides a framework for conducting the Ground Water Project; assesses the potential programmatic impacts of conducting the Ground Water Project; provides a method for determining the site-specific ground water compliance strategies; and provides data and information that can be used to prepare site-specific environmental impacts analyses more efficiently. This PEIS differs substantially from a site-specific environmental impact statement because multiple ground water compliance strategies, each with its own unique set of potential impacts, could be used to implement all the alternatives except the no action alternative. Implementing a PEIS alternative means applying a ground water compliance strategy or strategies at a specific site. It is the use of a strategy or a combination of strategies that would result in site-specific impacts.

102 (DOE/EM-0001/92) Annual status report on the Uranium Mill Tailings Remedial Action Program. USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). Dec 1992. 60p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE93040728. Source: OSTI; NTIS; INIS; GPO Dep.

This fourteenth annual status report for the Uranium Mill Tailings Remedial Action (UMTRA) Project Office summarizes activities of the Uranium Mill Tailings Remedial Action Surface (UMTRA-Surface) and Uranium Mill Tailings Remedial Action Groundwater (UMTRA-Groundwater) Projects undertaken during fiscal year (FY) 1992 by the US Department of Energy (DOE) and other agencies. Project goals for FY 1993 are also presented. An annual report of this type was a statutory requirement through January 1, 1986, pursuant to the Uranium Mill Tailings Radiation Control Act (UMTRCA) of 1978, Public Law (PL) 95-604. The DOE will continue to submit annual reports to DOE-Headquarters, the states, tribes, and local representatives through Project completion in order to inform the public of the yearly Project status. The purpose of the remedial action is to stabilize and control the tailings and other residual radioactive material (RRM) located on the inactive uranium processing sites in a safe and environmentally sound manner, and to minimize or eliminate potential health hazards. Commercial and residential properties near designated processing sites that are contaminated with material from the sites, herein referred to as "vicinity properties (VP)," are also eligible for remedial action. Included in the UMTRA Project are 24 inactive uranium processing sites and associated VPs located in 10 states, and the VPs associated with the Edgemont, South Dakota, uranium mill currently owned by the Tennessee Valley Authority (TVA) (Figure A.1, Appendix A).

103 (DOE/EM-0005P) Environmental Restoration and Waste Management (EM) program: An introduction. USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States); Virginia

Polytechnic Inst. and State Univ., Blacksburg, VA (United States). Management Systems Labs. Dec 1990. 91p. Sponsored by USDOE, Washington, DC (United States). Order Number DE91006061. Source: OSTI; NTIS; INIS; GPO Dep.

This booklet introduces the reader to the mission and functions of a major new unit within the US Department of Energy (DOE): the Office of Environmental Restoration and Waste Management (EM). The Secretary of Energy established EM in November 1989, implementing a central purpose of DOE's first annual Environmental Restoration and Waste Management Five-Year Plan, which had appeared three months earlier. The contents of this booklet, and their arrangement, reflect the annual update of the Five-Year Plan. The Five-Year Plan supports DOE's strategy for meeting its 30-year compliance and cleanup goal. This strategy involves: focusing DOE's activities on eliminating or reducing known or recognized potential risks to worker and public health and the environment, containing or isolating, removing, or detoxifying onsite and offsite contamination, and developing technology to achieve DOE's environmental goals.

104 (DOE/EM-0013P) Environmental Restoration and Waste Management (EM) program: An introduction. USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). Jun 1991. 94p. Sponsored by USDOE, Washington, DC (United States). Order Number DE91018290. Source: OSTI; NTIS; INIS; GPO Dep.

This booklet introduces the reader to the mission and functions of a major unit within the US Department of Energy (DOE): the Office of Environmental Restoration and Waste Management (EM). The Secretary of Energy established EM in November 1989, implementing the first step in fulfilling the central purpose of DOE's annually updated Environmental Restoration and Waste Management Five-Year Plan (FYP). The first FYP had been developed three months earlier. The contents of this booklet, and their arrangement, reflect (and will, it is hoped, serve as a kind of appetizer for) the annual update of the Five-Year Plan. The Five-Year Plan supports DOE's strategy for meeting its 30-year compliance and cleanup goal. This strategy involves: (1) focusing DOE's activities on eliminating or reducing known or recognized potential risks to workers, the public, and the environment; (2) containing or isolating, removing, or detoxifying onsite and offsite contamination; and (3) developing technology to achieve DOE's environmental goals. 101 refs.

105 (DOE/EM-0108P) EM-54 Technology Development In Situ Remediation Integrated Program: Annual report. USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). Office of Technology Development. Aug 1993. 68p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94003840. Source: OSTI; NTIS; INIS; GPO Dep.

The Department of Energy (DOE) established the Office of Technology Development (EM-50) as an element of Environmental Restoration and Waste Management (EM) in November 1989. EM manages remediation of all DOE sites as well as wastes from current operations. The goal of the EM program is to minimize risks to human health, safety and the environment, and to bring all DOE sites into compliance with Federal, state, and local regulations by 2019. EM-50 is charged with developing new technologies that are safer, more effective and less expensive than current methods. The In Situ Remediation Integrated Program (the subject of this report) is part of EM-541, the Environmental Restoration

Research and Development Division of EM-54. The In Situ Remediation Integrated Program (ISR IP) was instituted out of recognition that in situ remediation could fulfill three important criteria: Significant cost reduction of cleanup by eliminating or minimizing excavation, transportation, and disposal of wastes; reduced health impacts on workers and the public by minimizing exposure to wastes during excavation and processing; and remediation of inaccessible sites, including: deep subsurfaces; in, under, and around buildings. Buried waste, contaminated soils and groundwater, and containerized wastes are all candidates for in situ remediation. Contaminants include radioactive wastes, volatile and non-volatile organics, heavy metals, nitrates, and explosive materials. The ISR IP tends to facilitate development of in situ remediation technologies for hazardous, radioactive, and mixed wastes in soils, groundwater, and storage tanks. Near-term focus is on containment of the wastes, with treatment receiving greater effort in future years.

106 (DOE/EM-0109P) Office of Technology Development Program for Research, Development, Demonstration, Testing, and Evaluation: FY 1993 Program Summary. USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). Oct 1993. 224p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94002591. Source: OSTI; NTIS; INIS; GPO Dep.

DOE has set a goal to clean up its complex and to bring all sites into compliance with applicable environmental regulations. This initiative is slated for completion by the year 2019. Four years ago there was no coordinated plan for identifying or cleaning these contaminated sites. Since 1989, DOE's Office of Environmental Restoration and Waste Management has invested time, money, and manpower to establish a wide range of programs to meet this immense challenge. DOE is responsible for waste management and clean up of more than 100 contaminated installations in 36 states and territories. This includes 3,700 sites: over 26,000 acres, with hazardous or radioactive contaminated surface or groundwater, soil, or structures; over 26,000 acres requiring remediation, with the number growing as new sites are defined; 500 surplus facilities awaiting decontamination and decommissioning and approximately 5,000 peripheral properties (residences, businesses) that have soil contaminated with uranium tailings.

107 (DOE/ID-10382-App.A-F) Idaho National Engineering Laboratory response to the December 13, 1991, Congressional Inquiry on offsite release of hazardous and solid waste containing radioactive materials from Department of Energy facilities. Shapiro, C.; Garcia, K.M.; McMurtrey, C.D.; Williams, K.L.; Jordan, P.J. EG and G Idaho, Inc., Idaho Falls, ID (United States). May 1992. 2205p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92019702. Source: OSTI; NTIS; INIS; GPO Dep.

This report is a response to the December 13, 1991, Congressional inquiry that requested information on all hazardous and solid waste containing radioactive materials sent from Department of Energy facilities to offsite facilities for treatment or disposal since January 1, 1981. This response is for the Idaho National Engineering Laboratory. Other Department of Energy laboratories are preparing responses for their respective operations. The request includes ten questions, which the report divides into three parts, each responding to a related group of questions. Part 1 answers

Questions 5, 6, and 7, which call for a description of Department of Energy and contractor documentation governing the release of waste containing radioactive materials to offsite facilities. "Offsite" is defined as non-Department of Energy and non-Department of Defense facilities, such as commercial facilities. Also requested is a description of the review process for relevant release criteria and a list of all Department of Energy and contractor documents concerning release criteria as of January 1, 1981. Part 2 answers Questions 4, 8, and 9, which call for information about actual releases of waste containing radioactive materials to offsite facilities from 1981 to the present, including radiation levels and pertinent documentation. Part 3 answers Question 10, which requests a description of the process for selecting offsite facilities for treatment or disposal of waste from Department of Energy facilities. In accordance with instructions from the Department of Energy, the report does not address Questions 1, 2, and 3.

108 (DOE/ID-10432) Air emission inventory for the Idaho National Engineering Laboratory: Final report. Allen, P.H. EG and G Idaho, Inc., Idaho Falls, ID (United States). Mar 1991. 504p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. (INEL/MISC-93065). Order Number DE93013749. Source: OSTI; NTIS; GPO Dep.

During the fall of 1989, an Air Emission Inventory was initiated at the Idaho National Engineering Laboratory (INEL). This inventory was undertaken in part at the request of the State of Idaho Air Quality Bureau (IAQB) so that the emission of air contaminants from the INEL could be quantified and this information used when future air permits are evaluated. The INEL would also benefit by: enabling preparation of an application for a site-wide permit to operate, facilitating preparation of other air permits, and allowing the INEL management to track and receive credit for facilities that are being phased out. The air contaminants that are included in this inventory are the Criteria Pollutants (Nitrogen Oxides, Sulfur Oxides, Carbon Monoxide, Volatile Organic Compounds, Lead, and PM10), and Radionuclides. For this inventory, all particulate (TSP) is considered to be PM10, but will be differentiated in the Toxic Air Pollutant inventory that INEL will prepare over the next year. It is important to note that many of the terms used in this document are not used as defined in the regulations for the control of air pollution. Terms such as major, minor, and significant with regards to emissions are used as relational terms to the inventory, rather than descriptive of regulatory concepts. When this information is used for permitting purposes, these terms will be reserved for their regulatory meanings.

109 (DOE/ID-10433) Air Emission Inventory for the Idaho National Engineering Laboratory: 1990 and 1991 emissions report. Stirrup, T.S. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jun 1992. 599p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. (INEL/MISC-93066). Order Number DE93013730. Source: OSTI; NTIS; GPO Dep.

During the fall of 1989, the Air Emission Inventory (AEI) was initiated at the Idaho National Engineering Laboratory (INEL). This inventory was undertaken in part at the request of the State of Idaho Air Quality Bureau (IAQB). The request was to provide a mechanism so the emission of air contaminants from the INEL could be quantified and this information used when future air permits are evaluated. The pollutants associated with the inventory include nitrogen oxides, sulfur oxides, carbon monoxide, volatile organic compounds, lead,

and particulates as well as radionuclides. For the inventory, all particulate (TSP) is considered to be PM10, but will be differentiated in the INEL Toxic Air Pollutant Inventory which DOE-ID is presently preparing for submittal to the State. For the purposes of this report, only the criteria pollutants and radionuclides are reported; any noncriteria pollutants will be addressed as required.

110 (DOE/ID-10437(92)) Air Emission Inventory for the Idaho National Engineering Laboratory: 1992 emissions report. Stirrup, T.S. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jun 1993. 394p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93016687. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents the 1992 Air Emission Inventory for the Idaho National Engineering Laboratory. Originally, this report was in response to the Environmental Oversight and Monitoring Agreement in 1989 between the State of Idaho and the Department of Energy Idaho Field Office, and a request from the Idaho Air Quality Bureau. The current purpose of the Air Emission Inventory is to provide the basis for the preparation of the INEL Permit-to-Operate (PTO) an Air Emission Source Application, as required by the recently promulgated Title V regulations of the Clean Air Act. This report includes emissions calculations from 1989 to 1992. The Air Emission Inventory System, an ORACLE-based database system, maintains the emissions inventory.

111 (DOE/ID/13042-7) Moscow Test Well, INEL Oversight Program: Aqueous geochemistry. McCurry, M. (Idaho State Univ., Pocatello, ID (United States)); Fromm, J.; Welhan, J. Idaho INEL Oversight Program, Boise, ID (United States). 29 Sep 1992. 41p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG07-91ID13042. Order Number DE93012950. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents a summary and interpretation of data gathered during sampling of the Moscow Test Well at Moscow, Idaho during April and May of 1992. The principal objectives of this chemical survey were to validate sampling procedures with a new straddle packer sampling tool in a previously hydrologically well characterized and simple sampling environment, and to compare analytical results from two independent labs for reproducibility of analytical results. Analytes included a wide range of metals, anions, nutrients, BNA's, and VOC's. Secondary objectives included analyzing of waters from a large distilled water tank (utilized for all field laboratory purposes as "pure" stock water), of water which passed through a steamer used to clean the packer, and of rinsates from the packer tool itself before it was lowered into the test well. Analyses were also obtained of blanks and spikes for data validation purposes.

112 (DOE/ID/13042-16) INEL Oversight Program R and D 2-3 technical forum No. 1, June 27-28, 1991. Idaho Dept. of Health and Welfare, Boise, ID (United States). 5 Jun 1991. 95p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG07-91ID13042. Order Number DE93012956. Source: OSTI; NTIS; INIS; GPO Dep.

Memos, agendas, regional hydrology, and field trip reports are included for the INEL oversight program; they relate to the hydrogeology of INEL and ICPP, and to the cleanup effort at these sites.

113 (DOE/ID/13042-17) Summary of ground water and surface water flow and contaminant transport computer codes used at the Idaho National Engineering

Laboratory (INEL): Version 1.0. Bandy, P.J.; Hall, L.F. Idaho INEL Oversight Program, Boise, ID (United States). Mar 1993. 141p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG07-91ID13042. Order Number DE93012955. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents information on computer codes for numerical and analytical models that have been used at the Idaho National Engineering Laboratory (INEL) to model ground water and surface water flow and contaminant transport. Organizations conducting modeling at the INEL include: EG&G Idaho, Inc., US Geological Survey, and Westinghouse Idaho Nuclear Company. Information concerning computer codes included in this report are: agency responsible for the modeling effort, name of the computer code, proprietor of the code (copyright holder or original author), validation and verification studies, applications of the model at INEL, the prime user of the model, computer code description, computing environment requirements, and documentation and references for the computer code.

114 (DOE/ID/13042-18) Annual report on monitoring of the unsaturated zone and recharge areas at INEL to the state of Idaho INEL Oversight Committee. King, B.; Bloomsburg, G.; Horn, D.; Liou, J.; Finnie, J. Idaho Univ., Moscow, ID (United States). Water Resources Research Inst. 1992. 65p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG07-91ID13042. Order Number DE93012946. Source: OSTI; NTIS; INIS; GPO Dep.

During the early years of the INEL, the USGS conducted extensive studies (sitewide drilling program) of the geology and hydrology of the area collecting varied data over the years. The unsaturated zone has not received much attention until recently. The studies that have been done are a result of problems or concerns arising from liquid radioactive waste disposal. The TRA facility has the most information published about its waste disposal activities. The ICPP has less data about the unsaturated zone due to the fact that most waste water disposal has been to a well. Little is known about the effect of waste water disposal at the NRF on the unsaturated zone. Essentially no information was found about waste disposal activities at other facilities, primarily because there does not appear to be any reported problems associated with waste water disposal at these locations. The RWMC has received much attention in the last few years as the result of being priority No. 1 in the superfund clean up of the INEL. A considerable amount of data are available describing the unsaturated zone at the RWMC. These data have been collected to field calibrate a radionuclide migration model for the RWMC.

115 (DOE/ID/13042-22) Annual report on monitoring of the unsaturated zone and recharge areas at INEL to the state of Idaho INEL Oversight Committee: Draft. Horn, D.; Liou, J.; Finnie, J. Idaho Univ., Moscow, ID (United States). Idaho Water and Energy Resources Research Inst. Mar 1993. 121p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG07-91ID13042. Order Number DE93012947. Source: OSTI; NTIS; INIS; GPO Dep.

This project, begun in March 1991, was originally structured as two separate research efforts: An investigation of the recharge phenomenon and surface water-ground water interactions at the INEL; and a study of water and contaminant movement through the unsaturated zone, including a review of computer models used to described this process. During the initial months of work, it became obvious to those involved in these studies that the two topic areas were intimately related, and work since that time has proceeded with

no firm boundaries between the two efforts. Much of the Phase I work (March 1991–March 1992) consisted of a detailed review of available literature pertinent to the two research topics and to the INEL site. This Annual Report summarizes the other project activities during Phase III, and is organized into three sections: Section I – an overview of the ongoing efforts related to computer model algorithms and data requirements for modeling the transport process in the unsaturated zone (Dr. Jim Liou). Section H – a review of ongoing work to predict the growth and decay of the ground water mound beneath the INEL spreading basins, using the computer model UNSAT-2 (Dr. John Finnie). Section M – a final report of the completed study effort examining the recharge rates associated with stream flow in the Big Lost River, and the effects of this recharge on ground water levels at the INEL site (Dr. Dennis Horn). Phase M of the project has now begun, and will conclude in December 1993 with two final reports documenting the work that has been briefly described in Sections I and H of this report.

116 (DOE/ID/13042–23) Abstracts and parameter index database for reports pertaining to the unsaturated zone and surface water-ground water interactions at the Idaho National Engineering Laboratory. Bloomsburg, G. (Idaho Univ., Moscow, ID (United States)); Finnie, J.; Horn, D.; King, B.; Liou, J. Idaho INEL Oversight Program, Boise, ID (United States). May 1993. 150p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG07-91ID13042. (OPTR-93-01). Order Number DE94002418. Source: OSTI; NTIS; INIS; GPO Dep.

This report is a product generated by faculty at the University of Idaho in support of research and development projects on Unsaturated Zone Contamination and Transport Processes, and on Surface Water-Groundwater Interactions and Regional Groundwater Flow at the Idaho National Engineering Laboratory. These projects are managed by the State of Idaho's INEL Oversight Program under a grant from the US Department of Energy. In particular, this report meets project objectives to produce a site-wide summary of hydrological information based on a literature search and review of field, laboratory and modeling studies at INEL, including a cross-referenced index to site-specific physical, chemical, mineralogic, geologic and hydrologic parameters determined from these studies. This report includes abstracts of 149 reports with hydrological information. For reports which focus on hydrological issues, the abstracts are taken directly from those reports; for reports dealing with a variety of issues beside hydrology, the abstracts were generated by the University of Idaho authors concentrating on hydrology-related issues. Each abstract is followed by a "Data" section which identifies types of technical information included in a given report, such as information on parameters or chemistry, mineralogy, stream flows, water levels. The "Data" section does not include actual values or data.

117 (DOE/ID/13042–26) Directional dependency of air sampling: Research and development grant #4. Idaho INEL Oversight Program, Boise, ID (United States). 15 Jan 1994. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG07-91ID13042. Order Number DE94008822. Source: OSTI; NTIS; INIS; GPO Dep.

A field study was performed by Idaho State University-Environmental Monitoring Laboratory (EML) to examine the directional dependency of low-volume air samplers. A typical continuous low volume air sampler contains a sample head that is mounted on the sampler housing either horizontally through one of four walls or vertically on an exterior wall

'looking down or up.' In 1992, a field study was undertaken to estimate sampling error and to detect the directional effect of sampler head orientation. Approximately 1/2 mile downwind from a phosphate plant (continuous source of alpha activity), four samplers were positioned in identical orientation alongside one sampler configured with the sample head 'looking down'. At least five consecutive weekly samples were collected. The alpha activity, beta activity, and the Be-7 activity collected on the particulate filter were analyzed to determine sampling error. Four sample heads were then oriented to the four different horizontal directions. Samples were collected for at least five weeks. Analysis of the alpha data can show the effect of sampler orientation to a known near source term. Analysis of the beta and Be-7 activity shows the effect of sampler orientation to a ubiquitous source term.

118 (DOE/ID/13042–27) Tritium enrichment program research and development grant No. 4. Idaho INEL Oversight Program, Boise, ID (United States). 16 Jan 1994. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG07-91ID13042. Order Number DE94008823. Source: OSTI; NTIS; INIS; GPO Dep.

A procedure to measure tritium in water samples at contents as low as 20 pCi/L has been perfected, using alkaline electrolysis to enrich the tritium.

119 (DOE/ID/13042–28) Radiological air monitoring and sample analysis research and development progress report: Calendar year, 1992. Idaho INEL Oversight Program, Boise, ID (United States). [1992]. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG07-91ID13042. Order Number DE94008824. Source: OSTI; NTIS; INIS; GPO Dep.

Sponsored by a Department Of Energy (DOE) research and development grant, the State of Idaho INEL Oversight Program (OP) personnel designed an independent air monitoring system that provides detection of the presence of priority airborne contaminants potentially migrating beyond INEL boundaries. Initial locations for off-site ambient air monitoring stations were chosen in consultation with: DOE and NOAA reports; Mesodif modeling; review of the relevant literature; and communication with private contractors and experts in pertinent fields. Idaho State University (ISU) has initiated an Environmental Monitoring Program (EMP). The EMP provides an independent monitoring function as well as a training ground for students. Students learn research techniques dedicated to environmental studies and learn analytical skills and rules of compliance related to monitoring. ISU-EMP assisted OP in specific aspects of identifying optimum permanent monitoring station locations, and in selecting appropriate sample collection equipment for each station. The authorization to establish, prepare and install sampling devices on selected sites was obtained by OP personnel in conjunction with ISU-EMP personnel. All samples described in this program are collected by OP or ISU-EMP personnel and returned to the ISU for analysis. This report represents the summary of results of those samples collected and analyzed for radioactivity during the year of 1992.

120 (DOE/ID/13042–29) Radiological air monitoring and sample analysis: Research and development progress report, January–March 1993. Idaho INEL Oversight Program, Boise, ID (United States). [1993]. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG07-91ID13042. Order Number DE94008825. Source: OSTI; NTIS; GPO Dep.

The INEL Oversight Program (OP) began work in 1992 to establish a network of permanent air monitoring stations around the perimeter of the Idaho National Engineering Laboratory (INEL). Sponsored as a Department of Energy (DOE) research and development grant, the project was designed to provide the public with an independent assessment of air quality resulting from operations at the INEL. This progress report summarizes the results of air sampling during the first quarter of 1993. During 1992 and the first half of 1993, the OP obtained and operated air sampling equipment from EPA-Las Vegas and EG and G Idaho. These samplers were obtained on loan until the OP could develop specifications for and purchase instruments to be used in the permanent air monitoring network. These samplers were deployed at selected air sampling locations, while quality assurance plans and specifications for permanent samplers were developed. The results presented in this progress report should be considered as research data. During the initial phase of establishing the air monitoring network, several modifications were made to sampling instruments and, in some cases, sampling locations. Therefore, the OP did not complete a formal quality assurance plan during this development program.

121 (DOE/ID/13042-30) Radiological air monitoring and sample analysis: Research and development progress report, April-June 1993. Idaho INEL Oversight Program, Boise, ID (United States). [1993]. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG07-91ID13042. Order Number DE94008826. Source: OSTI; NTIS; GPO Dep.

The INEL Oversight Program (OP) began work in 1992 to establish a network of permanent air monitoring stations around the perimeter of the Idaho National Engineering Laboratory (INEL). Sponsored as a Department of Energy (DOE) research and development grant, the project was designed to provide the public with an independent assessment of air quality resulting from operations at the INEL. This progress report summarizes the results of air sampling during the second quarter of 1993. During 1992 and the first half of 1993, the OP obtained and operated air sampling equipment from EPA-Las Vegas and EG and G Idaho. These samplers were obtained on loan until the OP could develop specifications for and purchase instruments to be used in the permanent air monitoring network. These samplers were deployed at selected air sampling locations, while quality assurance plans and specifications for permanent samplers were developed. The results presented in this progress report should be considered as research data. During the initial phase of establishing the air monitoring network, several modifications were made to sampling instruments and, in some cases, sampling locations. Therefore, the OP did not complete a formal quality assurance plan during this developmental program.

122 (DOE/ID/13167-T2) Engineering considerations for the recovery of cesium from geologic materials. Whalen, C. Jason Associates Corp., San Diego, CA (United States). 18 May 1993. 159p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-92ID13167. Order Number DE93015092. Source: OSTI; NTIS; GPO Dep.

Sorption coefficients for cesium in a variety of media have been compiled from a search of the open literature. The sorption coefficient, or K_d , is a description of a dissolved substance's tendency to attach to a solid substrate. The compilation of K_d s reported here for cesium demonstrate

that this element readily sorbs onto-geological material. As a result of this sorption, the mass transport of cesium in the environment will be retarded. This retarded mass transport, characterized by the retardation factor, can be expected to be significant when compared to water velocities through porous-sorbing medium, such as geologic materials. K_d s for cesium are in the range of 100 mL/g up to 10,000 mL/g. K_d s are also an important parameter in the design of engineered systems for the purpose of recovering cesium from soils. The engineering design is based on a material-balance description of the extraction process. The information presented in this report provides a basis to predict the movement of cesium through geologic materials and also to design and predict the performance of extraction processes such as soil washing.

123 (DOE/MC/29103-3661) Development of a long-term post-closure radiation monitor: Phase 1, Final report, [September 30, 1992-February 28, 1994]. Reed, S.E. Babcock and Wilcox Co., Alliance, OH (United States). Research Center. Dec 1993. 134p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-92MC29103. Order Number DE94004078. Source: OSTI; NTIS; INIS; GPO Dep.

The long-term monitoring of a hazardous waste site for migration of radionuclides requires installation of radiation sensors at a large number of subsurface locations. Sensors which can be lowered into boreholes to make radiation measurements are available, but are relatively complex and expensive and generally not suitable for long-term installation underground. This problem is amenable to a solution based on fiber optic technology. The concept under development in the present contract employs a passive in-ground measurement probe which contains a scintillator coupled to optical fibers. Gamma radiation absorbed by the in-ground scintillator generates optical photons which are coupled into the fiber optic cable, conveyed to the surface and detected as an indication of the instantaneous subsurface radiation level. The in-ground probes will be configured to geometrically resemble cone penetrometers or penetrometer-based sampling tools and thus can be installed to depths of up to 50 meters using conventional CPT trucks and methods. The use of the penetrometer eliminates the cuttings normally associated with drilled wells, and thus minimizes worker exposure and eliminates the cost of cutting disposal. A large number of the in-ground passive probes can be multiplexed to a single, aboveground opto-electronics unit to provide for detection and readout of any long-term changes in the distribution of the radionuclides in the vadose zone. The overall goal of the Long-Term Post-Closure Radiation Monitor development program is to confirm a long-term radiation monitor using commercially available, demonstrated components to the largest extent possible. The development program is planned as a three phase program spanning a total time of 53 months.

124 (DOE/MC/29106-3531) Geophysical data fusion for subsurface imaging: Phase 1. Hoekstra, P.; Vandergraff, J.; Blohm, M.; Porter, D. Coleman Research Corp., Columbia, MD (United States). Aug 1993. 46p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-92MC29106. Order Number DE94000056. Source: OSTI; NTIS; INIS; GPO Dep.

A geophysical data fusion methodology is under development to combine data from complementary geophysical sensors and incorporate geophysical understanding to

obtain three dimensional images of the subsurface. The research reported here is the first phase of a three phase project. The project focuses on the characterization of thin clay lenses (aquitards) in a highly stratified sand and clay coastal geology to depths of up to 300 feet. The sensor suite used in this work includes time-domain electromagnetic induction (TDEM) and near surface seismic techniques. During this first phase of the project, enhancements to the acquisition and processing of TDEM data were studied, by use of simulated data, to assess improvements for the detection of thin clay layers. Secondly, studies were made of the use of compressional wave and shear wave seismic reflection data by using state-of-the-art high frequency vibrator technology. Finally, a newly developed processing technique, called "data fusion," was implemented to process the geophysical data, and to incorporate a mathematical model of the subsurface strata. Examples are given of the results when applied to real seismic data collected at Hanford, WA, and for simulated data based on the geology of the Savannah River Site.

125 (DOE/MWIP-1) An assessment of off-gas treatment technologies for application to thermal treatment of Department of Energy wastes. Dalton, J.D. (Science Applications International Corp., Idaho Falls, ID (United States)); Gillins, R.L.; Harris, T.L.; Wollerman, A.L. Oak Ridge National Lab., TN (United States). Sep 1992. 177p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (ORNL/M-2323). Order Number DE92041364. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this report is to describe available air pollution control technologies for pollutants generated by thermal treatment of DOE wastes. A basic process for selecting air pollution control devices is summarized. Types of air pollutants generated by thermal treatment units are described, as well as the factors that influence the types and quantities of pollutants generated. This report also reviews applicable regulatory emission requirements. A listing of available and emerging air pollution control technologies and a brief introduction to the basic engineering principles involved in collecting each of the pollutants are presented. Section 7 of this report contains two types of evaluations for air pollution control devices. First, comparative evaluations of individual technologies are presented, based upon criteria generally relevant to DOE facilities. Using this evaluation system, the spray dryer absorber received the highest rating for acid-gas removal; high-efficiency particulate air (HEPA) filters received the highest rating for particulate removal; activated carbon adsorption received the highest rating for the removal of both toxic metals and residual hydrocarbons; and selective catalytic reduction received the highest rating for nitrogen oxide abatement. Also evaluated in Sect. 7 is the expected performance of different types of pollution control systems on two hypothetical waste streams. The waste streams were defined based upon typical DOE wastes and thermal treatment technologies. Section 8 presents conclusions for this report. Two appendixes are included with this report. The first appendix contains a brief description of all the technologies evaluated and the second lists of some of the vendors for each of the technologies that was evaluated.

126 (DOE/NV/11432-32) Hydrogeologic data for science trench boreholes at the Area 5 Radioactive Waste Management Site, Nevada Test Site, Nye County, Nevada. Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV (United States). Dec 1993. 247p. Sponsored by USDOE, Washington, DC (United States). DOE Contract

AC08-94NV11432. Order Number DE94008647. Source: OSTI; NTIS; INIS; GPO Dep.

A program to conduct drilling, sampling, and laboratory testing was designed and implemented to obtain important physical, geochemical, and hydrologic property information for the near surface portion of thick unsaturated alluvial sediments at the Area 5 Radioactive Waste Management Site (RWMS). These data are required to understand and simulate infiltration and redistribution of water as well as the transport of solutes in the immediate vicinity of existing and future low-level, mixed, and high-specific-activity waste disposal cells at the site. The program was designed specifically to meet data needs associated with a Resource Conservation and Recovery Act (RCRA) Part B permit application for disposal of hazardous mixed waste, possible RCRA waivers involving mixed waste, DOE Order 5820.2A, "Radioactive Waste Management," and 40 Code of Federal Regulations (CFR) 191 requirements for land disposal of radioactive waste. The hydrologic condition data, when combined with hydrologic property data, indicate that very little net liquid flow (if any) is occurring in the upper vadose zone, and the direction of movement is upward. It follows that vapor movement is probably the dominant mechanism of water transport in this upper region, except immediately following precipitation events.

127 (DOE/OR-01-1115-D2) Remedial Investigation work plan for Bear Creek Valley Operable Unit 4 (shallow groundwater in Bear Creek Valley) at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee. Oak Ridge Y-12 Plant, TN (United States); Science Applications International Corp., Oak Ridge, TN (United States). Jul 1993. 387p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OS21400. (Y/ER-56-D2). Order Number DE94001950. Source: OSTI; NTIS; INIS; GPO Dep.

To effectively evaluate the cumulative impact of releases from multiple sources of contamination, a structured approach has been adopted for Oak Ridge Reservation (ORR) based on studies of the groundwater and surface water separate from studies of the sources. Based on the realization of the complexity of the hydrogeologic regime of the ORR, together with the fact that there are numerous sources contributing to groundwater contamination within a geographical area, it was agreed that more timely investigations, at perhaps less cost, could be achieved by separating the sources of contamination from the groundwater and surface water for investigation and remediation. The result will be more immediate attention [Records of Decision (RODs) for interim measures or removal actions] for the source Operable Units (OUs) while longer-term remediation investigations continue for the hydrogeologic regimes, which are labeled as integrator OUs. This remedial investigation work plan contains summaries of geographical, historical, operational, geological, and hydrological information specific to the unit. Taking advantage of the historical data base and ongoing monitoring activities and applying the observational approach to focus data gathering activities will allow the feasibility study to evaluate all probable or likely alternatives.

128 (DOE/OR-01-1115-D3) Remedial Investigation work plan for Bear Creek Valley Operable Unit 4 (shallow groundwater in Bear Creek Valley) at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee. Science Applications International Corp., Oak Ridge, TN (United States); Oak Ridge Y-12 Plant, TN (United States). Sep 1993. 391p. Sponsored by USDOE, Washington, DC (United States).

DOE Contract AC05-84OS21400. (Y/ER-56-D3). Order Number DE94001880. Source: OSTI; NTIS; INIS; GPO Dep.

To effectively evaluate the cumulative impact of releases from multiple sources of contamination, a structured approach has been adopted for Oak Ridge Reservation (ORR) based on studies of the groundwater and surface water separate from studies of the sources. Based on the realization of the complexity of the hydrogeologic regime of the ORR, together with the fact that there are numerous sources contributing to groundwater contamination within a geographical area, it was agreed that more timely investigations, at perhaps less cost, could be achieved by separating the sources of contamination from the groundwater and surface water for investigation and remediation. The result will be more immediate attention [Records of Decision (RODS) for interim measures or removal actions] for the source Operable Units (OUs) while longer-term remediation investigations continue for the hydrogeologic regime's, which are labeled as integrator OUs. This Remedial Investigation work plan contains summaries of geographical, historical, operational, geological, and hydrological information specific to the unit. Taking advantage of the historical data base and ongoing monitoring activities and applying the observational approach to focus data gathering activities will allow the Feasibility Study to evaluate all probable or likely alternatives.

129 (DOE/OR-01-1136) Annual report on the Background Soil Characterization Project on the Oak Ridge Reservation, Oak Ridge, Tennessee: Results of Phase 1 investigation. Watkins, D.R. (Oak Ridge National Lab., TN (United States)); Goddard, P.L.; Hatmaker, T.L.; Hook, L.A.; Jackson, B.L.; Kimbrough, C.W.; Lee, S.Y.; Lietzke, D.A.; McGin, C.W.; Nourse, B.D.; Schmoyer, R.L.; Shaw, R.A.; Stinnette, S.E.; Switek, J.; Wright, J. Oak Ridge National Lab., TN (United States). May 1993. 445p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (ES/ER/TM-43). Order Number DE93014394. Source: OSTI; NTIS; INIS; GPO Dep.

Many constituents of potential concern for human health occur naturally at low concentrations in undisturbed soils. The Background soil Characterization Project (BSCP) was undertaken to provide background concentration data on potential contaminants in natural soils on the Oak Ridge Reservation (ORR). The objectives of the BSCP are to provide baseline data for contaminated site assessment and estimates of potential human health risk associated with background concentrations of hazardous and other constituents in native soils. This report presents, evaluates, and documents data and results obtained in Phase I of the project. It is intended to be a stand-alone document for application and use in structuring and conducting remedial investigation and remedial action projects in the Environmental Restoration (ER) Program.

130 (DOE/OR/00033-T514) Simulating the spatial heterogeneity of sedimentological and hydrogeological characteristics for braided stream deposits. Webb, E.K. Oak Ridge Inst. for Science and Education, TN (United States). 1992. 260p. Sponsored by USDOE, Washington, DC (United States); American Association Petroleum Geologists, Tulsa, OK (United States); Wisconsin State Government, Madison, WI (United States). DOE Contract AC05-76OR00033. Order Number DE93005282. Source: OSTI; NTIS; GPO Dep.

Thesis submitted to University of Wisconsin, Madison.

The main objective of this research was to illustrate the control that discrete geological structures have on groundwater flow, and the usefulness of geometrical simulation models in approximating these internal structures. A new computer code, the Braided Channel Simulator (BCS-3D) was developed that: (1) produces realistic braided channel topology and topography using a random-walk approach in conjunction with information on channel hydraulic geometry; (2) generates estimates of the three-dimensional framework of sedimentary units defined by erosional bounding surfaces in braided alluvial deposits; and (3) uses a post-processor to produce multiple realizations of geologically-realistic, heterogeneous, hydraulic conductivity fields. Simulation of groundwater flow through BCS-3D-generated conductivity fields showed that discrete structures, when accentuated by a relatively minor contrast in hydraulic conductivity, controlled advective transport.

131 (DOE/OR/22000-1) Demonstration test and evaluation of Ultraviolet/Ultraviolet Catalyzed Peroxide Oxidation for Groundwater Remediation at Oak Ridge K-25 Site: Final report [March 16, 1993-March 16, 1994]. Schafer (W.J.) Associates, Inc., Chelmsford, MA (United States); Vulcan Peroxidation Systems, Inc., Tucson, AZ (United States). Mar 1994. 247p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-93OR22000. Order Number DE94013173. Source: OSTI; NTIS; INIS; GPO Dep.

We demonstrated, tested and evaluated a new ultraviolet (UV) lamp integrated with an existing commercial technology employing UV catalyzed peroxide oxidation to destroy organics in groundwater at an Oak Ridge K-25 site. The existing commercial technology is the perox-pure™ process of Peroxidation Systems Incorporated (PSI) that employs standard UV lamp technology to catalyze H₂O₂ into OH radicals, which attack many organic molecules. In comparison to classical technologies for remediation of groundwater contaminated with organics, the perox-pure™ process not only is cost effective but also reduces contaminants to harmless by-products instead of transferring the contaminants from one medium to another. Although the perox-pure™ process is cost effective against many organics, it is not effective for some organic contaminants of interest to DOE such as TCA, which has the highest concentration of the organics at the K-25 test site. Contaminants such as TCA are treated more readily by direct photolysis using short wavelength UV light. WJSA has been developing a unique UV lamp which is very efficient in the short UV wavelength region. Consequently, combining this UV lamp with the perox-pure™ process results in a means for treating essentially all organic contaminants. In the program reported here, the new UV lamp lifetime was improved and the lamp integrated into a PSI demonstration trailer. Even though this UV lamp operated at less than optimum power and UV efficiency, the destruction rate for the highest concentration organic (TCA) was more than double that of the commercial unit. An optimized UV lamp may double again the destruction rate; i.e., a factor of four greater than the commercial system. The demonstration at K-25 included tests with (1) the commercial PSI system, (2) the new UV lamp-based system and (3) the commercial PSI and new UV lamp systems in series.

132 (DOE/OR/22160-T2) Management Plan: Demonstration testing and evaluation of in situ soil heating. Dev, H. IIT Research Inst., Chicago, IL (United States). [1993]. 33p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-93OR22160.

(IITRI-C-06787). Order Number DE94003658. Source: OSTI; NTIS; INIS; GPO Dep.

In this project IITRI will demonstrate an in situ soil heating technology for the removal of hazardous organic contaminants present in the soil. In situ heating will be accomplished by the application of 60 Hz AC power to the soil. The soil will be heated to a temperature of about 90°C. This technology is suited for the removal of those organic compounds which have a normal boiling point in the range of 100° to 210°C, or else for those which exhibit a pure component vapor pressure of at least 10 mm Hg in the 90° to 100°C temperature range. For example, perchloroethylene, dichlorobenzene, trichlorobenzene, etc. may be removed by in situ AC heating. It is planned to demonstrate the technology by heating approximately 400 tons of soil in the K-1070 Classified Burial Ground located at DOE's K-25 Site located in Oak Ridge, TN. It is estimated that the heating portion of the demonstration will take approximately 3 weeks at an average power input rate of 150 to 175 kW. IITRI expects to spend considerable time in the front end reviewing site characteristics, preparing detail design, developing Health and Safety Plans and other documents needed to obtain regulatory approval for the demonstration, arranging for site sampling, infrastructure development and document preparation. It is anticipated that site activities will begin in approximately 5 to 6 months. This contract was signed on September 30, 1993. IITRI started work on it in October 1993. It is planned to complete the demonstration and submit approved final reports by September 30, 1994. This project has 12 tasks and four major milestones. The major milestones and their planned completion dates are presented.

133 (DOE/OR/22160-T5) Demonstration testing and evaluation of in situ soil heating: Management Plan. Dev, H. IIT Research Inst., Chicago, IL (United States). [1993]. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-93OR22160. Order Number DE94007161. Source: OSTI; NTIS; GPO Dep.

This document is the Management Plan for US DOE contract entitled, "Demonstration, Testing and Evaluation of In Situ Soil Heating," Contract No. DE-AC05-93OR22160, IITRI Project No. C06787. In this project IITRI will demonstrate an in situ soil heating technology for the removal of hazardous organic contaminants present in the soil. In situ heating will be accomplished by the application of 60 Hz ac power to the soil. The soil will be heated to a temperature of about 90°C. This technology is suited for the removal of those organic compounds which have a normal boiling point in the range of 100° to 210°C, or else for those which exhibit a pure component vapor pressure of at least 10 mm Hg in the 90° to 100°C temperature range. For example, perchloroethylene, dichlorobenzene, trichlorobenzene, etc. may be removed by in situ ac heating. It is planned to demonstrate the technology by heating approximately 400 tons of soil in the K-1070 Classified Burial Ground located at DOE's K-25 Site located in Oak Ridge, TN. It is estimated that the heating portion of the demonstration will take approximately 3 weeks at an average power input rate of 150 to 175 kW. IITRI expects to spend considerable time in the front end reviewing site characteristics, preparing detail design, developing Health and Safety Plans and other documents needed to obtain regulatory approval for the demonstration, arranging for site sampling, infrastructure development and document preparation. It is anticipated that site activities will begin in approximately 5 to 6 months. This contract was signed on September 30, 1993. IITRI started work on it in October

1993. It is planned to complete the demonstration and submit approved final reports by September 30, 1994. This project has 12 tasks and four major milestones. The major milestones and their planned completion dates are shown.

134 (DOE/RL-89-08-02) Registration for the Hanford Site: Sources of radioactive emissions. Silvia, M.J. USDOE Richland Field Office, WA (United States). Apr 1993. 51p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93016377. Source: OSTI; NTIS; INIS; GPO Dep.

This Registration Application serves to renew the registration for all Hanford Site sources of radioactive air emissions routinely reported to the State of Washington Department of Health (DOH). The current registration expires on August 15, 1993. The Application is submitted pursuant to the Washington Administrative Code (WAC) Chapter 246-247, and is consistent with guidance provided by DOH for renewal. The Application subdivides the Hanford Site into six major production, processing or research areas. Those six areas are in the 100 Area, 200 East Area, 200 West Area, 300 Area, 400 Area, and 600 Area. Each major group of point sources within the six areas listed above is represented by a Source Registration for Radioactive Air Emissions form. Annual emissions for the sources are listed in the "Radionuclide Air Emissions Report for the Hanford Site," published annually. It is a requirement that the following Statement of Compliance be provided: "The radioactive air emissions from the above sources do meet the emissions standards contained in Chapter 173-480-040 WAC, Ambient Air Quality Standards and Emissions Limits for Radionuclides. As the Statement of Compliance pertains to this submittal, the phrase "above sources" is to be understood as meaning the combined air emissions from all sources registered by this submittal.

135 (DOE/RL-89-12-Rev.1) Hanford Site Groundwater Protection Management Program: Revision 1. Westinghouse Hanford Co., Richland, WA (United States). Nov 1993. 82p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94005512. Source: OSTI; NTIS; INIS; GPO Dep.

Groundwater protection is a national priority that is promulgated in a variety of environmental regulations at local, state, and federal levels. To effectively coordinate and ensure compliance with applicable regulations, the US Department of Energy has issued DOE Order 5400.1 (now under revision) that requires all US Department of Energy facilities to prepare separate groundwater protection program descriptions and plans. This document describes the Groundwater Protection Management Program for the Hanford Site located in the state of Washington. DOE Order 5400.1 specifies that the Groundwater Protection Management Program cover the following general topical areas: (1) documentation of the groundwater regime, (2) design and implementation of a groundwater monitoring program to support resource management and comply with applicable laws and regulations, (3) a management program for groundwater protection and remediation, (4) a summary and identification of areas that may be contaminated with hazardous waste, (5) strategies for controlling these sources, (6) a remedial action program, and (7) decontamination and decommissioning and related remedial action requirements. Many of the above elements are covered by existing programs at the Hanford Site; thus, one of the primary purposes of this document is to provide a framework for coordination of existing groundwater protection activities.

Additionally, it describes how information needs are identified and can be incorporated into existing or proposed new programs. The Groundwater Protection Management Program provides the general scope, philosophy, and strategies for groundwater protection/management at the Hanford Site. Subtier documents provide the detailed plans for implementing groundwater-related activities and programs. Related schedule and budget information are provided in the 5-year plan for environmental restoration and waste management at the Hanford Site.

136 (DOE/RL-92-12) Sampling and analysis of 100 Area springs. Westinghouse Hanford Co., Richland, WA (United States); USDOE Richland Field Office, WA (United States). Feb 1992. 109p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93013032. Source: OSTI; NTIS; INIS; GPO Dep.

This report is submitted in fulfillment of Hanford Federal Facility Agreement and Consent Order Milestone M-30-01, submit a report to EPA and Ecology evaluating the impact to the Columbia River from contaminated springs and seeps as described in the operable unit work plans listed in M-30-03. Springs, seeps, sediments, and the Columbia River were sampled for chemical and radiological analyses during the period September 16 through October 21, 1991. A total of 26 locations were sampled. Results of these analyses show that radiological and nonradiological contaminants continue to enter the Columbia River from the retired reactor areas of the 100 Area via the springs. The primary contaminants in the springs are strontium-90, tritium, and chromium. These contaminants were detected in concentrations above drinking water standards. Analysis of total organic carbon were run on all water samples collected; there is no conclusive evidence that organic constituents are entering the river through the springs. Total organic carbon analyses were generally higher for the surface water than for the springs. The results of this study will be used to develop a focused, yet flexible, long-term spring sampling program. Analysis of Columbia River water samples collected at the Hanford Townsite (i.e., downstream of the reactor areas) did not detect any Hanford-specific contaminants.

137 (DOE/RL-93-18) Nonradioactive air emissions notice of construction for the Waste Receiving And Processing facility. USDOE Richland Field Office, WA (United States). Feb 1993. 46p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93016357. Source: OSTI; NTIS; INIS; GPO Dep.

The mission of the Waste Receiving And Processing (WRAP) Module 1 facility (also referred to as WRAP 1) is to examine assay, characterize, treat, and repack solid radioactive and mixed waste to enable permanent disposal of the wastes in accordance with all applicable regulations. WRAP 1 will contain equipment and facilities necessary for non-destructive examination (NDE) of wastes and to perform a non-destructive examination assay (NDA) of the total radionuclide content of the wastes, without opening the outer container (e.g., 55-gal drum). WRAP 1 will also be equipped to open drums which do not meet waste acceptance and shipping criteria, and to perform limited physical treatment of the wastes to ensure that storage, shipping, and disposal criteria are met. The solid wastes to be handled in the WRAP 1 facility include low level waste (LLW), transuranic (TRU) waste, and transuranic and low level mixed wastes (LLMW). The WRAP 1 facility will only accept contact handler (CH) waste containers. A Best Available Control Technology for

Toxics (TBACT) assessment has been completed for the WRAP 1 facility (WHC 1993). Because toxic emissions from the WRAP 1 facility are sufficiently low and do not pose any health or safety concerns to the public, no controls for volatile organic compounds (VOCs), and installation of HEPA filters for particulates satisfy TBACT for the facility.

138 (DOE/RL-93-23) N Springs expedited response action proposal. USDOE Richland Operations Office, WA (United States). Jan 1994. 185p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94007158. Source: OSTI; NTIS; INIS; GPO Dep.

Since signing the Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement) in 1989, the parties to the agreement have recognized the need to modify the approach to conducting investigations, studies, and cleanup actions at Hanford. To implement this approach, the parties have jointly developed the Hanford Past-Practice Strategy. The strategy defines a non-time-critical expedited response action (ERA) as a response action "needed to abate a threat to human health or welfare or the environment where sufficient time exists for formal planning prior to initiation of response. In accordance with the past-practice strategy, DOE proposes to conduct an ERA at the N Springs, located in the Hanford 100 N Area, to substantially reduce the strontium-90 transport into the river through the groundwater pathway. The purpose of this ERA proposal is to provide sufficient information to select a preferred alternative at N Springs. The nature of an ERA requires that alternatives developed for the ERA be field ready; therefore, all the technologies proposed for the ERA should be capable of addressing the circumstances at N Springs. A comparison of these alternatives is made based on protectiveness, cost, technical feasibility, and institutional considerations to arrive at a preferred alternative. Following the selection of an alternative, a design phase will be conducted; the design phase will include a detailed look at design parameters, performance specifications, and costs of the selected alternative. Testing will be conducted as required to generate design data.

139 (DOE/RL-93-36) Radionuclide air emissions report for the Hanford Site, calendar year 1992. Diediker, L.P. (Westinghouse Hanford Co., Richland, WA (United States)); Johnson, A.R.; Rhoads, K.; Klages, D.L.; Soldat, J.K.; Rokkan, D.J. Westinghouse Hanford Co., Richland, WA (United States). Jun 1993. 112p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93018737. Source: OSTI; NTIS; INIS; GPO Dep.

This report documents radionuclide air emissions from the Hanford Site in 1992 and the resulting effective dose equivalent to a member of the public. The report has been prepared and will be submitted in accordance with reporting requirements in the Code of Federal Regulations, Title 40, Protection of the Environment, Part 61, "National Emissions Standards for Hazardous Air Pollutants," Subpart H, "National Emission Standards for Emissions of Radionuclides Other than Radon from Department of Energy Facilities."

140 (DOE/RL-93-56-3) Quarterly report of RCRA groundwater monitoring data for period July 1, 1993–September 30, 1993. Jungers, D.K. USDOE Richland Operations Office, WA (United States). Jan 1994. 507p. Sponsored by USDOE, Washington, DC (United

States). DOE Contract AC06-87RL10930. Order Number DE94007424. Source: OSTI; NTIS; GPO Dep.

Hanford Site interim-status groundwater monitoring projects are conducted as either background, indicator parameter evaluation, or groundwater quality assessment monitoring programs as defined in the Resource Conservation and Recovery Act of 1976 (RCRA); and "Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities," as amended (40 Code of Federal Regulations [CFR] 265). Compliance with the 40 CFR 265 regulations is required by the Washington Administrative Code (WAC) 173-303. This quarterly report contains data received between August 21 and November 19, 1993, which are the cutoff dates for this reporting period. This report may contain not only data from samples collected during the July through September quarter but also data from earlier sampling events that were not previously reported.

141 (DOE/RL-93-56-4) Quarterly report of RCRA groundwater monitoring data for period October 1, 1993-December 31, 1993. Jungers, D.K. Westinghouse Hanford Co., Richland, WA (United States). Apr 1994. 474p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94012934. Source: OSTI; NTIS; GPO Dep.

Hanford Site interim-status groundwater monitoring projects are conducted as either background, indicator parameter evaluation, or groundwater quality assessment monitoring programs as defined in the Resource Conservation and Recovery Act of 1976 (RCRA); and Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities, as amended (40 Code of Federal Regulations [CFR] 265). Compliance with the 40 CFR 265 regulations is required by the Washington Administrative Code (WAC) 173-303. This report contains data from Hanford Site groundwater monitoring projects. Westinghouse Hanford Company (WHC) manages the RCRA groundwater monitoring projects for federal facilities on the Hanford Site. Project management, specifying data needs, performing quality control (QC) oversight, managing data, and preparing project sampling schedules are all parts of this responsibility. Pacific Northwest Laboratory (PNL) administers the contract for analytical services and provides groundwater sampling services to WHC for the RCRA groundwater monitoring program. This quarterly report contains data received between November 20 and February 25, 1994, which are the cutoff dates for this reporting period. This report may contain not only data from the October through December quarter but also data from earlier sampling events that were not previously reported.

142 (DOE/RL-93-88) Annual report for RCRA groundwater monitoring projects at Hanford Site facilities for 1993. USDOE Richland Operations Office, WA (United States); Westinghouse Hanford Co., Richland, WA (United States). Geosciences Group. Feb 1994. 706p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94009665. Source: OSTI; NTIS; GPO Dep.

This report presents the annual hydrogeologic evaluation of 20 Resource Conservation and Recovery Act of 1976 groundwater monitoring projects and 1 nonhazardous waste facility at the US Department of Energy's Hanford Site. Most of the projects no longer receive dangerous waste; a few projects continue to receive dangerous waste constituents for treatment, storage, or disposal. The 20 RCRA projects

comprise 30 waste management units. Ten of the units are monitored under groundwater quality assessment status because of elevated levels of indicator parameters. The impact of those units on groundwater quality, if any, is being investigated. If dangerous waste or waste constituents have entered groundwater, their concentration, distribution, and rate of migration are evaluated. Groundwater is monitored at the other 20 units to detect contamination, should it occur. This report provides an interpretation of groundwater data collected at the waste management units between October 1992 and September 1993. Recent groundwater quality is also described for the 100, 200, 300, and 600 Areas and for the entire Hanford Site. Widespread contaminants include nitrate, chromium, carbon tetrachloride, tritium, and other radionuclides.

143 (DOE/RL-93-94) Plan and schedule for disposition and regulatory compliance for all remaining Miscellaneous Streams. Skurla, S.J. USDOE Richland Operations Office, WA (United States). Jan 1994. 23p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94006997. Source: OSTI; NTIS; INIS; GPO Dep.

On December 23, 1991, the US Department of Energy, Richland Operations Office (RL) and the Washington State Department of Ecology (Ecology) agreed to adhere to the provisions of Department of Ecology Consent Order No. DE 91NM-177 (Consent Order) (Ecology and USDOE, 1991). The Consent Order lists regulatory milestones for liquid effluent streams at the Hanford Site to comply with the permitting requirements of Washington Administrative Code 173-216 or 173-218 where applicable (WAC 173-216/218). Hanford Site liquid effluent stream discharging to the soil column have been categorized in the Consent Order as follows: Phase I Streams; Phase II Streams; Miscellaneous Streams. Phase I and Phase II Streams are identified in two RL reports: "Plan and Schedule to Discontinue Disposal of Contaminated Liquids into the Soil Column at the Hanford Site" (DOE-RL 1987), and "Annual Status of the Report of the Plan and Schedule to Discontinue Disposal of Contaminated Liquids into the Soil Column at the Hanford Site" (Stordeur 1988). Miscellaneous Streams are those liquid effluent streams discharged to the ground that are not categorized as Phase I or Phase II Streams. Miscellaneous Streams discharging to the soil column at the Hanford Site are subject to the requirements of several milestones identified in the Consent Order. This document provides a plan and schedule for the disposition of Miscellaneous Streams to satisfy one of the Miscellaneous Stream Consent Order requirements. The disposition process for the Miscellaneous Streams as developed for this milestone is facilitated using a decision tree format. The logic diagram and corresponding analysis for determining appropriate disposition of these streams is presented in this document.

144 (DOE/RL-94-32) State Waste Discharge Permit Application: Electric resistance tomography testing. USDOE Richland Operations Office, WA (United States). Apr 1994. 83p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94010337. Source: OSTI; NTIS; INIS; GPO Dep.

This permit application documentation is for a State Waste Discharge Permit issued in accordance with requirements of Washington Administrative Code 173-216. The activity being permitted is a technology test using electrical resistance tomography. The electrical resistance tomography technology was developed at Lawrence Livermore

National Laboratory and has been used at other waste sites to track underground contamination plumes. The electrical resistance tomography technology measures soil electrical resistance between two electrodes. If a fluid contaminated with electrolytes is introduced into the soil, the soil resistance is expected to drop. By using an array of measurement electrodes in several boreholes, the areal extent of contamination can be estimated. At the Hanford Site, the purpose of the testing is to determine if the electrical resistance tomography technology can be used in the vicinity of large underground metal tanks without the metal tank interfering with the test. It is anticipated that the electrical resistance tomography technology will provide a method for accurately detecting leaks from the bottom of underground tanks, such as the Hanford Site single-shell tanks.

145 (DOE/S-0089P) Environmental Restoration and Waste Management: Five-year plan, fiscal years 1993-1997. USDOE, Washington, DC (United States). Aug 1991. 779p. Sponsored by USDOE, Washington, DC (United States). Order Number DE91018149. Source: OSTI; NTIS; INIS; GPO Dep.

In the first Five-Year Plan, written in 1989, the Department of Energy (DOE) committed to rapidly bringing all operating facilities into compliance with applicable laws and regulations and to cleaning up the 1989 inventory of contaminated inactive sites and facilities by the year 2019. This FY 1993-1997 Five-Year Plan moves the Office of Environmental Restoration and Waste Management (EM) one step closer to this 30-year goal. The overall EM strategy has three thrusts. First, where risk assessment shows an actual or potential threat to human health and safety - do immediately whatever is possible to reduce, mitigate, stabilize, and confine the threat. Second, where nobody knows how to solve a problem (as distinct from merely preventing it from getting worse) - act decisively to develop methods to do it right the first time. Third, where compliance and cleanup must proceed with or without next-generation technologies - plan, with affected parties and within the provisions of Interagency Agreements, the work to be accomplished and its schedule. This third Five-Year Plan discusses current EM program accomplishments, what the program intends to achieve over the next 5 years, and where it needs to be heading in order to meet its 30-year and other environmental goals.

146 (DOE/UMTRA-050126-0000) An evaluation of the results of alluvial groundwater sampling from 1987-1990 at the Durango disposal site. USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Apr 1991. 45p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE93009470. Source: OSTI; NTIS; INIS; GPO Dep.

This evaluation was conducted to determine if surface discharges of contaminated water from a retention pond and seepage of tailings pore water from the disposal cell have affected ground water quality in the alluvial deposits east and northeast of the Bodo Canyon disposal cell. The question of whether corrective remedial action is needed for the alluvial groundwater downgradient of the disposal cell is also addressed. Maximum observed concentrations of seven hazardous constituents equalled or exceeded proposed US Environmental Protection Agency (EPA) maximum concentration limits (MCLs) in the alluvial groundwater downgradient of the disposal cell. These constituents include chromium, lead, molybdenum, net gross alpha,

radium-226 and -228, selenium, and uranium. Concentrations greater than MCLs for molybdenum, net gross alpha, and radium-226 and -228 may be naturally occurring in the alluvial groundwater. There is no statistical evidence that these hazardous constituents are groundwater contaminants with concentrations that exceed the MCLs in alluvial groundwater. However, the median selenium concentration in monitor well 608 exceeds the MCL. Therefore, selenium contamination in the alluvial groundwater in the area of monitor well 608 is possible. Selenium concentrations show no definite increasing or decreasing trend. Since groundwater contamination by selenium is possible in one monitor well, but concentrations are not increasing, corrective action is not warranted at this time. Alluvial groundwater quality will continue to be monitored quarterly and the discharge from the retention pond should be sampled after treatment to ascertain its potential affects on groundwater quality.

147 (DOE/UMTRA-050127-0000) Baseline risk assessment for groundwater contamination at the uranium mill tailings site, Gunnison, Colorado. USDOE Albuquerque Field Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Nov 1990. 72p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-82AL14086. Order Number DE93010395. Source: OSTI; NTIS; INIS; GPO Dep.

The Gunnison Baseline Risk Assessment for Groundwater Contamination at the Uranium Mill Tailings Site was performed to determine if long-term use of groundwater from domestic wells near the site has a potential for adverse health effects. The risk assessment was based on the results of sampling domestic wells during 1989-1990. A risk assessment evaluates health risks by comparing the amount of a contaminant taken in by a person with the amount of the contaminant that may be toxic. The Gunnison Risk Assessment used high intake values to estimate the maximum levels a person might be exposed to. The results of the risk assessment are divided into cancer (carcinogenic) risks and non-carcinogenic risks. Five key contaminants were evaluated for adverse health risks: uranium, manganese, lead, antimony, and cadmium. Due to the potential health risks and the unavoidable uncertainties associated with limited groundwater and toxicity data, it is prudent public health policy to provide a permanent alternate water supply. Additionally, providing a permanent alternate water supply is cost-effective compared to long-term routine monitoring.

148 (DOE/UMTRA-050128-0000) Site-specific analysis of the cobbly soils at the Grand Junction processing site. USDOE Albuquerque Field Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Jun 1992. 162p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE93010392. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes a recent site-specific analysis to evaluate the necessity of a recommendation to install a slurry trench around the Grand Junction processing site. The following analysis addresses the cobbly nature of the site's radiologically contaminated foundation soil, re-assesses the excavation depths based on bulk radionuclide concentrations, and presents data-based arguments that support the elimination of the initially proposed slurry trench. The slurry trench around the processing site was proposed by the Remedial Action Contractor (RAC) to minimize the amount of water encountered during excavation. The initial depths of excavation developed during conceptual design,

which indicated the need for a slurry wall, were reexamined as part of this analysis. This reanalysis, based on bulk concentrations of a cobbly subsoil, supports decreasing the original excavation depth, limiting the dewatering quantities to those which can be dissipated by normal construction activities. This eliminates the need for a slurry trench and separate water treatment prior to permitted discharge.

149 (DOE/UMTRA-050129-0000) Neutron moisture monitoring (NMM) and moisture contents in the Green River, Utah, UMTRA disposal cell. USDOE Albuquerque Field Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Jun 1992. 37p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE93010393. Source: OSTI; NTIS; INIS; GPO Dep.

This report provides the basis for the US Department of Energy's (DOE) request to discontinue neutron moisture monitoring (NMM) at the Green River, Utah, Uranium Mill Tailings Remedial Action (UMTRA) disposal cell and decommission the neutron access holes. After 3 years of monitoring the disposal cell, the DOE has determined that the NMM method is not suitable for determining changes in moisture content in the disposal cell. Existing tailings moisture contents in the disposal cell result in a low seepage flux. The combination of a low seepage flux and geochemical retardation by foundation materials underneath the disposal cell ensures that the proposed US Environmental Protection Agency (EPA) groundwater protection standards will not be exceeded within the design life of the disposal cell. To assess the effectiveness of the NMM method for monitoring moisture contents in the disposal cell at Green River, the DOE subsequently conducted a field study and a review of historical and new literature. The literature review allowed the DOE to identify performance criteria for the NMM method. Findings of these studies suggest that: The NMM method is not sensitive to the low moisture contents found in the disposal cell.; there is an insufficient range of moisture contents in the disposal cell to develop a field calibration curve relating moisture content to neutron counts; it is not possible to collect NMM data from the disposal cell that meet data quality objectives for precision and accuracy developed from performance criteria described in the literature.

150 (DOE/UMTRA-050130-0000) Hydrogeologic characterization of the former Vitro processing site, Salt Lake City, Utah: Final report. USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Jan 1993. 81p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE93008959. Source: OSTI; NTIS; INIS; GPO Dep.

During fiscal year (FY) 1992, the US Department of Energy received Congressional direction to investigate whether contamination from former processing activities is present in groundwater and soils at the former Vitro processing site in Salt Lake City, Utah. A total of \$100,000 was appropriated for this activity. The surface of the Vitro site was cleaned up by the state of Utah under the Uranium Mill Tailings Remedial Action (UMTRA) Project during the mid- to late 1980s. The basis for the directive was the desire of the site owners, the Central Valley Water Reclamation Facility (CVWRF), to develop the site. This report, as well as the final Vitro Site Certification Report and the Clive Completion Report (both to be prepared and submitted by the state of Utah), will have to be reviewed and concurred with by the US Nuclear Regulatory Commission (NRC) prior to release of the Vitro

site for restricted development. The groundwater and soil investigation was performed by the Technical Assistance Contractor (TAC) to the DOE UMTRA Project Office during FY92. The investigation at the Vitro site consisted of the installation of monitoring wells and soil borings, aquifer testing, and the collection and analyses of groundwater and soil samples. This report presents the results of this hydrogeologic investigation.

151 (DOE/UMTRA-150329-0003) Department of Energy PEIS scoping session. Badar, L. Advanced Court Reporting, Albuquerque, NM (United States); Jacobs Engineering Group, Inc., Pasadena, CA (United States); USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. 10 Dec 1992. 58p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE93005695. Source: OSTI; NTIS; INIS; GPO Dep.

This is the second programmatic environmental impact statement scoping session held in Durango, Colorado. The purpose was: to present the ground water program so as to build some familiarity and understanding about the issue involved; and to get Durango community's input. Scoping is the collection of information and getting everyone involved and really making a team out of coming up with a proposed action. This report contains the presentations made by the project manager for the Uranium Mill Tailings (UMTRA) program, site manager for the Durango UMTRA site, manager of ground water hydrology, and include comments made by local residents.

152 (DOE/UMTRA-350214-0000) Escarpment seeps at Shiprock, New Mexico. Jacobs Engineering Group, Inc., Albuquerque, NM (United States); USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Oct 1991. 274p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE93005953. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this report is to characterize the seeps identified at the Shiprock UMTRA Project site during the precensing custodial care inspection conducted in December of 1990, to evaluate the relationship between the seeps and uranium processing activities or tailings disposal, and to evaluate the risk posed by the seep water to human health and the environment. The report provides a brief description of the geology, groundwater hydrology, and surface water hydrology. The locations of the seeps and monitor wells are identified, and the water quality of the seeps and groundwater is discussed in the context of past activities at the site. The water quality records for the site are presented in tables and appendices; this information was used in the risk assessment of seep water.

153 (DOE/UMTRA-400327-0000) Groundwater protection management program plan. USDOE Albuquerque Field Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Jun 1992. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE93010759. Source: OSTI; NTIS; INIS; GPO Dep.

US Department of Energy (DOE) Order 5400.1 requires the establishment of a groundwater protection management program to ensure compliance with DOE requirements and applicable Federal, state, and local laws and regulations. The Uranium Mill Tailings Remedial Action (UMTRA) Project Office has prepared a "Groundwater Protection Management

Program Plan" (groundwater protection plan) of sufficient scope and detail to reflect the program's significance and address the seven activities required in DOE Order 5400.1, Chapter 3, for special program planning. The groundwater protection plan highlights the methods designed to preserve, protect, and monitor groundwater resources at UMTRA Project processing and disposal sites. The plan includes an overview of the remedial action status at the 24 designated processing sites and identifies project technical guidance documents and site-specific documents for the UMTRA groundwater protection management program. In addition, the groundwater protection plan addresses the general information required to develop a water resources protection strategy at the permanent disposal sites. Finally, the plan describes ongoing activities that are in various stages of development at UMTRA sites (long-term care at disposal sites and groundwater restoration at processing sites). This plan will be reviewed annually and updated every 3 years in accordance with DOE Order 5400.1.

154 (DOE/UMTRA-400653-0000) Source modification special study. USDOE Albuquerque Field Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Apr 1989. 60p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-82AL14086. Order Number DE93010469. Source: OSTI; NTIS; INIS; GPO Dep.

One of the major issues that must be addressed during the evaluation of the efficiency of tailings embankment designs for compliance with groundwater standards is the estimation of source concentrations and the change in these concentrations with time. Because any effort to predict concentrations of contaminants in the uppermost aquifer requires a source concentration, data from these analyses are essential. The technical approach of this study was twofold. The first approach was to investigate the rates of natural flushing of contaminants. Two sets of tailings samples were collected at two sites on the Old Rifle tailings pile at the Rifle UMTRA Project site in Colorado. One set of samples was collected at a site where the lower portion of the profile is continuously inundated with water and the other set was collected in an area that only receives water from precipitation. The tailings samples were refluxed in strong acid (nitric acid) and the leachate was analyzed for hazardous constituents. The results of this investigation indicate that many of the hazardous constituents have been leached from the tailings at the wet site and that there has been little redistribution of elemental hazardous constituents at the dry site. The second approach involved a laboratory investigation of contaminant removal from tailings by doubly distilled water and two lixiviants. Tailings samples from the Gunnison, Colorado, UMTRA Project site were subjected to leaching by doubly distilled water, and by the lixiviants sodium bicarbonate and disodium ethylenediaminetetraacetic acid. The resulting data were tabulated and plotted with concentration as a function of pore volume. Evaluation of the data indicates that pore fluids should show a decrease in concentration after very few pore volumes of liquid have eluted through the tailings. It is also demonstrated that lixiviants significantly increase the solubility and rate of elution of all of the hazardous constituents.

155 (DOE/UMTRA-400666-0000) Investigation of a natural geochemical barrier. USDOE Albuquerque Field Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office; Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Feb 1991. 94p. Sponsored by

USDOE, Washington, DC (United States). DOE Contract AC04-82AL14086. Order Number DE93010094. Source: OSTI; NTIS; INIS; GPO Dep.

Groundwater data from lysimeters and monitor wells in the vicinity of the Bowman, North Dakota, Uranium Mill Tailings Remedial Action (UMTRA) Project site indicated that there is a mechanism in the subsurface which cleans up downward-percolating fluids. It was hypothesized that clays and organic materials in the sediments sequestered hazardous constituents from infiltrating fluids. A program was designed to collect sediment cores from various locations on and around the site and to analyze the sediments to determine whether there has been a build up of hazardous constituents in any specific type of sedimentary material. Materials that concentrate the hazardous constituents would be potential candidates to be used in constructed geochemical barriers. The water quality of the groundwater contained within the sedimentary section indicates that there is a transport of contaminants down through the sediments and that these contaminants are removed from solution by the iron-bearing minerals in the organic-rich lignite beds. The data gathered during the course of this investigation indicate that the lignite ashing operations have added very little of the hazardous constituents of concern—arsenic, chromium, molybdenum, selenium, or uranium—to the sediments beneath the UMTRA Project site. At both locations, the hazardous constituents are concentrated in the upper most lignite bed. These data offer a natural analog for laboratory tests in which sphagnum peat was used to sequester hazardous constituents. Constructed geochemical barriers are a viable mechanism for the clean-up of the majority of hazardous constituents from uranium mill tailings in groundwater.

156 (DOE/UMTRA-400669-0000) Alternative geochemical barrier materials. USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office; Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Jul 1991. 39p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-82AL14086. Order Number DE93008966. Source: OSTI; NTIS; INIS; GPO Dep.

Previous investigations of the effects of neutralization and reduction on uranium mill tailings pore fluids by the Technical Support Contractor indicated that arsenic, selenium, and molybdenum continue to remain in solution in all but reducing conditions. These hazardous constituents are present in groundwaters as oxyanions and, therefore, are not expected to be removed by adsorption into clays and most other soil constituents. It was decided to investigate the attenuation capacity of two commonly available crystalline iron oxides, taconite and scoria, and a zeolite, a network aluminosilicate with a cage structure. Columns of the candidate materials were exposed to solutions of individual constituents, including arsenic, molybdenum, selenium, and, uranium, and to the spiked tailings pore fluid from the Bodo Canyon disposal cell near Durango, Colorado. In addition to the single material columns, a homogeneous blend of the three materials and layers of the materials were exposed to spiked tailings pore fluids. The results of these experiments indicate that with the exception of molybdenum, the constituents of concern are attenuated by the taconite; however, they are not sufficiently attenuated to meet the groundwater protection standards applicable to the UMTRA Project. Therefore, the candidate barrier materials did not prove to be useful to the UMTRA Project for the cleanup of groundwaters.

157 (DOE/UMTRA-400670-0000) Preplanning guidance document for groundwater restoration. USDOE Albuquerque Field Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Jun 1991. 43p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE93009140. Source: OSTI; NTIS; INIS; GPO Dep.

This document is intended to present decision makers on the Uranium Mill Tailings Remedial Action (UMTRA) Project with a strategy for evaluating the need for and accomplishing groundwater restoration at those UMTRA Project sites that will require restoration as specified in Subpart B of 40 CFR 192. A synopsis of the Uranium Mill Tailings Restoration Control Act (UMTRCA) and a discussion of the proposed US Environmental Protection Agency (EPA) groundwater cleanup standards in 40 CFR 192 are provided to define the regulatory basis of groundwater cleanup. Once the EPA groundwater standards are finalized, this document may be revised, depending on the changes in the final standards. A procedure for determining the need for groundwater restoration is outlined and a cost-effective strategy for selecting, designing, implementing, and evaluating appropriate restoration procedures is presented. The determination of the need for groundwater restoration is based on the EPA groundwater cleanup standards and must be compatible with and complementary to the National Environmental Policy Act (NEPA) process. Therefore, this document describes a programmatic approach for compliance with the NEPA process.

158 (DOE/UMTRA-400671-0000) Technical framework for groundwater restoration. Jacobs Engineering Group, Inc., Pasadena, CA (United States); USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Apr 1991. 96p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE93005948. Source: OSTI; NTIS; INIS; GPO Dep.

This document provides the technical framework for groundwater restoration under Phase II of the Uranium Mill Tailings Remedial Action (UMTRA) Project. A preliminary management plan for Phase II has been set forth in a companion document titled "Preplanning Guidance Document for Groundwater Restoration". General principles of site characterization for groundwater restoration, restoration methods, and treatment are discussed in this document to provide an overview of standard technical approaches to groundwater restoration.

159 (DOE/UMTRA-400673-0000) Contaminant immobilization via microbial activity. USDOE Albuquerque Field Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office; Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Nov 1991. 38p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-82AL14086. Order Number DE93010322. Source: OSTI; NTIS; INIS; GPO Dep.

The aim of this study was to search the literature to identify biological techniques that could be applied to the restoration of contaminated groundwaters near uranium milling sites. Through bioremediation it was hypothesized that the hazardous heavy metals could be immobilized in a stable, low-solubility form, thereby halting their progress in the migrating groundwater. Three basic mechanisms were examined: reduction of heavy metals by microbially produced hydrogen sulfide; direct microbial mediated reduction; and biosorption.

160 (DOE/UMTRA-400675-0000) Selection of water treatment processes special study. USDOE Albuquerque Field Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Nov 1991. 92p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE93010097. Source: OSTI; NTIS; INIS; GPO Dep.

Characterization of the level and extent of groundwater contamination in the vicinity of Title I mill sites began during the surface remedial action stage (Phase I) of the Uranium Mill Tailings Remedial Action (UMTRA) Project. Some of the contamination in the aquifer(s) at the abandoned sites is attributable to milling activities during the years the mills were in operation. The restoration of contaminated aquifers is to be undertaken in Phase II of the UMTRA Project. To begin implementation of Phase II, DOE requested that groundwater restoration methods and technologies be investigated by the Technical Assistance Contractor (TAC), and that the results of the TAC investigations be documented in special study reports. Many active and passive methods are available to clean up contaminated groundwater. Passive groundwater treatment includes natural flushing, geochemical barriers, and gradient manipulation by stream diversion or slurry walls. Active groundwater cleanup techniques include gradient manipulation by well extraction or injection, in-situ biological or chemical reclamation, and extraction and treatment. Although some or all of the methods listed above may play a role in the groundwater cleanup phase of the UMTRA Project, the extraction and treatment (pump and treat) option is the only restoration alternative discussed in this report. Hence, all sections of this report relate either directly or indirectly to the technical discipline of process engineering.

161 (DOE/UMTRA-400679-0000) Modeling technology and techniques special study: Final report. USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. May 1992. 48p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE93008963. Source: OSTI; NTIS; INIS; GPO Dep.

The Modeling Technology and Techniques Special Study evaluates computer software and hardware requirements for Uranium Mill Tailings Remedial Action restoration activities, and provides recommendations for acquisition of computer software, graphics packages, and hardware. As part of this study, a literature search was conducted, and information was solicited from the national laboratories and university and government research organizations to assess recent groundwater modeling developments. In addition, the Geraghty & Miller Modeling Group and In-Situ were contacted for information on their modeling techniques. A peer review of this special study was conducted by Weston; their comments have been incorporated into this report. The results of the literature search and the personal contacts were incorporated into recommendations on modeling software, hardware, and graphics for groundwater restoration.

162 (DOE/UMTRA-400680-0000) Risk assessment guidance document for the UMTRA project groundwater remediation phase. USDOE Albuquerque Field Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. May 1992. 50p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE93010591. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of the groundwater remedial activities at the Uranium Mill Tailings Remedial Action (UMTRA) sites is to reduce, control, or eliminate risks to human health and the environment. This is in accordance with Subpart B of 40 CFR 192. According to this regulation, the need for groundwater restoration is based upon US Environmental Protection Agency (EPA)-defined groundwater cleanup standards and must be consistent with the National Environmental Policy Act (NEPA) process. Risk assessments will be used in the UMTRA Groundwater Program to aid in the evaluation of sites. Risk assessments are conducted for four purposes: (1) Preliminary risk assessments are used to aid in prioritizing sites, scope data collection, and determine if a site presents immediate health risks. (2) Baseline risk assessments provide a comprehensive integration and interpretation of demographic, geographic, physical, chemical, and biological factors at a site to determine the extent of actual or potential harm. This information is used to determine the need for remedial action. (3) Risk evaluation of remedial alternatives is performed to evaluate risks to humans or the environment associated with the various remedial strategies. (4) After remediation, an evaluation of residual risks is conducted. The information gathered for each of these risk evaluations is used to determine the need for subsequent evaluation. Several sites may be eliminated after a preliminary risk assessment if there is no current or future threat to humans or the environment. Likewise, much of the data from a baseline risk assessment can be used to support alternate concentration limits or supplemental standards demonstrations, or identify sensitive habitats or receptors that may be of concern in selecting a remedy.

163 (DOE/UMTRA-400681-0000) **Mobile water treatment plant special study: Uranium Mill Tailings Remedial Action Project.** USDOE Albuquerque Field Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Dec 1992. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE93008500. Source: OSTI; NTIS; INIS; GPO Dep.

Characterization of the level and extent of groundwater contamination in the vicinity of Title I mill sites began during the surface remedial action stage (Phase 1) of the Uranium Mill Tailings Remedial Action (UMTRA) Project. Some of the contamination in the aquifer(s) at the abandoned sites is attributable to milling activities during the years the mills were in operation. To begin implementation of Phase 11 groundwater remediation, the US Department of Energy (DOE) requested that (1) the Technical Assistance Contractor (TAC) conduct a study to provide for the design of a mobile water treatment plant to treat groundwater extracted during site characterization studies at completed Phase I UMTRA sites, and (2) the results of the TAC investigations be documented in a special study report. This special study develops the design criteria for a water treatment plant that can be readily transported from one UMTRA site to another and operated as a complete treatment system. The 1991 study provides the basis for selecting a mobile water treatment system to meet the operating requirements recommended in this special study. The scope of work includes the following: Determining contaminants, flows, and loadings. Setting effluent quality criteria. Sizing water treatment unit(s). Evaluating non-monetary aspects of alternate treatment processes. Comparing costs of alternate treatment processes. Recommending the mobile water treatment plant design criteria.

164 (DOE/UMTRA-400689-0000) **Accelerating transient drainage from UMTRA Project tailings piles.** USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Sep 1990. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-82AL14086. Order Number DE93008965. Source: OSTI; NTIS; INIS; GPO Dep.

The period between the completion of construction of the tailings disposal cell and the establishment of equilibrium moisture content and seepage conditions is considered to be the period of transient drainage. Transient drainage may be due to factors such as construction water, precipitation, or residual water from the milling process. Transient seepage rates usually exceed steady state seepage rates. If the transient seepage rate causes contaminant levels to exceed groundwater compliance standards, then an alternative groundwater compliance strategy or technical approach to reduce or mitigate the effects of the drainage must be adopted. This study examines methods to accelerate the transient drainage of soils and hence to remove excess pore water from tailings in UMTRA Project disposal cells. The technical and economic feasibility of possible methods is examined. In order to perform comparative economical analyses of the various methods, an example tailings pile is postulated. This pile is considered to be 300 meters by 300 meters by 10 meters in thickness.

165 (EGG-2678(92)) **Drinking Water Program 1992 annual report.** Andersen, B.D.; Peterson-Wright, L.J. EG and G Idaho, Inc., Idaho Falls, ID (United States). Aug 1993. 94p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94002897. Source: OSTI; NTIS; INIS; GPO Dep.

EG&G Idaho, Inc., initiated a monitoring program for drinking water in 1988 for the US Department of Energy at the Idaho National Engineering Laboratory. EG&G Idaho structured this monitoring program to ensure that they exceeded the minimum regulatory requirements for monitoring drinking water. This program involves tracking the bacteriological, chemical, and radiological parameters that are required for a "community water system" (maximum requirements). This annual report describes the drinking water monitoring activities conducted at the 17 EG&G Idaho operated production wells and 11 distribution systems. It also contains all of the drinking water parameters that were detected and the regulatory limits that were exceeded during 1992. In addition, ground water quality is discussed as it relates to contaminants identified at the wellhead for EG&G Idaho production wells.

166 (EGG-EEL-10498) **A modeling study of contaminant transport resulting from flooding of Pit 9 at the Radioactive Waste Management Complex, Idaho National Engineering Laboratory.** Magnuson, S.O.; Sondrup, A.J. EG and G Idaho, Inc., Idaho Falls, ID (United States). Sep 1992. 40p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93016668. Source: OSTI; NTIS; INIS; GPO Dep.

A simulation study was conducted to determine if dissolved-phase transport due to flooding is a viable mechanism for explaining the presence of radionuclides in sedimentary interbeds below the Radioactive Waste Management Complex. In particular, the study focused on ^{241}Am migration due to flooding of Pit 9 in 1969. A kinetically-controlled source term model was used to estimate the mass of ^{241}Am that leached as a function of a variable surface infiltration rate. This mass release rate was then used

in a numerical simulation of unsaturated flow and transport to estimate the advance due to flooding of the ^{241}Am front down towards the 110 ft interbed. The simulation included the effect of fractures by superimposing them onto elements that represented the basalt matrix. For the base case, hydraulic and transport parameters were assigned using the best available data. The advance of the ^{241}Am front due to flooding for this case was minimal, on the order of a few meters. This was due to the strong tendency for ^{241}Am to sorb onto both basalts and sediments. In addition to the base case simulation, a parametric sensitivity study was conducted which tested the effect of sorption in the fractures, in the kinetic source term, and in the basalt matrix. Of these, the only case which resulted in significant transport was when there was no sorption in the basalt matrix. The indication being that other processes such as transport by radiocolloids or organic complexation may have contributed. However, caution is advised in interpreting these results due to approximations in the numerical method that was used incorporate fractures into the simulation. The approximations are a result of fracture apertures being significantly smaller than the elements over which they are superimposed. The sensitivity of the ^{241}Am advance to the assumed hydraulic conductivity for the fractures was also tested.

167 (EGG-EEL-10794) Elevation of surficial sediment/basalt contact in the Subsurface Disposal Area, Idaho National Engineering Laboratory. Hubbell, J.M. EG and G Idaho, Inc., Idaho Falls, ID (United States). 13 May 1993. 60p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93018934. Source: OSTI; NTIS; INIS; GPO Dep.

The elevation of the surficial sediment/basalt contact at the Subsurface Disposal Area (SDA), within the Radioactive Waste Management Complex (RWMC) is presented to provide a data base for future remedial actions at this site. About 1,300 elevation data from published and unpublished reports, maps, and surveyors notes were compiled to generate maps and cross-sections of the surficial sediment/basalt contact. In general, an east to west trending depression exists in the south central portion of the SDA with basalt closer to land surface on the northern and southern boundaries of the SDA. The lowest elevation of the surficial sediment/basalt contact is 4,979 ft and the greatest is land surface at 5,012 ft. The median elevation of the sediment/basalt interface is 4,994 ft. The median depth to basalt in the SDA is 16 ft if land surface elevation is assumed to be 5,010 ft. The depth from land surface to the sediment/basalt interface ranges from 24 ft in the southeast corner of the SDA to less than 3 ft at the north-central boundary of the SDA.

168 (EGG-EELS-10666) Software quality assurance plan for PORFLOW-3D. Maheras, S.J. EG and G Idaho, Inc., Idaho Falls, ID (United States). Mar 1993. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93012331. Source: OSTI; INIS; NTIS (documentation only); ESTSC (complete software package), P.O. Box 1020, Oak Ridge, TN 37831-1020; GPO Dep.

This plan describes the steps taken by the Idaho National Engineering Laboratory Subsurface and Environmental Modeling Unit personnel to implement software quality assurance procedures for the PORFLOW-3D computer code. PORFLOW-3D was used to conduct radiological performance assessments at the Savannah River Site. software quality assurance procedures for PORFLOW-3D include

software acquisition, installation, testing, operation, maintenance, and retirement. Configuration control and quality assurance procedures are also included or referenced in this plan.

169 (EGG-ENV-10975) Benchmark and partial validation testing of the FLASH computer code, Version 3.0. Martian, P.; Smith, C.S. EG and G Idaho, Inc., Idaho Falls, ID (United States). Sep 1993. 64p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94010796. Source: OSTI; NTIS; INIS; GPO Dep.

This document presents methods and results of benchmark testing (i.e., code-to-code comparisons) and partial validation testing (i.e., tests which compare field data to the computer generated solutions) of the FLASH computer code, Version 3.0, which were conducted to determine if the code is ready for performance assessment studies of the Radioactive Waste Management Complex. Three test problems are presented that were designed to check computational efficiency, accuracy of the numerical algorithms, and the capability of the code to simulate diverse hydrological conditions. These test problems were designed to specifically test the code's ability to simulate, (a) seasonal infiltration in response to meteorological conditions, (b) changing watertable elevations due to a transient areal source of water, (i.e., influx from spreading basins), and (c) infiltration into fractured basalt as a result of seasonal water in drainage ditches. The FLASH simulations generally compared well with the benchmark codes, indicating good stability and acceptable computational efficiency while simulating a wide range of conditions. The code appears operational for modeling both unsaturated and saturated flow in fractured, heterogeneous porous media. However, the code failed to converge when an unsaturated to saturated transition occurred. Consequently, the code should not be used when this condition occurs or is expected to occur, i.e. when perched water is present or when infiltration rates exceed the saturated conductivity of the soil.

170 (EGG-ESQ-10614) Summary report: Assessment of deep injection well associated surface soils at the Idaho National Engineering Laboratory. Pole, S.B. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jan 1993. 102p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93010756. Source: OSTI; NTIS; INIS; GPO Dep.

This report summarizes sampling activities and analytical results of the chemical and radiological content of surface soils from storm water retention basins and drainage ditches associated with eight deep injection wells at the Idaho National Engineering Laboratory. The results of the sampling effort were intended to support permitting of the injection wells by the State of Idaho Department of Water Resources. In August 1992, the surface soils associated with eight storm water retention basins and ditches were sampled. All samples were collected and analyzed in accordance with a written sampling and analysis plan. The samples were analyzed by an off-Site contract laboratory, and the results were compared to local and regional soil analytical data to determine the presence of contaminants. The results indicated that the surface soils from the storm water retention basins and ditches did not have concentrations of metals or radionuclides greater than the range of concentrations found in local and regional soils. Volatile organic compounds were below detection limits.

171 (EGG-GEO-9987) Aquifer test at Comore Loma No. 4, Idaho Falls, Idaho. Hubbell, J.M. EG and G Idaho, Inc., Idaho Falls, ID (United States). Dec 1991. 35p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92011699. Source: OSTI; NTIS; GPO Dep.

An aquifer test was conducted at Comore Loma Well #4 to determine the aquifer hydraulic characteristics at this location on July 11 and 12, 1991. Water was withdrawn from Comore Loma Well #4 at approximately 850 gallons per minute for 8 hours while monitoring the water level in the pumping well and an observation well 930 ft away. The pumped well showed over 12 ft of drawdown with no discernable drawdown in the observation well. The drawdown in the pumped well was nearly instantaneous, showing little additional drawdown after 1 minute. The transmissivity was calculated to be approximately 140,000 ft²/day using the Jacob solution. This gives a hydraulic conductivity of 1300 ft/day for the 110 ft interval tested. The high transmissivity and geologic setting suggest the aquifer may in part produce water from the Snake River Plain aquifer. However, the warm water temperature (71°F) indicates the presence of a geothermal source typical of the foothills aquifer. The storage coefficient could not be calculated since no water level decline was detected in the observation well.

172 (EGG-GEO-9990) Aquifer tests near the Idaho Falls Foothills, Idaho. Hubbell, J.M. EG and G Idaho, Inc., Idaho Falls, ID (United States). 3 Oct 1991. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012237. Source: OSTI; NTIS; GPO Dep.

Ground water pumping tests were performed in two wells located in the foothills east of Idaho Falls to determine the aquifer characteristics at these locations. These data were used to differentiate this aquifer from the Snake River Plain aquifer. The wells were pumped at rates of 11 and 14 gallons per minute with 0.03 and 0.04 ft of drawdown measured in the pumping wells. The transmissivity is estimated to be 525,000 gpd/ft and 450,000 gpd/ft, respectively. The hydraulic conductivity is 925 ft/day and 1,070 ft/day, respectively. These hydraulic conductivities are similar to those measured in the Snake River Plain aquifer. Water level data in these wells are consistent with the water table in the Snake River Plain aquifer and indicates ground water movement from the foothills toward the Plain. The high transmissivity suggests water may move rapidly from the foothills area to mix with water in the Snake River Plain aquifer. Elevated water temperatures (76 and 70°F) and high specific conductivities in these wells indicate the presence of a foothills aquifer with characteristics that can be used to separate the two aquifer systems.

173 (EGG-GEO-10068) A modeling study of water flow in the vadose zone beneath the Radioactive Waste Management Complex. Baca, R.G.; Magnuson, S.O.; Nguyen, H.D.; Martian, P. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jan 1992. 74p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012320. Source: OSTI; NTIS; INIS; GPO Dep.

A modeling study was conducted for the purpose of gaining insight into the nature of water flow in the vadose zone beneath the Radioactive Waste Management Complex (RWMC). The modeling study focused on three specific hydrologic aspects: (1) relationship between meteorologic

conditions and net infiltration, (2) water movement associated with past flooding events, and (3) estimation of water travel-times through the vadose zone. This information is necessary for understanding how contaminants may be transported through the vadose zone. Evaluations of net infiltration at the RWMC were performed by modeling the processes of precipitation, evaporation, infiltration and soil-moisture redistribution. Water flow simulations were performed for two distinct time periods, namely 1955-1964 and 1984-1990. The patterns of infiltration were calculated for both the undisturbed (or natural sediments) and the pit/trench cover materials. Detailed simulations of the 1969 flooding of Pit 10 were performed to estimate the rate and extent of water movement through the vadose zone. Water travel-times through the vadose zone were estimated using a Monte Carlo simulation approach. The simulations accounted for variability of soil and rock hydraulic properties as well as variations in the infiltration rate.

174 (EGG-GEO-10158) GWSCREEN: A semi-analytical model for assessment of the groundwater pathway from surface or buried contamination: Theory and user's manual. Rood, A.S. EG and G Idaho, Inc., Idaho Falls, ID (United States). Mar 1992. 98p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012532. Source: OSTI; NTIS; INIS; GPO Dep.

GWSCREEN was developed for assessment of the groundwater pathway from leaching of radioactive and non radioactive substances from surface or buried sources. The code was designed for implementation in the Track 1 and Track 2 assessment of Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) sites identified as low probability hazard at the Idaho National Engineering Laboratory (DOE, 1991). The code calculates the limiting soil concentration such that regulatory contaminant levels in groundwater are not exceeded. The code uses a mass conservation approach to model three processes: Contaminant release from a source volume, contaminant transport in the unsaturated zone, and contaminant transport in the saturated zone. The source model considers the sorptive properties and solubility of the contaminant. Transport in the unsaturated zone is described by a plug flow model. Transport in the saturated zone is calculated with a semi-analytical solution to the advection dispersion equation for transient mass flux input.

175 (EGG-GEO-10274) FLASH: A finite element computer code for variably saturated flow. Baca, R.G.; Magnuson, S.O. EG and G Idaho, Inc., Idaho Falls, ID (United States). May 1992. 62p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92018038. Source: OSTI; NTIS; INIS; GPO Dep.

A numerical model was developed for use in performance assessment studies at the INEL. The numerical model, referred to as the FLASH computer code, is designed to simulate two-dimensional fluid flow in fractured-porous media. The code is specifically designed to model variably saturated flow in an arid site vadose zone and saturated flow in an unconfined aquifer. In addition, the code also has the capability to simulate heat conduction in the vadose zone. This report presents the following: description of the conceptual frame-work and mathematical theory; derivations of the finite element techniques and algorithms; computational examples that illustrate the capability of the code; and input instructions for the general use of the code. The FLASH computer

code is aimed at providing environmental scientists at the INEL with a predictive tool for the subsurface water pathway. This numerical model is expected to be widely used in performance assessments for: (1) the Remedial Investigation/Feasibility Study process and (2) compliance studies required by the US Department of Energy Order 5820.2A.

176 (EGG-GEO-10329) FLAME: A finite element computer code for contaminant transport in variably-saturated media. Baca, R.G.; Magnuson, S.O. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jun 1992. 52p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92019760. Source: OSTI; NTIS; INIS; GPO Dep.

A numerical model was developed for use in performance assessment studies at the INEL. The numerical model referred to as the FLAME computer code, is designed to simulate subsurface contaminant transport in a variably-saturated media. The code can be applied to model two-dimensional contaminant transport in an and site vadose zone or in an unconfined aquifer. In addition, the code has the capability to describe transport processes in a porous media with discrete fractures. This report presents the following: description of the conceptual framework and mathematical theory, derivations of the finite element techniques and algorithms, computational examples that illustrate the capability of the code, and input instructions for the general use of the code. The development of the FLAME computer code is aimed at providing environmental scientists at the INEL with a predictive tool for the subsurface water pathway. This numerical model is expected to be widely used in performance assessments for: (1) the Remedial Investigation/Feasibility Study process and (2) compliance studies required by the US Department of Energy Order 5820.2A.

177 (EGG-GEO-10330) Independent verification and validation testing of the FLASH computer code, Version 3.0. Martian, P. (Washington State Univ., Pullman, WA (United States). Dept. of Mechanical and Materials Engineering); Chung, J.N. EG and G Idaho, Inc., Idaho Falls, ID (United States); Washington State Univ., Pullman, WA (United States). Dept. of Mechanical and Materials Engineering. Jun 1992. 43p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92019768. Source: OSTI; NTIS; INIS; GPO Dep.

Independent testing of the FLASH computer code, Version 3.0, was conducted to determine if the code is ready for use in hydrological and environmental studies at various Department of Energy sites. This report describes the technical basis, approach, and results of this testing. Verification tests, and validation tests, were used to determine the operational status of the FLASH computer code. These tests were specifically designed to test: correctness of the FORTRAN coding, computational accuracy, and suitability to simulating actual hydrologic conditions. This testing was performed using a structured evaluation protocol which consisted of: blind testing, independent applications, and graduated difficulty of test cases. Both quantitative and qualitative testing was performed through evaluating relative root mean square values and graphical comparisons of the numerical, analytical, and experimental data. Four verification tests were used to check the computational accuracy and correctness of the FORTRAN coding, and three validation tests were used to check the suitability to simulating actual conditions. These tests cases ranged in complexity from

simple 1-D saturated flow to 2-D variably saturated problems. The verification tests showed excellent quantitative agreement between the FLASH results and analytical solutions. The validation tests showed good qualitative agreement with the experimental data. Based on the results of this testing, it was concluded that the FLASH code is a versatile and powerful two-dimensional analysis tool for fluid flow. In conclusion, all aspects of the code that were tested, except for the unit gradient bottom boundary condition, were found to be fully operational and ready for use in hydrological and environmental studies.

178 (EGG-GEO-10368) Independent validation testing of the FLAME computer code, Version 1.0. Martian, P. (Washington State Univ., Pullman, WA (United States). Dept. of Mechanical and Materials Engineering); Chung, J.N. EG and G Idaho, Inc., Idaho Falls, ID (United States); Washington State Univ., Pullman, WA (United States). Dept. of Mechanical and Materials Engineering. Jul 1992. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92019691. Source: OSTI; NTIS; INIS; GPO Dep.

Independent testing of the FLAME computer code, Version 1.0, was conducted to determine if the code is ready for use in hydrological and environmental studies at Department of Energy sites. This report describes the technical basis, approach, and results of this testing. Validation tests, (i.e., tests which compare field data to the computer generated solutions) were used to determine the operational status of the FLAME computer code and were done on a qualitative basis through graphical comparisons of the experimental and numerical data. These tests were specifically designed to check: (1) correctness of the FORTRAN coding, (2) computational accuracy, and (3) suitability to simulating actual hydrologic conditions. This testing was performed using a structured evaluation protocol which consisted of: (1) independent applications, and (2) graduated difficulty of test cases. Three tests ranging in complexity from simple one-dimensional steady-state flow field problems under near-saturated conditions to two-dimensional transient flow problems with very dry initial conditions.

179 (EGG-GEO-10797) GWSCREEN: A semi-analytical model for assessment of the groundwater pathway from surface or buried contamination: Version 2.0 theory and user's manual. Rood, A.S. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jun 1993. 134p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93019026. Source: OSTI; NTIS (documentation only); ESTSC (complete software package), P.O. Box 1020, Oak Ridge, TN 37831-1020; INIS; GPO Dep.

GWSCREEN was developed for assessment of the groundwater pathway from leaching of radioactive and non radioactive substances from surface or buried sources. The code was designed for implementation in the Track I and Track II assessment of CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) sites identified as low probability hazard at the Idaho National Engineering Laboratory (DOE, 1992). The code calculates the limiting soil concentration such that, after leaching and transport to the aquifer, regulatory contaminant levels in groundwater are not exceeded. The code uses a mass conservation approach to model three processes: contaminant release from a source volume, contaminant transport in the unsaturated zone, and contaminant transport in the saturated zone. The source model considers the sorptive

properties and solubility of the contaminant. Transport in the unsaturated zone is described by a plug flow model. Transport in the saturated zone is calculated with a semi-analytical solution to the advection dispersion equation in groundwater. In Version 2.0, GWSCREEN has incorporated an additional source model to calculate the impacts to groundwater resulting from the release to percolation ponds. In addition, transport of radioactive progeny has also been incorporated. GWSCREEN has shown comparable results when compared against other codes using similar algorithms and techniques. This code was designed for assessment and screening of the groundwater pathway when field data is limited. It was not intended to be a predictive tool.

180 (EGG-GEO-10798) Software verification and validation plan for the GWSCREEN code. Rood, A.S. EG and G Idaho, Inc., Idaho Falls, ID (United States). May 1993. 37p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94002877. Source: OSTI; NTIS (documentation only); ESTSC (complete software package), P.O. Box 1020, Oak Ridge, TN 37831-1020; INIS; GPO Dep.

The purpose of this Software Verification and Validation Plan (SVVP) is to prescribe steps necessary to verify and validate the GWSCREEN code, version 2.0 to Quality Level B standards. GWSCREEN output is to be verified and validated by comparison with hand calculations, and by output from other Quality Level B computer codes. Verification and validation will also entail performing static and dynamic tests on the code using several analysis tools. This approach is consistent with guidance in the ANSI/ANS-10.4-1987, "Guidelines for Verification and Validation of Scientific and Engineering Computer Programs for the Nuclear Industry."

181 (EGG-M-89238) Modeling potential migration of petroleum hydrocarbons from a mixed-waste disposal site in the vadose zone. Rawson, S.A.; Walton, J.C.; Baca, R.G. EG and G Idaho, Inc., Idaho Falls, ID (United States). [1989]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. (CONF-8911162-1: NWWA/API conference on petroleum hydrocarbons and organic chemicals in ground water, Houston, TX (United States), 15-17 Nov 1989). Order Number DE91018694. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental monitoring of a mixed-waste disposal site at the Idaho National Engineering Laboratory has confirmed release and migration into the vadose zone of: (1) chlorinated hydrocarbons in the vapor phase and (2) trace levels of certain transuranic elements. The finding has prompted an evaluation of the potential role of waste petroleum hydrocarbons in mediating or influencing contaminant migration from the disposal site. Disposal records indicate that a large volume of machine oil contaminated with transuranic isotopes was disposed at the site along with the chlorinated solvents and other radioactive wastes. A multiphase flow model was used to assess the possible extent of oil and vapor movement through the 177 m thick vadose zone. One dimensional simulations were performed to estimate the vertical distribution of the vapor phase, the aqueous phase, and immiscible free liquid as a function of time. The simulations indicate that the oil may migrate slowly through the vadose zone, to potentially significant depths. Calculated transport rates support the following ranking with regard to relative mobility: vapor phase > aqueous phase > free liquid. 21 refs., 7 figs., 2 tabs.

182 (EGG-M-91219) 3D vadose zone modeling using geostatistical inferences. Knutson, C.F.; Lee, C.B. EG and G Idaho, Inc., Idaho Falls, ID (United States). [1991]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. (CONF-9109306-1: 1991 GeoTech/Geochautauqua meeting, Denver, CO (United States), 21-24 Sep 1991). Order Number DE92003334. Source: OSTI; NTIS; INIS; GPO Dep.

In developing a 3D model of the 600 ft thick interbedded basalt and sediment complex that constitutes the vadose zone at the Radioactive Waste Management Complex (RWMC) at the Idaho National Engineering Laboratory (INEL) geostatistical data were captured for 12-15 parameters (e.g. permeability, porosity, saturation, etc. and flow height, flow width, flow internal zonation, etc.). This two scale data set was generated from studies of subsurface core and geophysical log suites at RWMC and from surface outcrop exposures located at the Box Canyon of the Big Lost River and from Hell's Half Acre lava field all located in the general RWMC area. Based on these currently available data, it is possible to build a 3D stochastic model that utilizes: cumulative distribution functions obtained from the geostatistical data; backstripping and rebuilding of stratigraphic units; an "expert" system that incorporates rules based on expert geologic analysis and experimentally derived geostatistics for providing: (a) a structural and isopach map of each layer, (b) a realization of the flow geometry of each basalt flow unit, and (c) a realization of the internal flow parameters (eg permeability, porosity, and saturation) for each flow. 10 refs., 4 figs., 1 tab.

183 (EGG-WM-11066) Soil moisture monitoring results at the radioactive waste management complex of the Idaho National Engineering Laboratory, FY-1993. McElroy, D.L. EG and G Idaho, Inc., Idaho Falls, ID (United States). Nov 1993. 114p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94010795. Source: OSTI; NTIS; GPO Dep.

In FY-1993, two tasks were performed for the Radioactive Waste Management Complex (RWMC) Low Level Waste Performance Assessment to estimate net infiltration from rain and snow at the Subsurface Disposal Area (SDA) and provide soil moisture data for hydrologic model calibration. The first task was to calibrate the neutron probe to convert neutron count data to soil moisture contents. A calibration equation was developed and applied to four years of neutron probe monitoring data (November 1986 to November 1990) at W02 and W06 to provide soil moisture estimates for that period. The second task was to monitor the soils at two neutron probe access tubes (W02 and W06) located in the SDA of the RWMC with a neutron probe to estimate soil moisture contents. FY-1993 monitoring indicated net infiltration varied widely across the SDA. Less than 1.2 in. of water drained into the underlying basalts near W02 in 1993. In contrast, an estimated 10.9 in. of water moved through the surficial sediments and into the underlying basalts at neutron probe access tube W06. Net infiltration estimates from the November 1986 to November 1990 neutron probe monitoring data are critical to predictive contaminant transport modeling and should be calculated and compared to the FY-1993 net infiltration estimates. In addition, plans are underway to expand the current neutron probe monitoring system in the SDA to address the variability in net infiltration across the SDA.

184 (EGG-WTD-9291) A summary of the environmental restoration program Retrieval Demonstration

Project at the Idaho National Engineering Laboratory. McQuary, J. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jan 1991. 56p. Sponsored by USDOE, Washington, DC (USA). DOE Contract AC07-76ID01570. Order Number DE91014090. Source: OSTI; NTIS; INIS; GPO Dep.

This document summarizes the of retrieval techniques developed to excavate buried transuranic (TRU) mixed waste from the Subsurface Disposal Area (SDA). The SDA is located at the Idaho National Engineering Laboratory (INEL) in the Radioactive Waste Management Complex (RWMC). 31 refs., 1 fig.

185 (EGG-WTD-9291-Rev.1) A summary of the environmental restoration program retrieval demonstration project at the Idaho National Engineering Laboratory: Revision 1. McQuary, J. EG and G Idaho, Inc., Idaho Falls, ID (United States). Feb 1991. 55p. Sponsored by USDOE, Washington, DC (USA). DOE Contract AC07-76ID01570. Order Number DE91014168. Source: OSTI; NTIS; INIS; GPO Dep.

This report provides a summary of the Environmental Restoration Program's Retrieval Demonstration Project at the Idaho National Engineering Laboratory. This project developed concepts for demonstrating facilities and equipment for the retrieval of buried transuranic mixed waste at the INEL. Included is a brief assessment of the viability, cost effectiveness, and safety of retrieval based on the developed concept. Changes made in Revision 1 reflect editorial changes only. 31 refs., 1 fig.

186 (EGG-WTD-9336) Transuranic contamination control using electrostatic curtain (proof-of-principle experiments). Meyer, L.C. EG and G Idaho, Inc., Idaho Falls, ID (United States). Nov 1990. 97p. Sponsored by USDOE, Washington, DC (USA). DOE Contract AC07-76ID01570. Order Number DE91014167. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents the results of proof-of-principle experiments for using electrostatic curtains (ESCs) as a transuranic (TRU) contamination control technique. The TRU contaminants controlled included small (micron to sub-micron) particles of plutonium and americium compounds associated with defense related waste. A series of four experiments were conducted, with the first two experiments using uncontaminated Idaho National Engineering Laboratory (INEL), soil, and third and fourth experiments using contaminated soil containing plutonium-239 and americium-241 (from a mixture of Rocky Flat Plant contaminated soil and INEL uncontaminated soil). All experiments were conducted inside a glove box in which electrically charged metal plates and fabric coupons were placed. The data for these experiments consisted of the mass of dust collected on the various sample coupons, plates, and filters; radiochemical analysis of selected dust samples; and photographs from the scanning electron microscope. The conclusion is the ESC has potential as a contamination control technique. Because of the positive charge of plutonium and americium particles, these particles were strongly attracted to plates with a negative charge, with some plutonium attaching to negatively charged dust particles on positive plates. The trend was for radioactivity per gram to increase as the particle size decreased. 4 refs., 23 figs., 36 tabs.

187 (EGG-WTD-9383-Rev.1) In situ vitrification program treatability investigation progress report: Revision 1. Arrhenholz, D.A. EG and G Idaho, Inc., Idaho Falls, ID (United States). Feb 1991. 66p. Sponsored by USDOE,

Washington, DC (USA). DOE Contract AC07-76ID01570. Order Number DE91014093. Source: OSTI; NTIS; INIS; GPO Dep.

This document presents a summary of the efforts conducted under the in situ vitrification treatability study during the period from its initiation in FY-88 until FY-90. In situ vitrification is a thermal treatment process that uses electrical power to convert contaminated soils into a chemically inert and stable glass and crystalline product. Contaminants present in the soil are either incorporated into the product or are pyrolyzed during treatment. The treatability study being conducted at the Idaho National Engineering Laboratory by EG&G Idaho is directed at examining the specific applicability of the in situ vitrification process to buried wastes contaminated with transuranic radionuclides and other contaminants found at the Subsurface Disposal Area of the Radioactive Waste Management Complex. This treatability study consists of a variety of tasks, including engineering tests, field tests, vitrified product evaluation, and analytical models of the in situ vitrification process. 6 refs., 4 figs., 3 tabs.

188 (EGG-WTD-9412) Rapid monitoring for transuranic contaminants during buried waste retrieval. McIsaac, C.V.; Sill, C.W.; Gehrke, R.J.; Shaw, P.G.; Randolph, P.D.; Amaro, C.R.; Pawelko, R.J.; Thompson, D.N.; Loomis, G.G. EG and G Idaho, Inc., Idaho Falls, ID (United States). Mar 1991. 407p. Sponsored by USDOE, Washington, DC (USA). DOE Contract AC07-76ID01570. Order Number DE91014160. Source: OSTI; NTIS; INIS; GPO Dep. Includes 2 sheets of microfiche supplements.

This document reports results of research performed in support of possible future transuranic waste retrieval operations at the Idaho National Engineering Laboratory Radioactive Waste Management Complex. The focus of this research was to evaluate various methods of performing rapid and, as much as possible, "on-line" quantitative measurements of ^{239}Pu or ^{241}Am , either as airborne or loose contamination. Four different alpha continuous air monitors were evaluated for lower levels of detection of airborne ^{239}Pu . All of the continuous air monitors were evaluated by sampling ambient air. In addition, three of the continuous air monitors were evaluated by sampling air synthetically laden with clean dust and dust spiked with ^{239}Pu . Six methods for making quantitative measurements of loose contamination were investigated. They were: (1) microwave digestion followed by counting in a photon electron rejecting alpha liquid scintillation spectrometer, (2) rapid radiochemical separation followed by alpha spectrometry, (3) measurement of the ^{241}Am 59 keV gamma ray using a thin window germanium detector, (4) measurement of uranium L-shell x-rays, (5) gross alpha counting using a large-area Ag activated ZnS scintillator, and (6) direct counting of alpha particles using a large-area ionization chamber. 40 refs., 42 figs., 24 tabs.

189 (EGG-WTD-9422-Rev.1) In situ vitrification application to buried waste: Interim report of intermediate field tests at Idaho National Engineering Laboratory: Revision 1. Callow, R.A. (EG and G Idaho, Inc., Idaho Falls, ID (United States)); Weidner, J.R.; Thompson, L.E. EG and G Idaho, Inc., Idaho Falls, ID (United States). Feb 1991. 189p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92017999. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes the two in situ vitrification field tests conducted in June and July 1990 at Idaho National Engineering Laboratory. In situ vitrification, an emerging

technology for in-place conversion of contaminated soils into a durable glass and crystalline waste form, is being investigated as a potential remediation technology for buried waste. The overall objective of the two tests was to assess the general suitability of the process to remediate waste structures representative of buried waste found at Idaho National Engineering Laboratory. In particular, these tests, as part of a treatability study, were designed to provide essential information on the field performance of the process under conditions of significant combustible and metal wastes and to test a newly developed electrode feed technology. The tests were successfully completed, and the electrode feed technology successfully processed the high metal content waste, indicating the process is a feasible technology for application to buried waste.

190 (EGG-WTD-9423) Test plan for electrostatic curtain studies. Meyer, L.C.; Loomis, G.G. EG and G Idaho, Inc., Idaho Falls, ID (United States). Mar 1991. 48p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE91014169. Source: OSTI; NTIS; INIS; GPO Dep.

This test plan describes experimental details of engineering-scale electrostatic curtain research experiments to be performed at the Idaho National Engineering Laboratory in FY-91. These experiments will investigate the feasibility of using electrostatic curtains as devices to control the spread of contaminants during transuranic waste handling operations. Test objectives, detailed experimental procedures, and data quality objectives necessary to perform the FY-91 experiments are included in this plan. 11 refs.

191 (EGG-WTD-9432-Vol.1-Rev.1) Use of noninvasive geophysical techniques for the In Situ Vitrification Program: Volume 1, Literature review: Revision 1. Josten, N.E.; Marts, S.T.; Carpenter, G.S. EG and G Idaho, Inc., Idaho Falls, ID (United States). Nov 1991. 45p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012568. Source: OSTI; NTIS; GPO Dep.

In situ vitrification (ISV) is a waste pit remediation technology that can potentially eliminate the need for pit excavation. The ISV program at the Idaho National Engineering Laboratory (INEL) funded this study to evaluate geophysical techniques that might be useful for performing detailed screening of the materials, soil conditions, and local geology of waste pits targeted for remediation. The evaluation focuses on a specific set of characterization objectives developed by ISV engineers. The objectives are based on their assessment of safety, environmental, and cost efficiency issues associated with the ISV process. A literature review of geophysical case histories was conducted and a geophysical survey was performed at the INEL simulated waste pit so that the evaluation could be based on demonstrable results.

192 (EGG-WTD-9432-Vol.2) Use of noninvasive geophysical techniques for the In Situ Vitrification Program: Volume 2, Demonstration at the simulated waste pit. Marts, S.T.; Josten, N.E.; Carpenter, G.S. EG and G Idaho, Inc., Idaho Falls, ID (United States). Nov 1991. 46p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012569. Source: OSTI; NTIS; GPO Dep.

This document is the second volume of a three volume report to evaluate geophysical methods for use in the detailed characterization of waste pits. The In Situ Vitrification (ISV) Program funded the study to support the ISV remediation

technology being developed at the Idaho National Engineering Laboratory (INEL). The ISV Program is considering geophysical waste characterization as a means to enhance the efficiency of the ISV process. Field tests were conducted to demonstrate and evaluate the application of magnetic, electromagnetic induction, and ground penetrating radar methods to waste site characterization. The primary objective was to investigate the ability of these noninvasive geophysical methods to locate and identify buried waste materials under conditions representative of the INEL Subsurface Disposal Area (SDA). The tests were conducted at an simulated waste pit designed to represent conditions at the SDA.

193 (EGG-WTD-9432-Vol.3) Use of noninvasive geophysical techniques for the in situ vitrification program: Volume 3, Discussion and recommendations. Josten, N.E.; Marts, S.T.; Carpenter, G.S. EG and G Idaho, Inc., Idaho Falls, ID (United States). Nov 1991. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012601. Source: OSTI; NTIS; GPO Dep.

In situ vitrification (ISV) is a waste pit remediation technology that can potentially eliminate the need for pit excavation. The ISV program at the Idaho National Engineering Laboratory (INEL) funded this study to evaluate geophysical techniques that might be useful for performing detailed screening of the materials, soil conditions, and local geology of waste pits targeted for remediation. The evaluation focuses on a specific set of characterization objectives developed by ISV engineers. The objectives are based on their assessment of safety, environmental, and cost efficiency issues associated with the ISV process. A literature review of geophysical case histories was conducted and a geophysical survey was performed at the INEL simulated waste pit so that the evaluation could be based on demonstrable results. The literature review shows that all the ISV objectives are theoretically achievable because they involve physical properties (such as electrical conductivity, density, or magnetization) that can be sensed by geophysical instruments. However, most of the ISV objectives require substantially higher resolution than is achieved in typical waste site investigations, or than has been demonstrated by researches using state-of-the-art techniques. The survey at the INEL simulated waste pit yielded useful, qualitative information on subsurface materials and boundaries; but quantitative information, such as depth, size, or composition of buried materials, was subject to significant uncertainty. For ISV, the usefulness of geophysical characterization depends both on the capabilities of geophysical methods and on an assessment of the amount of uncertainty that is acceptable. Based on a preliminary assessment of these factors, the location of trench boundaries and detection of massive metallic objects are the important achievable objectives using current technology.

194 (EGG-WTD-9438) A brief analysis and description of transuranic wastes in the subsurface disposal area of the radioactive waste management complex at INEL. Arrenholz, D.A.; Knight, J.L. EG and G Idaho, Inc., Idaho Falls, ID (United States). Feb 1991. 43p. Sponsored by USDOE, Washington, DC (USA). DOE Contract AC07-76ID01570. Order Number DE91014094. Source: OSTI; NTIS; INIS; GPO Dep.

This document presents a brief summary of the wastes and waste types disposed of in the transuranic contaminated portions of the Subsurface Disposal Area during the

period 1954 through 1970. Wastes included in this summary are organics, inorganics, metals, radionuclides, and special-case wastes. In addition to summarizing amounts of wastes disposed and describing the wastes, the document also provides information on disposal pit and trench dimensions and contaminated soil volumes. The report also points out discrepancies that exist in available documentation regarding waste and soil volumes and makes recommendations for future efforts at waste characterization. 20 refs., 3 figs., 17 tabs.

195 (EGG-WTD-9594-Vol.1) Preliminary Systems Design Study assessment report: Volume 1: Executive summary. Mayberry, J.L.; Quapp, W.J.; Feizollahi, F.; Del Signore, J.C. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jul 1991. 32p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92003326. Source: OSTI; NTIS; INIS; GPO Dep.

The System Design Study (SDS), part of the Waste Technology Development Department at Idaho National Engineering Laboratory (INEL), examined techniques available for the remediation of hazardous and transuranic (TRU) waste stored at the Radioactive Waste Management Complex's (RWMC's) Subsurface Disposal Area (SDA) at INEL. Using specific technologies, system concepts for treating the buried waste and the surrounding contaminated soil were evaluated. Evaluation included implementability, effectiveness, and cost. SDS resulted in the development of technology requirements including demonstration, testing and evaluation activities needed for implementing each concept. The SDS results are published in eight volumes. Volume 1 contains an executive summary. The SDS summary and analysis of results are presented in volume 2. Volumes 3 through 7 contain detailed descriptions of twelve system and four subsystem concepts. Volume 8 contains the appendices. 3 figs., 3 tabs.

196 (EGG-WTD-9594-Vol.2) Preliminary Systems Design Study assessment report: Volume 2: Main report. Mayberry, J.L.; Quapp, W.J.; Feizollahi, F.; Del Signore, J.C. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jul 1991. 160p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92003327. Source: OSTI; NTIS; INIS; GPO Dep.

The System Design Study (SDS), part of the Waste Technology Development Department at the Idaho National Engineering Laboratory (INEL), examined techniques available for the remediation of hazardous and transuranic waste stored at the Radioactive Waste Management Complex's Subsurface Disposal Area at the INEL. Using specific technologies, system concepts for treating the buried waste and the surrounding contaminated soil were evaluated. Evaluation included implementability, effectiveness, and cost. SDS resulted in the development of technology requirements including demonstration, testing, and evaluation activities needed for implementing each concept. The SDS results are published in eight volumes. Volume 1 contains an executive summary. The SDS summary and analysis of results are presented in Volume 2. Volumes 3 through 7 contain detailed descriptions of twelve system and four subsystem concepts. Volume 8 contains the appendices. 23 refs., 23 figs., 16 tabs.

197 (EGG-WTD-9594-Vol.3) Preliminary systems design study assessment report: Volume 3, Process in-place/leave in-place concepts. Mayberry, J.L. (EG and G Idaho, Inc., Idaho Falls, ID (United States)); Feizollahi, F.;

Del Signore, J.C. EG and G Idaho, Inc., Idaho Falls, ID (United States). Sep 1991. 86p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012533. Source: OSTI; NTIS; INIS; GPO Dep.

The System Design Study (SDS), part of the Waste Technology Development Department at the Idaho National Engineering Laboratory (INEL), examined techniques available for the remediation of hazardous and transuranic waste stored at the Radioactive Waste Management Complex's Subsurface Disposal Area at the INEL. Using specific technologies, system concepts for treating the buried waste and the surrounding contaminated soil were evaluated. Evaluation included implementability, effectiveness, and cost. The SDS resulted in the development of technology requirements including demonstration, testing, and evaluation activities needed for implementing each concept.

198 (EGG-WTD-9594-Vol.4) Preliminary systems design study assessment report: Volume 4, Leach resistant/high integrity structure concepts. Mayberry, J.L.; Feizollahi, F.; Del Signore, J.C. EG and G Idaho, Inc., Idaho Falls, ID (United States). Oct 1991. 118p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92010848. Source: OSTI; NTIS; GPO Dep.

The System Design Study (SDS), part of the Waste Technology Development Department of the Idaho National Engineering Laboratory (INEL), examined techniques available for the remediation of hazardous and transuranic waste stored at the Radioactive Waste Management Complex's Subsurface Disposal Area at the INEL. Using specific technologies, system concepts for treating the buried waste and the surrounding contaminated soil were evaluated. Evaluation included implementability, effectiveness, and cost. The SDS resulted in the development of technology requirements including demonstration, testing, and evaluation activities needed for implementing each concept. The SDS results are published in eight volumes. Volume I contains an executive summary. The SDS summary and analysis of results are presented in Volume II. Volumes III through VII contain descriptions of twelve system and four subsystem concepts. Volume VIII contains the appendices.

199 (EGG-WTD-9594-Vol.5) Preliminary Systems Design Study assessment report: Volume 5, Land disposal compliance and hydrogen generation restricted concepts. Mayberry, J.L.; Feizollahi, F.; Del Signore, J.C. EG and G Idaho, Inc., Idaho Falls, ID (United States). Nov 1991. 237p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012534. Source: OSTI; NTIS; INIS; GPO Dep.

The System Design Study (SDS), part of the Waste Technology Development Department at the Idaho National Engineering Laboratory (INEL), examined techniques available for the remediation of hazardous and transuranic waste stored at the Radioactive Waste Management Complex's Subsurface Disposal Area at the INEL. Using specific technologies, system concepts for treating the buried waste and the surrounding contaminated soil were evaluated. Evaluation included implementability, effectiveness, and cost. The SDS resulted in the development of technology requirements including demonstration, testing, and evaluation activities needed for implementing each concept.

200 (EGG-WTD-9594-Vol.7) Preliminary systems design study assessment report: Volume 7, Subsystem

concepts. Mayberry, J.L.; Feizollahi, F.; Del Signore, J.C. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jan 1992. 156p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012536. Source: OSTI; NTIS; INIS; GPO Dep.

The System Design Study (SDS), part of the Waste Technology Development Department at the Idaho National Engineering Laboratory (INEL), examined techniques available for the remediation of hazardous and transuranic waste stored at the Radioactive Waste Management Complex's Subsurface Disposal Area at the INEL. Using specific technologies, system concepts for treating the buried waste and the surrounding contaminated soil were evaluated. Evaluation included implementability, effectiveness, and cost. The SDS resulted in the development of technology requirements including demonstration, testing, and evaluation activities needed for implementing each. This volume contains the descriptions and other relevant information of the four subsystems required for most of the ex situ processing systems. This volume covers the metal decontamination and sizing subsystem, soils processing subsystem, low-level waste subsystem, and retrieval subsystem.

201 (EGG-WTD-9594-Vol.8) Preliminary Systems Design Study assessment report: Volume 8, Appendixes. Mayberry, J.L.; Feizollahi, F.; Del Signore, J.C. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jan 1992. 94p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012537. Source: OSTI; NTIS; INIS; GPO Dep.

The System Design Study (SDS), part of the Waste Technology Development Department at the Idaho National Engineering Laboratory (INEL), examined techniques available for the remediation of hazardous and transuranic waste stored at the Radioactive Waste Management Complex's Subsurface Disposal Area at the INEL. Using specific technologies, system concepts for treating the buried waste and the surrounding contaminated soil were evaluated. Evaluation included implementability, effectiveness, and cost. The SDS resulted in the development of technology requirements including demonstration, testing, and evaluation activities needed for implementing each concept. This volume of the Systems Design Study contain four Appendixes that were part of the study. Appendix A is an EG&G Idaho, Inc., report that represents a review and compilation of previous reports describing the wastes and quantities disposed in the Subsurface Disposal Area of the Idaho National Engineering Laboratory. Appendix B contains the process flowsheets considered in this study, but not selected for detailed analysis. Appendix C is a historical tabulation of radioactive waste incinerators. Appendix D lists Department of Energy facilities where cementation stabilization systems have been used.

202 (EGG-WTD-9671) ISV electrical power availability. West, G.S. Sr. EG and G Idaho, Inc., Idaho Falls, ID (United States). May 1991. 57p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE91018787. Source: OSTI; NTIS; INIS; GPO Dep.

This document presents the engineering design file report for the In Situ Vitrification (ISV) Electrical Power Availability study. The purpose of this study is to assess whether electrical power at the Idaho National Engineering Laboratory is sufficient enough to supply any or all of the ISV field test programs. The capacities of the 15 kV-class distribution systems and the 138 kV substation transformers upstream were assessed to determine viable electrical service alternatives

for the ISV test beds. Load-flow analyses were performed to determine actual distribution circuit capacities with respect to established voltage constraints. Load flow analysis validated that the area feeders for the Semi-Scale Test Facility, Loss-of-Fluid Test Facility, and Water Reactor Research Test Facility would support the proposed ISV test beds. Construction cost estimates for planning are provided for these three locations, which this study identified as the best locations for possible connection of the ISV electrical service. This report will be used to determine an appropriate location for the ISV field test equipment used for cold testing. 2 refs., 1 tab.

203 (EGG-WTD-9672) Technical baseline description for in situ vitrification laboratory test equipment. Beard, K.V.; Bonnenberg, R.W.; Watson, L.R. EG and G Idaho, Inc., Idaho Falls, ID (United States). Sep 1991. 36p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92003263. Source: OSTI; NTIS; INIS; GPO Dep.

In situ vitrification (ISV) has been identified as possible waste treatment technology. ISV was developed by Pacific Northwest Laboratory (PNL), Richland, Washington, as a thermal treatment process to treat contaminated soils in place. The process, which electrically melts and dissolves soils and associated inorganic materials, simultaneously destroys and/or removes organic contaminants while incorporating inorganic contaminants into a stable, glass-like residual product. This Technical Baseline Description has been prepared to provide high level descriptions of the design of the Laboratory Test model, including all design modifications and safety improvements made to data. Furthermore, the Technical Baseline Description provides a basic overview of the interface documents for configuration management, program management interfaces, safety, quality, and security requirements. 8 figs.

204 (EGG-WTD-9752) Buried Waste Integrated Demonstration: Selection of potential demonstration locations. Arrhenholz, D.A.; Knight, J.L. EG and G Idaho, Inc., Idaho Falls, ID (United States). Nov 1991. 40p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012224. Source: OSTI; NTIS; INIS; GPO Dep.

The first step towards identifying primary Buried Waste Integrated Demonstration locations is the selection of potential demonstration sites within the Subsurface Disposal Area. The sites selected are Pits 4, 5, 6, and 9, containing transuranic waste of Rocky Flats origin, the Acid Pit, and Pad A. The criteria and methodology for selection of these sites, as well as a description of the wastes present in each area, are included in this report. At a later date, technology-specific demonstration locations will be selected from these six potential sites. The selected locations will be used as necessary to demonstrate technologies whose potential abilities may be optimal on waste forms present at these identified locations.

205 (EGG-WTD-9776) Pad A treatability study long-range project plan. Mousseau, J.D. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jun 1991. 97p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE91018715. Source: OSTI; NTIS; INIS; GPO Dep.

This plan addresses the work to be accomplished by the Pad A Treatability Study Project. The purpose of this project is to investigate potential treatment and separation technologies, identify the best technologies, and to demonstrate by

both lab- and pilot-scale demonstration, the most applicable remedial technologies for treating plutonium-contaminated salts at the Pad A site located at the Subsurface Disposal Area (SDA) at the Radioactive Waste Management Complex (RWMC) at the Idaho National Engineering Laboratory (INEL). The conduct of this project will be supported by other DOE laboratories, universities, and private industries, who will provide support for near-term demonstrations of treatment and separation technologies. The purpose of this long-range planning document is to present the detailed plan for the implementation of the Pad A Treatability Study Project.

206 (EGG-WTD-9776-Rev.1) Pad A Treatability Study long-range project plan: Revision 1. Mousseau, J.D. EG and G Idaho, Inc., Idaho Falls, ID (United States). Aug 1991. 98p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92003336. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of the Pad A Treatability Study Project is to identify and demonstrate through lab- and pilot-scale testing, technologies for treating plutonium-contaminated salt waste. This document presents proposed objectives and schedules, scope of work and breakdown structure, cost elements, deployment, benefits, and change controls for the project.

207 (EGG-WTD-9780) Test plan for cryofracture demonstration, sampling, and analysis. Osborne, D.; Winberg, M. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jul 1991. 39p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE91018833. Source: OSTI; NTIS; INIS; GPO Dep.

This test plan defines basic test procedures for demonstrating the applicability of cryofracture techniques for size reduction of wastes at the Idaho National Engineering Laboratory (INEL). To demonstrate the cryofracture process, drums and boxes with simulated waste will be cryogenically cooled and then fractured in a hydraulic press. The cryofracture process was originally developed for the demilitarization of chemical and biological munitions. It is expected that cryofracture will provide a safe, simple, and reliable method of accessing and downsizing packaged wastes for subsequent treatment and disposal operations. The demonstration will include initial tests to determine rates of cryogenic cooling, cryofracture demonstration, characterization and documentation of cryofracture process end products, and a sampling program to simulate the extent of contamination dispersion during the cryofracture process. A description of test apparatus and test methods is provided in this plan. Quality assurance and safety requirements for this project are also identified. 9 figs., 7 tabs.

208 (EGG-WTD-9799) In situ technology evaluation and functional and operational guidelines for treatability studies at the radioactive waste management complex at the Idaho National Engineering Laboratory. Hyde, R.A.; Donehey, A.J.; Piper, R.B.; Roy, M.W.; Rubert, A.L.; Walker, S. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jul 1991. 211p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92003269. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this document is to provide EG&G Idaho's Waste Technology Development Department with a basis for selection of in situ technologies for demonstration at the Radioactive Waste Management Complex (RWMC) of the

Idaho National Engineering Laboratory (INEL) and to provide information for Feasibility Studies to be performed according to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The demonstrations will aid in meeting Environmental Restoration/Waste Management (ER/WM) schedules for remediation of waste at Waste Area Group (WAG) 7. This report is organized in six sections. Section 1, summarizes background information on the sites to be remediated at WAG-7, specifically, the acid pit, soil vaults, and low-level pits and trenches. Section 2 discusses the identification and screening of in situ buried waste remediation technologies for these sites. Section 3 outlines the design requirements. Section 4 discusses the schedule [in accordance with Buried Waste Integrated Demonstration (BWID) scoping]. Section 5 includes recommendations for the acid pit, soil vaults, and low-level pits and trenches. A listing of references used to compile the report is given in Section 6. Detailed technology information is included in the Appendix section of this report.

209 (EGG-WTD-9807) In situ vitrification application to buried waste: Final report of intermediate field tests at Idaho National Engineering Laboratory. Callow, R.A. (EG and G Idaho, Inc., Idaho Falls, ID (United States)); Weidner, J.R.; Loehr, C.A.; Bates, S.O.; Thompson, L.E.; McGrail, B.P. EG and G Idaho, Inc., Idaho Falls, ID (United States). Aug 1991. 304p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92003384. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes two in situ vitrification field tests conducted on simulated buried waste pits during June and July 1990 at the Idaho National Engineering Laboratory. In situ vitrification, an emerging technology for in place conversion of contaminated soils into a durable glass and crystalline waste form, is being investigated as a potential remediation technology for buried waste. The overall objective of the two tests was to access the general suitability of the process to remediate waste structures representative of buried waste found at Idaho National Engineering Laboratory. In particular, these tests, as part of a treatability study, were designed to provide essential information on the field performance of the process under conditions of significant combustible and metal wastes and to test a newly developed electrode feed technology. The tests were successfully completed, and the electrode feed technology successfully processed the high metal content waste. Test results indicate the process is a feasible technology for application to buried waste. 33 refs., 109 figs., 39 tabs.

210 (EGG-WTD-9868) Product evaluation of in situ vitrification engineering, Test 4. Loehr, C.A.; Weidner, J.R.; Bates, S.O. EG and G Idaho, Inc., Idaho Falls, ID (United States). Sep 1991. 101p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012310. Source: OSTI; NTIS; INIS; GPO Dep.

This report is one of several that evaluates the In Situ Vitrification (ISV) Engineering-Scale Test 4 (ES-4). This document describes the chemical and physical composition, microstructure, and leaching characteristics of ES-4 product samples; these data provide insight into the expected performance of a vitrified product in an ISV buried waste application similar to that studied in ES-4.

211 (EGG-WTD-9870-Rev.1) Buried Waste Integrated Demonstration Plan: Revision 1. Kostelnik, K.M.

EG and G Idaho, Inc., Idaho Falls, ID (United States). Dec 1991. 93p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012223. Source: OSTI; NTIS; INIS; GPO Dep.

This document presents the plan of activities for the Buried Waste Integrated Demonstration (BWID) program which supports the environmental restoration (ER) objectives of the Department of Energy (DOE) Complex. Discussed in this plan are the objectives, organization, roles and responsibilities, and the process for implementing and managing BWID. BWID is hosted at the Idaho National Engineering Laboratory (INEL), but involves participants from throughout the DOE Complex, private industry, universities, and the international community. These participants will support, demonstrate, and evaluate a suite of advanced technologies representing a comprehensive remediation system for the effective and efficient remediation of buried waste. The processes for identifying technological needs, screening candidate technologies for applicability and maturity, selecting appropriate technologies for demonstration, field demonstrating, evaluation of results and transferring technologies to environmental restoration programs are also presented. This document further describes the elements of project planning and control that apply to BWID. It addresses the management processes, operating procedures, programmatic and technical objectives, and schedules. Key functions in support of each demonstration such as regulatory coordination, safety analyses, risk evaluations, facility requirements, and data management are presented.

212 (EGG-WTD-9872) Parametric melting studies for in situ vitrification. Fryer, M.O.; Hawkes, G.L.; Murray, P.E. EG and G Idaho, Inc., Idaho Falls, ID (United States). Nov 1991. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012526. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes a series of simulation studies which examine heat conduction and electric heating during in situ vitrification (ISV). The simulation studies determine the effects of soil parameter changes on the ISV process. Changes in heat capacity, thermal conductivity and electrical conductivity are considered. The results of these studies provide a basis for experimental measurement accuracy requirements.

213 (EGG-WTD-9876) APOLLO: A computer program for the calculation of chemical equilibrium and reaction kinetics of chemical systems. Nguyen, H.D. EG and G Idaho, Inc., Idaho Falls, ID (United States). Nov 1991. 44p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92017864. Source: OSTI; NTIS; INIS; GPO Dep.

Several of the technologies being evaluated for the treatment of waste material involve chemical reactions. Our example is the in situ vitrification (ISV) process where electrical energy is used to melt soil and waste into a "glass like" material that immobilizes and encapsulates any residual waste. During the ISV process, various chemical reactions may occur that produce significant amounts of products which must be contained and treated. The APOLLO program was developed to assist in predicting the composition of the gases that are formed. Although the development of this program was directed toward ISV applications, it should be applicable to other technologies where chemical reactions are of interest. This document presents the mathematical methodology of the APOLLO computer code. APOLLO is a computer code that calculates the products of

both equilibrium and kinetic chemical reactions. The current version, written in FORTRAN, is readily adaptable to existing transport programs designed for the analysis of chemically reacting flow systems. Separate subroutines EQREACT and KIREACT for equilibrium and kinetic chemistry respectively have been developed. A full detailed description of the numerical techniques used, which include both Lagrange multipliers and a third-order integrating scheme is presented. Sample test problems are presented and the results are in excellent agreement with those reported in the literature.

214 (EGG-WTD-9901) Physical and chemical properties of the products of in situ vitrification engineering tests 5, 6, and 7. Loehr, C.A.; Weidner, J.R. EG and G Idaho, Inc., Idaho Falls, ID (United States). Dec 1991. 56p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012371. Source: OSTI; NTIS; GPO Dep.

In situ vitrification (ISV) is an in situ thermal treatment process that is being investigated by the Idaho National Engineering Laboratory (INEL) for application to buried waste sites. ISV is a thermal treatment process that converts contaminated soil into a chemically inert and stable glass and crystalline product. The INEL is evaluating whether the treatment process is a viable one for remediating a buried mixed transuranic waste site at the INEL Subsurface Disposal Area (SDA). The SDA is a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site. As part of the INEL investigation, a series of tests have been performed that address issues associated with vitrification of buried waste. Two pilot ISV tests and four tests at laboratory scale, formerly called engineering scale, were performed in 1990 to support the INEL investigation. The chemical composition and leaching of the produce glass is described.

215 (EGG-WTD-9916) Executive summary of the Cryofracture demonstration program. Loomis, G.; Osborne, D.; Ancho, M. EG and G Idaho, Inc., Idaho Falls, ID (United States). Sep 1991. 37p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92003255. Source: OSTI; NTIS; INIS; GPO Dep.

This report provides an executive summary of the Cryofracture demonstration program performed at Nuclear Remedial Technologies Corporation under contract to EG&G Idaho, Inc., for the Department of Energy (DOE). Cryofracture is a size-reducing process whereby objects are frozen whereby objects are frozen to liquid nitrogen temperatures and crushed in a large hydraulic press. Material at the cryogenic temperatures have low ductility and are easily size reduced by fracturing. The main application being investigated for the DOE is for retrieved buried and stored transuranic (TRU) waste. Six 55-gallon drums and six 2 ft x 2 ft x 8 ft boxes containing simulated waste with tracers were subjected to the Cryofracture process. Data was obtained on (a) cool-down time, (b) yield strength of the containers, (c) size distribution of the waste before and after the Cryofracture process, (d) volume reduction of the waste, and (e) sampling of air and surface dusts for spread of tracers to evaluate potential contamination spread. The Cryofracture process was compared to conventional shredders and detailed cost estimates were established for construction of a Cryofracture facility at the Idaho National Engineering Laboratory. Although cost estimates for conventional shredding are higher for Cryofracture, the potential for fire and explosion during conventional shredding would

incur additional costs to preclude these events. These additional costs are unknown and would require considerable research and development. 4 refs., 6 figs., 7 tabs.

216 (EGG-WTD-9925) Plasma treatment of INEL soil contaminated with heavy metals. Detering, B.A.; Batdorf, J.A. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jan 1992. 41p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012372. Source: OSTI; NTIS; INIS; GPO Dep.

INEL soil spiked with inorganic salts of chromium, lead, mercury, silver, and zinc was melted in a 150 kW plasma furnace to produce a glassy slag product. This glassy slag is an environmentally safe waste form. In order to reduce the melting temperature of the soil, sodium carbonate was added to half of the test batches. Random sample from each batch of glassy slag product were analyzed by an independent laboratory for total metals concentration and leachability of metals via the Environmental Protection Agency (EPA) toxicity characterization leaching procedure (RCLP) tests. These tests showed the residual metals were very tightly bound to the slag matrix and were within EPA TCLP limits under these test conditions. Additionally, scanning electron microscopy (SEM) and emissions dispersive spectroscopy (EDS) analysis of the vitrified soil also confirmed that the added metals present in the vitrified soil were totally contained in the crystalline phase as distinct oxide crystallites.

217 (EGG-WTD-9985-Vol.1) Technical issues associated with in situ vitrification of the INEL Subsurface Disposal Area: Volume 1, A systematic approach for identification, prioritization, and closure of technical issues. Stoots, C.M.; Bates, S.O.; Callow, R.A.; Campbell, K.A.; Farnsworth, R.K.; Gratson, G.K.; McKellar, M.G.; Nickelson, D.F.; Slater, C.E. EG and G Idaho, Inc., Idaho Falls, ID (United States). Dec 1991. 53p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012513. Source: OSTI; NTIS; INIS; GPO Dep.

In situ vitrification (ISV) has been identified as an alternative technology for remediation of the Acid Pit and Transuranic Pits and Trenches (TRU-PTs) that are present at the Idaho National Engineering Laboratory (INEL) Subsurface Disposal Area (SDA). However, a number of technical issues exist that must be resolved before ISV can be considered applicable to these waste sites. To assist in the ISV technology evaluation, an ISV Steering Committee was formed to identify, prioritize, and develop closure roadmaps for technical issues associated with ISV application at the INEL SDA. The activities of the ISV Steering Committee are summarized in three volumes of this report. This document, Volume 1, identifies the systematic approach used to identify and prioritize the ISV technical issues, and briefly discusses the methodology that will be employed to resolve these issues.

218 (EGG-WTD-9985-Vol.2) Technical Issues associated with in situ vitrification of the INEL Subsurface Disposal Area: Volume 2, Application of technical issues to the Acid Pit. Stoots, C.M.; Bates, S.O.; Callow, R.A.; Campbell, K.A.; Farnsworth, R.K.; Gratson, G.K.; McKellar, M.G.; Nickelson, D.F.; Slater, C.E. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jan 1992. 127p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012514. Source: OSTI; NTIS; INIS; GPO Dep.

In situ vitrification (ISV) has been identified as an alternative technology for remediation of the Acid Pit and Transuranic Pits and Trenches (TRU-PTs) that are present at the Idaho National Engineering Laboratory (INEL) Subsurface Disposal Area (SDA). However, a number of technical issues exist that must be resolved before ISV can be considered applicable to these waste sites. To assist in the ISV technology evaluation, an ISV Steering Committee was formed to identify, prioritize, and develop closure roadmaps for technical issues associated with ISV application at the INEL SDA. The activities of the ISV Steering Committee are summarized in three volumes of this report. Volume 1 identifies the systematic approach used to identify and prioritize the ISV technical issues, and briefly discusses the methodology that will be employed to resolve these issues. This document Volume 2 and Volume 3 discusses each technical issue in greater detail and suggest specific closure roadmaps to be used in resolving technical issues associated with ISV at the SDA Acid Pit and TRU-PTs, respectively.

219 (EGG-WTD-9985-Vol.3) Technical issues associated with in situ vitrification of the INEL Subsurface Disposal Area: Volume 3, Application of technical issues to the TRU-contaminated pits and trenches. Stoots, C.M.; Bates, S.O.; Callow, R.A.; Campbell, K.A.; Farnsworth, R.K.; Krisman, G.K.; McKellar, M.G.; Nickelson, D.F.; Slater, C.E. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jul 1992. 67p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92018039. Source: OSTI; NTIS; INIS; GPO Dep.

In situ vitrification (ISV) has been identified as an alternative technology for remediation of the acid pit and transuranic pits and trenches (TRU-PTs) at the Idaho National Engineering Laboratory (INEL) Subsurface Disposal Area (SDA). However, a number of technical issues must be resolved before ISV can be considered applicable to these waste sites. To assist in the ISV technology evaluation, an ISV Steering Committee was formed to identify, prioritize, and develop closure roadmaps for technical issues associated with ISV application at the SDA. The activities of the ISV Steering Committee are summarized in a three-volume report. Volume 1 identifies the systematic approach used to identify and prioritize the ISV technical issues and briefly discusses the methodology that will be employed to resolve these issues. Volumes 2 and 3 discuss each technical issue in greater detail and suggest specific closure roadmaps to be used in resolving technical issues associated with ISV at the SDA Acid Pit and TRU-PTS, respectively. The three-volume report is a working document that will be updated as necessary to reflect current evaluation strategy for the ISV technology. This is Volume 3.

220 (EGG-WTD-9993) Energy and costs scoping study for plasma pyrolysis thermal processing system. Sherick, K.E.; Findley, J.E. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jan 1992. 66p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012359. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this study was to provide information in support of an investigation of thermal technologies as possible treatment process for buried wastes at the INEL. Material and energy balances and a cost estimate were generated for a representative plasma torch-based thermal waste treatment system operating in a pyrolysis mode. Two

waste streams were selected which are representative of INEL buried wastes, large in volume, and difficult to treat by other technologies. These streams were a solidified nitrate sludge waste stream and a waste/soil mix of other buried waste components. The treatment scheme selected includes a main plasma chamber operating under pyrolyzing conditions; a plasma afterburner to provide additional residence time at high temperature to ensure complete destruction of hazardous organics; an off-gas treatment system; and a incinerator and stack to oxidize carbon monoxide to carbon dioxide and vent the clean, oxidized gases to atmosphere. The material balances generated provide materials flow and equipment duty information of sufficient accuracy to generate initial rough-order-of-magnitude (ROM) system capital and operating cost estimates for a representative plasma thermal processing system.

221 (EGG-WTD-10033) Idaho National Engineering Laboratory In Situ Vitrification Project FY-91 progress report. Gardner, B.M.; Arrenholz, D.A.; Bates, S.O.; Farnsworth, R.K.; Nickelson, D.F.; Callow, R.A.; Slater, C.E. EG and G Idaho, Inc., Idaho Falls, ID (United States). Mar 1992. 38p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012368. Source: OSTI; NTIS; GPO Dep.

The purpose of this report is to present an overview conducted under the In Situ Vitrification (ISV) Project at the Idaho National Engineering Laboratory (INEL) during the 1991 Fiscal Year. The report will concentrate on describing the activities being conducted by the ISV project at the INEL and the advances made in this project at the INEL and the advances made in this project during FY 1991. Because detailed descriptions of the ISV process are available elsewhere (Arrenholz et al. 1990, Callow et al. 1991a), this discussion will not be repeated here.

222 (EGG-WTD-10035) Assessment of Incineration and melting treatment technologies for RWMC buried waste. Geimer, R. (Science Applications International Corp., Idaho Falls, ID (United States)); Hertzler, T.; Gillins, R.; Anderson, G.L. EG and G Idaho, Inc., Idaho Falls, ID (United States); Science Applications International Corp., Idaho Falls, ID (United States). Feb 1992. 109p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012522. Source: OSTI; NTIS; INIS; GPO Dep.

This report provides an identification, description, and ranking evaluation of the available thermal treatment technologies potentially capable of treating the Idaho National Engineering Laboratory Radioactive Waste Management Complex (RWMC) buried mixed waste. The ranking evaluation focused separately upon incinerators for treatment of combustible wastes and melters for noncombustible wastes. The highest rank incinerators are rotary kilns and controlled air furnaces, while the highest rank melters are the hearth configuration plasma torch, graphite electrode arc, and joule-heated melters. 4 refs.

223 (EGG-WTD-10092) Low-level and transuranic waste transportation, disposal, and facility decommissioning cost sensitivity analysis. Schlueter, R. (Bechtel National, Inc., San Francisco, CA (United States)); Schafer, J.J. EG and G Idaho, Inc., Idaho Falls, ID (United States). May 1992. 45p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92018036. Source: OSTI; NTIS; INIS; GPO Dep.

The Systems Design Study (SDS) identified technologies available for the remediation of low-level and transuranic waste stored at the Radioactive Waste Management Complex's Subsurface Disposal Area at the Idaho National Engineering Laboratory. The SDS study intentionally omitted the costs of transportation and disposal of the processed waste and the cost of decommissioning the processing facility. This report provides a follow-on analysis of the SDS to explore the basis for life-cycle cost segments of transportation, disposal, and facility decommissioning; to determine the sensitivity of the cost segments; and to quantify the life-cycle costs of the 10 ex situ concepts of the Systems Design Study.

224 (EGG-WTD-10129) Release model for in situ vitrification large-field test off-gas treatment system. Pafford, D.J.; Tung, V.X. EG and G Idaho, Inc., Idaho Falls, ID (United States). Mar 1992. 139p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012373. Source: OSTI; NTIS; GPO Dep.

A conceptual model for the vapor and aerosol transport and deposition in the in situ vitrification large-field test off-gas system (OGS) has been developed. This model can be used to predict the emissions from the OGS under normal and off-normal conditions. Results generated by the model can be used to evaluate design and/or procedural modifications, define tests, and predict results. The OGS vapor and aerosol transport and deposition is modeled using the PULSE/MOD-ISV/VER 1.0.0 developmental computer code. Input data requirements for this code include the specific geometries of the OGS components; the composition, rate, and temperature of the vapors and aerosols entering the OGS; and the OGS component surface temperatures or heat fluxes. Currently, not all of these model inputs are available. Therefore, conceptual input parameters are developed. Using this input data, preliminary calculations with the code have been performed. These calculations include a demonstration that the code predicts convergent results, a comparison of predicted results with performance data for one of the OGS components, and a preliminary sensitivity study of the complete model.

225 (EGG-WTD-10172) Predictions of PuO₂ and tracer compound release from ISV melts. Cronenberg, A.W. (Engineering Science and Analysis, Albuquerque, NM (United States)); Callow, R.A. EG and G Idaho, Inc., Idaho Falls, ID (United States). Apr 1992. 65p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92018050. Source: OSTI; NTIS; INIS; GPO Dep.

Two field tests were conducted at the Idaho National Engineering Laboratory (INEL) to assess in situ vitrification (ISV) suitability for long-term stabilization of buried radioactive waste. Both tests contained rare-earth oxide tracers (DY₂O₃, Yb₂O₃, and Tb₄O₇) to simulate the presence of plutonium in the form of PuO₂. In the first test, Intermediate Field Test (IFT)-1, approximately 4-% release of tracer material occurred during soil melting and associated off-gassing, while essentially nil release was observed for the second experiment (IFT-2) for which off-gassing was much reduced. This report presents an evaluation of the IFT test data in terms of governing release processes. Prediction of tracer release during ISV melting centered on an assessment of three potential transport mechanisms, (a) tracer diffusion through stagnant pool, (b) tracer transport by convective currents, and (c) tracer carry-off by escaping gas bubbles.

Analysis indicates that tracer release by escaping gas is the dominant release mechanism, which is consistent with video records of gas bubble escape from the ISV melt surface. Quantitative mass transport predictions were also made for the IFT-I test conditions, indicating similarity between the 4-% release data and calculational results at viscosities of $\approx 10^{-6}$ poise and tracer diffusivities of $\approx 10^{-6}$ CM²/s. Since PuO₂ has similar chemical and transport (diffusivity) properties as the rare-earth tracers used in the rare earth tracers used in the IFT experiments, release of PuO₂ is predicted for similar off-gassing conditions. Reduced off-gassing during ISV would thus be expected to improve the overall retention of heavy-oxides within vitrified soil.

226 (EGG-WTD-10194) Performance-Based Technology Selection Filter application report for Teledyne Wah Chang Albany Operable Unit Number One: INEL Buried Waste Integrated Demonstration. Richardson, J.G.; Morrison, J.L.; Morneau, R.A.; O'Brien, M.C.; Rudin, M.J. EG and G Idaho, Inc., Idaho Falls, ID (United States). May 1992. 63p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92017998. Source: OSTI; NTIS; INIS; GPO Dep.

This report summarizes the application of the Performance-Based Technology Selection Filter (PBTSE) developed for the Idaho National Laboratory's Buried Waste Integrated Demonstration Program as applied to remediation activities conducted at the Teledyne Wah Chang Albany (TWCA) Superfund Site, Operable Unit One. The remedial action at the TWCA Operable Unit One consisted of solidification, excavation, transportation, and monocell disposal of the contents of two sludge ponds contaminated with various inorganic and organic compounds. Inorganic compounds included low levels of uranium and radium isotopes, as well as zirconium, hafnium, chromium, mercury, and nickel. Organic compounds included methylene chloride, 1,1,1-trichloroethane, 1,1-dichloroethane, tetrachloroethane, and hexachlorobenzene. Remediation began in June 1991, and was completed in November 1991. The TWCA Operable Unit One configuration option consisted of 15 functional subelements. Data were gathered on these subelements and end-to-end system operation to calculate numerical values for 28 system performance measures. These were then used to calculate a system performance score. An assessment was made of the availability and definitional clarity of these performance measures, applicability of PBTSE utility functions, and rollup methodology. The PBTSE scoring function worked well, with few problems noted in data gathering, utility function normalization, and scoring calculation. The application of this process to an actual in situ treatment and excavation technical process option clarified the specific terms and bounds of the performance score functions, and identified one problem associated with the definition of system boundary.

227 (EGG-WTD-10204) INEL Operable Unit 7-13 Retrieval/Ex Situ Thermal Treatment configuration options: INEL Buried Waste Integrated Demonstration Systems Analysis project. Richardson, J.G.; Rudin, M.J.; O'Brien, M.C.; Morrison, J.L.; Raivo, B. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jul 1992. 215p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93001938. Source: OSTI; NTIS; INIS; GPO Dep.

The mission of the Buried Waste Integrated Demonstration (BWID) Systems Analysis project is to identify and evaluate cradle-to-grave systems for the remediation of Transuranic

(TRU) Contaminated Waste Pits and Trenches within the Subsurface Disposal Area (SDA) of the Radioactive Waste Management Complex (RWMC) at the Idaho National Engineering Laboratory (INEL). The BWID program will use the results of the BWID Systems Analysis in conjunction with identified Department of Energy (DOE) Complex buried waste needs to develop a long-term strategy for improving buried waste remediation capabilities throughout the DOE system. This report presents Buried Waste Retrieval/Ex Situ Thermal Treatment configuration option concepts in the form of block diagrams. These configuration options are: Retrieval/Melter Treatment; Retrieval/Metal Sort/Thermal Treatment; Retrieval/No Sort/Incineration/Melter Treatment; Retrieval/Interim Storage/Melter Treatment; Retrieval/Interim Storage/Metal Sort/Thermal Treatment; and Retrieval/Interim Storage/No Sort/Incineration/Melter Treatment. Each option is presented as a complete end-to-end system.

228 (EGG-WTD-10255) Electrostatic curtain studies. Meyer, L.C. EG and G Idaho, Inc., Idaho Falls, ID (United States). May 1992. 56p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92017996. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents the results of experiments using electrostatic curtains (ESCS) as a transuranic (TRU) contamination control technique. The TRU contaminants included small (micrometer to sub micrometer) particles of plutonium and americium compounds associated with defense-related waste. Three series of experiments were conducted. The first was with uncontaminated Idaho National Engineering Laboratory (INEL) soil, the second used contaminated soil containing plutonium-239 (from a mixture of Rocky Flats Plant contaminated soil and INEL uncontaminated soil), and the third was uncontaminated INEL soil spiked with plutonium-239. All experiments with contaminated soil were conducted inside a glove box containing a dust generator, low volume cascade impactor (LVCI), electrostatic separator, and electrostatic materials. The data for these experiments consisted of the mass of dust collected on the various material coupons, plates, and filters; radiochemical analysis of selected samples; and photographs, as well as computer printouts giving particle size distributions and dimensions from the scanning electron microscope (SEM). The following results were found: (a) plutonium content (pCi/g) was found to increase with smaller soil particle sizes and (b) the electrostatic field had a stronger influence on smaller particle sizes compared to larger particle sizes. The SEM analysis indicated that the particle size of the tracer Pu239 used in the spiked soil experiments was below the detectable size limit (0.5 μ m) of the SEM and, thus, may not be representative of plutonium particles found in defense-related waste. The use of radiochemical analysis indicated that plutonium could be found on separator plates of both polarities, as well as passing through the electric field and collecting on LVCI filters.

229 (EGG-WTD-10325) ISV technology development plan for buried waste. Nickelson, D.F. (EG and G Idaho, Inc., Idaho Falls, ID (United States)); Callow, R.A.; Luey, J.K. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jul 1992. 81p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92019687. Source: OSTI; NTIS; INIS; GPO Dep.

This report identifies the main technical issues facing the in situ vitrification (ISV) application to buried waste, and

presents a plan showing the top-level schedule and projected resources needed to develop and demonstrate the technology for meeting Environmental Restoration Department (ERD) needs. The plan also proposes a model strategy for the technology transfer from the Department of Energy's Office of Technology Development (DOE-OTD) to the Office of Environmental Restoration (DOE-ER) as the technology proceeds from issues resolution (development) to demonstration and remedial readiness. Implementation of the plan would require \$34,911K in total funding to be spread in the years FY-93 through FY-98. Of this amount, \$10,183K is planned to be funded by DOE-OTD through the ISV Integrated Program. The remaining amount, \$24,728K, is recommended to be split between the Department of Energy (DOE) Office of Technology Development (\$6,670K) and DOE Office of Environmental Restoration (\$18,058K).

230 (EGG-WTD-10354) Fugitive dust control experiments using soil fixatives on vehicle traffic surfaces. Winberg, M.R.; Wixom, V.E. EG and G Idaho, Inc., Idaho Falls, ID (United States). Aug 1992. 32p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93001939. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents the results of engineering scale dust control experiments using soil fixative for contamination control during handling of transuranic waste. These experiments focused on controlling dust during retrieval operations of buried waste where waste and soil are intimately mixed. Sources of dust generation during retrieval operations include digging, dumping, and vehicle traffic. Because contaminants are expected to attach to soil particles and move with the generated dust, control of the dust spread may be the key to contamination control. Dust control techniques examined in these experiments include the use of soil fixatives to control generation of fugitive dusts during vehicle traffic operations. Previous experiments conducted in FY 1990 included testing of the soil fixative, ENTAC. These experiments showed that ENTAC was effective in controlling dust generation but had several undesirable properties such as slow cure times and clogged the pumps and application nozzles. Therefore, other products would have to be evaluated to find a suitable candidate. As a result, two soil fixatives were tested in these present experiments, COHEREX-PM, an asphalt emulsion product manufactured by Witco Corporation and FLAMBINDER, a calcium lignosulfonate product manufactured by Flambeau Corporation. The results of the experiments include product performance and recommended application methods for application in a field deployable contamination control unit to be built in FY 1993.

231 (EGG-WTD-10360) Fugitive dust control experiments using directed airflow in dumping operations. Winberg, M.R.; Menkhous, D.E.; Thompson, D.N.; Wixom, V.E. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jul 1992. 41p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92019690. Source: OSTI; NTIS; INIS; GPO Dep.

Experiments were conducted to evaluate the degree of dust control for using directed airflow in a funnel during dumping operations. Retrieved buried transuranic waste or overburden soils are expected to require focusing the retrieved material into a transporter box with a funnel and control of transuranic-contaminated dust at the funnel is mandatory. In these experiments, the Idaho National Engineering Laboratory soil was dumped into a full-scale funnel (capable of focusing waste into a 4 x 4 x 8 ft box) that was

specially equipped with a directed airflow into the funnel. The degree of dust control was determined by comparing collected dust on filters in high volume samplers (strategically located) for a baseline case with no airflow to cases with airflow. Tests involving airflow into the funnel spanned a range of airflows at the opening between 15-100 linear feet per minute. The basic result is that the directed airflow concept is adequate to control dust spread during dumping.

232 (EGG-WTD-10386) INEL support to the plutonium in soil integrated demonstration (Nevada): Interim report. Weidner, J.R. EG and G Idaho, Inc., Idaho Falls, ID (United States). Sep 1992. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93005260. Source: OSTI; NTIS; GPO Dep.

A grab sample of 14 metric tons of uncontaminated Idaho National Engineering Laboratory (INEL) soil was excavated, packaged, and shipped to the Nevada Test Site for soil separation testing. The grab sample was from the Lost River Settling Area-B, located north-663541.06, east-262153.12, and elevation-5013.83 ft. The sample material contained soil and unconsolidated sediments from the ground surface to approximately 3.3-m deep. The material was collected in exactly the same way and from exactly the same place as material used to landscape and backfill the Radioactive Waste Management Complex at the INEL. Qualitative observations, using polarizing light microscopy, indicated that the principal components of the material are quartz, plagioclase, and calcite. Iron oxide material was present as a coating on most sediment particles. Clay minerals were not observed but are probably present. The diameter of most of the particles was between 10 and 75 gm. Field observations indicated that the calcite was a cement and occurred in vertical trending veins in the unconsolidated sediments.

233 (EGG-WTD-10397) Final report for the cryogenic retrieval demonstration. Valentich, D.J.; Yokuda, E.L. EG and G Idaho, Inc., Idaho Falls, ID (United States). Sep 1992. 221p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93005202. Source: OSTI; NTIS; INIS; GPO Dep.

This report documents a demonstration of a proposed buried transuranic waste retrieval concept that uses cryogenic ground freezing and remote excavation. At the Idaho National Engineering Laboratory (INEL), there are over 8 million ft³ of intermingled soil and transuranic (TRU) wastes in shallow land burial, and retrieval of the material is one of the options being considered by the Buried Waste Integrated Demonstration for the Environmental Restoration program. Cryogenically freezing contaminated soil and buried waste has been proposed as a way to greatly reduce or eliminate the climate threat of contamination spread during retrieval activities. In support of this idea, a demonstration of an innovative ground freezing and retrieval technology was performed at the INEL. This initial demonstration was held near the Radioactive Waste Management Complex at a "cold test pit" that was built in 1988 as a test bed for the demonstration of retrieval contamination control technologies. This pit is not contaminated with any radioactive or hazardous wastes. Barrels and boxes filled with metals, plastics, tools, paper, cloth, etc. configured in the same manner as expected in contaminated pits and trenches are buried at the cold test pit. After design, fabrication, and shop testing, Sonsub mobilized to the field in early July 1992 to perform the field demonstration. It was planned to freeze

and extract four pits, each $9 \times 9 \times 10$ ft. Each pit represented a different configuration of buried waste (stacked boxes, stacked barrels, random dumped barrels and boxes, and random dumped barrels). Sonsub's proposed technology consisted of driving a series of freeze pipes into the soil and waste, using liquid nitrogen to freeze the mass, and extracting the soil and debris using a series of remote operated, bridge crane mounted tools. In conjunction with the freezing and removal activities, temperature and moisture measurements, and air monitoring were performed.

234 (EGG-WTD-10429) Remediation of TRU-contaminated soil by aqueous phase leaching and coprecipitation. Lee, Jae-Ho; Martins, G.P.; Weidner, J.R. Colorado School of Mines, Golden, CO (United States). Dept. of Metallurgical and Materials Engineering. Sep 1992. 36p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93005261. Source: OSTI; NTIS; GPO Dep.

Chemical leaching studies were carried out on transuranic (TRU) waste contaminated (≈ 882 pCi/gm) soil samples that were collected near the 903 Pad at the Rocky Flats Plant, Colorado. The studies for this report were conducted in the research facilities of the Department of Metallurgical and Material Engineering, Colorado School of Mines.

235 (EGG-WTD-10450) Preconceptual design for the electrostatic enclosure. Meyer, L.C. EG and G Idaho, Inc., Idaho Falls, ID (United States). Sep 1992. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93005233. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents a preconceptual design (design criteria and assumptions) for electrostatic enclosures to be used during buried transuranic waste recovery operations. These electrostatic enclosures (along with the application of dust control products) will provide an in-depth contamination control strategy. As part of this preconceptual design, options for electrostatic curtain design are given including both hardwall and fabric enclosures. Ventilation systems, doors, air locks, electrostatic curtains, and supporting systems also are discussed. In addition to the conceptual design, engineering scale tests are proposed to be run at the Test Reactor Area. The planned engineering scale tests will give final material specifications for full-scale retrieval demonstrations.

236 (EGG-WTD-10539) Buried Waste Integrated Demonstration FY-93 Deployment Plan. Bonnenberg, R.W.; Heard, R.E.; Milam, L.M.; Watson, L.R. EG and G Idaho, Inc., Idaho Falls, ID (United States). Feb 1993. 68p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93012167. Source: OSTI; NTIS; INIS; GPO Dep.

The Buried Waste Integrated Demonstration (BWID) is a program funded by the US Department of Energy Office of Technology Development. BWID supports the applied research, development, demonstration, and evaluation of a suite of advanced technologies that together form a comprehensive remediation system for the effective and efficient remediation of buried waste. The fiscal year 1993 effort will deploy seven major field demonstrations at the Idaho National Engineering Laboratory's (INEL's) Radioactive Waste Management Complex Cold Test Pit. These major demonstrations are Remote Characterization System, Remote Excavation System, Overburden Removal, Waste Isolation, Contamination Control Unit, Rapid Monitoring Unit, and Fixation of Soil Surface Contamination. This document is the

basic operational planning document for BWID deployment of the INEL field demonstrations. Additional sections deal briefly with four nonINEL field and laboratory demonstrations (Buried Waste Retrieval, Arc Melter Vitrification, Graphite DC Plasma Arc Melter, and Fixed Hearth Plasma Process) and with four INEL laboratory demonstrations (Electrostatic Curtain, Thermal Kinetics, Multiaxis Crane Control System, and Dig-Face Characterization).

237 (EGG-WTD-10610) Buried Waste Integrated Demonstration Strategy Plan. Kostelnik, K.M. EG and G Idaho, Inc., Idaho Falls, ID (United States). Feb 1993. 48p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93012188. Source: OSTI; NTIS; INIS; GPO Dep.

The Buried Waste Integrated Demonstration (BWID) supports the applied research, development, demonstration, and evaluation of a suite of advanced technologies that form a comprehensive remediation system for the effective and efficient remediation of buried waste. These efforts are identified and coordinated in support of the US Department of Energy (DOE), Environmental Restoration and Waste Management (ERWM) needs and objectives. The present focus of BWID is to support retrieval and ex situ treatment configuration options. Future activities will explore and support containment and stabilization efforts in addition to the retrieval/ex situ treatment options. Long and short term strategies of the BWID are provided. Processes for identifying technological needs, screening candidate technologies for BWID applicability, researching technical issues, field demonstrating technologies, evaluating demonstration results to determine each technology's threshold of capability, and commercializing successfully demonstrated technologies for implementation for environmental restoration also are presented in this report.

238 (EGG-WTD-10612) Buried waste Integrated demonstration fiscal year 1992 close-out report. Cannon, P.G.; Kostelnik, K.M.; Owens, K.J. EG and G Idaho, Inc., Idaho Falls, ID (United States). Feb 1993. 45p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93012182. Source: OSTI; NTIS; INIS; GPO Dep.

The mission of the Buried Waste Integrated Demonstration Program (BWID) is to support the development and demonstration of a suite of technologies that when integrated with commercially-available baseline technologies form a comprehensive remediation system for the effective and efficient remediation of buried waste disposed of throughout the US Department of Energy complex. To accomplish this mission of identifying technological solutions for remediation deficiencies, the Office of Technology Development initiated the BWID at the Idaho National Engineering Laboratory in fiscal year (FY)-91. This report summarizes the activities of the BWID Program during FY-92.

239 (EGG-WTD-10635) Test plan for engineering scale electrostatic enclosure demonstration. Meyer, L.C. EG and G Idaho, Inc., Idaho Falls, ID (United States). Feb 1993. 42p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93012183. Source: OSTI; NTIS; INIS; GPO Dep.

This test plan describes experimental details of an engineering-scale electrostatic enclosure demonstration to be performed at the Idaho National Engineering Laboratory in fiscal year (FY)-93. This demonstration will investigate, in the engineering scale, the feasibility of using electrostatic

enclosures and devices to control the spread of contaminants during transuranic waste handling operations. Test objectives, detailed experimental procedures, and data quality objectives necessary to perform the FY-93 experiments are included in this plan.

240 (EGG-WTD-10660) Definition and compositions of standard wastestreams for evaluation of Buried Waste Integrated Demonstration treatment technologies. Bates, S.O. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jun 1993. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94002841. Source: OSTI; NTIS; INIS; GPO Dep.

The Buried Waste Integrated Demonstration (BWID) Project was organized at the Idaho National Engineering Laboratory to support research, development, demonstration, testing, and evaluation of emerging technologies that offer promising solutions to remediation of buried waste. BWID will identify emerging technologies, screen them for applicability to the identified needs, select technologies for demonstration, and then evaluate the technologies based on prescribed performance objectives. The technical objective of the project is to establish solutions to Environmental Restoration and Waste Management's technological deficiencies and improve baseline remediation systems. This report establishes a set of standard wastestream compositions that will be used by BWID to evaluate the emerging technologies. Five wastestreams are proposed that use four types of waste and a nominal case that is a homogenized combination of the four wastes. The five wastestreams will provide data on the compositional extremes and indicate the technologies' effectiveness over the complete range of expected wastestream compositions.

241 (EGG-WTD-10716) Test Plan for the overburden removal demonstration. Rice, P. (EG and G Idaho, Inc., Idaho Falls, ID (United States)); Thompson, D.; Winberg, M.; Skaggs, J. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jun 1993. 73p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93018990. Source: OSTI; NTIS; INIS; GPO Dep.

The removal of soil overburdens from contaminated pits and trenches involves using equipment that will remove a small layer of soil from 3 to 6 in. at any time. As a layer of soil is removed, overburden characterization techniques perform surveys to a depth that exceeds each overburden removal layer to ensure that the removed soil will be free of contamination. It is generally expected that no contamination will be found in the soil overburden, which was brought in after the waste was put in place. It is anticipated that some containers in the waste zone have lost their integrity, and the waste leakage from those containers has migrated by gravity downward into the waste zone. To maintain a safe work environment, this method of overburden removal should allow safe preparation of a pit or trench for final remediation. To demonstrate the soil overburden techniques, the Buried Waste Integrated Demonstration Program has contracted vendor services to provide equipment and techniques demonstrating soil overburden removal technology. The demonstration will include tests that will evaluate equipment performance and techniques for removal of overburden soil, control of contamination spread, and dust control. To evaluate the performance of these techniques, air particulate samples, physical measurements of the excavation soil cuts, maneuverability measurements, and time versus volume (rate) of soil removal data will be collected

during removal operations. To provide a medium for sample evaluation, the overburden will be spiked at specific locations and depths with rare earth tracers. This test plan will describe the objectives of the demonstration, data quality objectives, methods to be used to operate the equipment and use the techniques in the test area, and methods to be used in collecting data during the demonstration.

242 (EGG-WTD-10717) Test plan for the field evaluation and demonstration of the Contamination Control Unit. Winberg, M.R.; Thompson, D.N. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jun 1993. 58p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93016636. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes test details of a full demonstration of the Contamination Control Unit (CCU). The CCU is a mobile trailer capable of employing the use of soil fixatives, dust suppression agents, misting, and vacuum systems. These systems can perform a large number of contamination control functions to support the Office of Waste Technology Development (OTD) Buried Waste Integrated Demonstration (BWID) projects, transuranic (TRU) waste retrieval operations, and emergency response for hazardous and radioactive materials incidents. The demonstration will include both performance testing at the North Holmes Laboratory Facility (NHLF) and field testing in conjunction with the Remote Excavation System Demonstration at the Cold Test Pit. The NHLF will test operational parameters using water only, and the field demonstration at the Cold Test Pit involves full scale operation of vacuum, fixant, misting, and dust suppression systems. Test objectives, detailed experimental procedures, and data quality objectives necessary to perform the field demonstration are included in this test plan.

243 (EGG-WTD-10719) Retrieval/ex situ thermal treatment scoring interaction report. Raivo, B.D.; Richardson, J.G. EG and G Idaho, Inc., Idaho Falls, ID (United States). Nov 1993. 91p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94008516. Source: OSTI; NTIS; GPO Dep.

A retrieval/ex situ thermal treatment technology process for the Idaho National Engineering Laboratory transuranic waste pits and trenches is present. A system performance score is calculated, and assumptions, requirements, and reference baseline technologies for all subelements are included.

244 (EGG-WTD-10744) Test plan for the retrieval demonstration. Valentich, D.J. (EG and G Idaho, Inc., Idaho Falls, ID (US)). EG and G Idaho, Inc., Idaho Falls, ID (United States); Caterpillar, Inc., Peoria, IL (United States); Martin Marietta Corp., Baltimore, MD (United States). May 1993. 57p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93016374. Source: OSTI; NTIS; INIS; GPO Dep.

This test plan describes a simulated buried waste retrieval demonstration that will be performed at the Caterpillar, Inc., Edwards Training Center located near Peoria, Illinois. The purpose of the demonstration is to determine the effectiveness of using readily available excavation equipment to retrieve, size, and handle various simulated waste forms that are similar in size, structure, and composition to those expected to be found in US Department of Energy contaminated waste pits and trenches. The objectives of this demonstration are to: meet and maintain daily production goals of 80 yd³/day; minimize spillage and dust generation

through careful and deliberate operations; document and evaluate methods for manipulating, sizing, and/or working around large objects; and document and evaluate requirements for operator augmentation and remote operation for hot test pit excavation operations. Four conditions comprising the range of environments to be evaluated include excavation of random material from below grade; stacked boxes and barrels from below grade; random materials from at grade; and stacked boxes and barrels from at grade. Results of the retrieval demonstration will reduce unknowns in the body of knowledge about retrieval equipment and procedural options for removal of buried transuranic (TRU) waste at the Idaho National Engineering Laboratory. It is anticipated that DOE will factor this information into a remedial investigation/feasibility plan leading to a final record of decision for disposition of buried TRU waste.

245 (EGG-WTD-10766) Test plan for dig-face characterization performance testing. Josten, N.E. EG and G Idaho, Inc., Idaho Falls, ID (United States). Sep 1993. 62p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94002861. Source: OSTI; NTIS; INIS; GPO Dep.

The dig-face characterization concept has been under development at the Idaho National Engineering Laboratory (INEL) since FY 1992 through the support of the Buried Waste Integrated Demonstration Program. A Dig-face Characterization System conducts continuous subsurface characterization simultaneously with retrieval of hazardous and radioactive waste from buried waste sites. The system deploys multiple sensors at the retrieval operation dig-face and collects data that provide a basis for detecting, locating, and identifying hazardous conditions before they are disturbed by the retrieval equipment. This test plan describes initial efforts to test the dig-face characterization concept at the INEL Cold Test Pit using a simplified prototype apparatus and off-the-shelf sensors. The Cold Test Pit is a simulated waste site containing hazardous and radioactive waste surrogates at known locations. Testing will be directed toward three generic characterization problems: metal detection, plume detection, and radioactive source detection. The prototype apparatus will gather data using magnetometers, a ground conductivity meter, a trace gas analyzer, and a gamma ray sensor during simulated retrieval of the surrogate waste materials. The data acquired by a dig-face characterization system are unique because of the high precision, high data density, and multiple viewpoints attainable through the dig-face deployment approach. The test plan establishes procedures for collecting and validating a representative dig-face characterization data set. Analysis of these data will focus on developing criteria for predicting the depth, location, composition, and other characteristics of the surrogate waste materials. If successful, this proof-of-concept exercise will provide a foundation for future development of a fully-operational system that is capable of operating on an actual waste site.

246 (EGG-WTD-10771) Digface characterization test plan (remote testing). Croft, K.; Hyde, R.; Allen, S. EG and G Idaho, Inc., Idaho Falls, ID (United States). Aug 1993. 121p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94002842. Source: OSTI; NTIS; INIS; GPO Dep.

The objective of the Digface Characterization (DFC) Remote Testing project is to remotely deploy a sensor head (Mini-Lab) across a digface to determine if it can characterize the contents below the surface. The purpose of this

project is to provide a robotics technology that allows removal of workers from hazards, increases speed of operations, and reduces life cycle costs compared to alternate methods and technologies. The Buried Waste Integrated Demonstration (BWID) is funding the demonstration, testing, and evaluation of DFC. This document describes the test plan for the DFC remote deployment demonstration for the BWID. The purposes of the test plan are to establish test parameters so that the demonstration results are deemed useful and usable and perform the demonstration in a safe manner and within all regulatory requirements.

247 (EGG-WTD-10784-Vol.1) Idaho National Engineering Laboratory waste area groups 1-7 and 10 Technology Logic Diagram: Volume 1. O'Brien, M.C.; Meservey, R.H.; Little, M.; Ferguson, J.S.; Gilmore, M.C. EG and G Idaho, Inc., Idaho Falls, ID (United States). Sep 1993. 87p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94008589. Source: OSTI; NTIS; INIS; GPO Dep.

The Technology Logic Diagram was developed to provide technical alternatives for environmental restoration projects at the Idaho National Engineering Laboratory. The diagram (three volumes) documents suggested solutions to the characterization, retrieval, and treatment phases of cleanup activities at contaminated sites within 8 of the laboratory's 10 waste area groups. Contaminated sites at the laboratory's Naval Reactor Facility and Argonne National Laboratory-West are not included in this diagram.

248 (EGG-WTD-10784-Vol.2) Idaho National Engineering Laboratory Waste Area Groups 1-7 and 10 Technology Logic Diagram: Volume 2. O'Brien, M.C.; Meservey, R.H.; Little, M.; Ferguson, J.S.; Gilmore, M.C. EG and G Idaho, Inc., Idaho Falls, ID (United States). Sep 1993. 574p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94008590. Source: OSTI; NTIS; INIS; GPO Dep.

The Idaho National Engineering Laboratory (INEL) Technology Logic Diagram (TLD) was developed to provide a decision support tool that relates Environmental Restoration (ER) and Waste Management (WM) problems at the INEL to potential technologies that can remediate these problems. The TLD identifies the research, development, demonstration, testing, and evaluation needed to develop these technologies to a state that allows technology transfer and application to an environmental restoration need. It is essential that follow-on engineering and system studies be conducted to build on the output of this project. These studies will begin by selecting the most promising technologies identified in this TLD and finding an optimum mix of technologies that will provide a socially acceptable balance between cost and risk to meet the site windows of opportunity. The TLD consists of three separate volumes: Volume I includes the purpose and scope of the TLD, a brief history of the INEL Waste Area Groups, and environmental problems they represent. A description of the TLD, definitions of terms, a description of the technology evaluation process, and a summary of each subelement, is presented. Volume II (this volume) describes the overall layout and development of the TLD in logic diagram format. This section addresses the environmental restoration of contaminated INEL sites. Specific INEL problem areas/contaminants are identified along with technology solutions, the status of the technologies, precise science and technology needs, and implementation requirements. Volume III provides the Technology Evaluation Data Sheets (TEDS) for Environmental Restoration and Waste

Management (EM) activities that are referenced by a TEDS codenumber in Volume II. Each of these sheets represents a single logic trace across the TLD. These sheets contain more detail than provided for technologies in Volume II.

249 (EGG-WTD-10784-Vol.3) Idaho National Engineering Laboratory Waste Area Groups 1-7 and 10 Technology Logic Diagram: Volume 3. O'Brien, M.C.; Meservey, R.H.; Little, M.; Ferguson, J.S.; Gilmore, M.C. EG and G Idaho, Inc., Idaho Falls, ID (United States). Sep 1993. 347p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94008591. Source: OSTI; NTIS; INIS; GPO Dep.

The Idaho National Engineering Laboratory (INEL) Technology Logic Diagram (TLD) was developed to provide a decision support tool that relates Environmental Restoration (ER) and Waste Management (WM) problems at the INEL to potential technologies that can remediate these problems. The TLD identifies the research, development, demonstration, testing, and evaluation needed to develop these technologies to a state that allows technology transfer and application to an environmental restoration need. It is essential that follow-on engineering and system studies be conducted to build on the output of this project. These studies will begin by selecting the most promising technologies identified in this TLD and finding an optimum mix of technologies that will provide a socially acceptable balance between cost and risk to meet the site windows of opportunity. The TLD consists of three separate volumes: Volume I includes the purpose and scope of the TLD, a brief history of the INEL Waste Area Groups, and environmental problems they represent. A description of the TLD, definitions of terms, a description of the technology evaluation process, and a summary of each subelement, is presented. Volume II describes the overall layout and development of the TLD in logic diagram format. This section addresses the environmental restoration of contaminated INEL sites. Volume III (this volume) provides the Technology Evaluation Data Sheets (TEDS) for Environmental Restoration and Waste Management (EM) activities that are reference by a TEDS code number in Volume II. Each of these sheets represents a single logic trace across the TLD. These sheets contain more detail than provided for technologies in Volume II. Data sheets are arranged alphanumerically by the TEDS code number in the upper right corner of each sheet.

250 (EGG-WTD-10812) Test plan for prototype dielectric permittivity sensor. Pfeifer, M.C. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jul 1993. 31p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94002838. Source: OSTI; NTIS; INIS; GPO Dep.

The digface characterization project funded by the Buried Waste Integrated Demonstration (BWID) is designed to test a new method of monitoring hazardous conditions during the remediation at waste sites. Often on a large scale, the exact cause of each anomaly is difficult to determine and ambiguities remain in the characterization of a site. The digface characterization concept is designed to alleviate some of this uncertainty by creating systems that monitor small volumes of soil and detect anomalous areas during remediation before they are encountered. The goal of the digface characterization demonstration is to detect changes in the physical properties from one volume to another and relate these changes in physical properties to changes in the level of contamination. Dielectric permittivity mapping is a method that might prove useful in digface characterization. In this

project, the role of a dielectric permittivity monitoring device is under investigation. This project addresses two issues: what are the optimal means of mapping dielectric permittivity contrasts and what types of targets can be detected using dielectric permittivity mapping.

251 (EGG-WTD-10813) Test plan for Digface Chemical and Radiation Assay System. Akers, D.W. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jul 1993. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94002881. Source: OSTI; NTIS; INIS; GPO Dep.

The Digface Chemical and Radiation Assay System (CRAS) Project will develop a sensor using Prompt Gamma Neutron Activation Analysis (PGNAA) that can detect the presence of hazardous chemicals and radioactive materials. The CRAS is being designed for in situ assay of closed drums and contaminated soils for gamma-ray emitting radionuclides and hazardous elements. The CRAS is based upon the use of ^{252}Cf PGNAA with a germanium gamma-ray spectrometer as the analyzer. Tasks being performed include determining detection limits for a number of hazardous chemicals and assessing matrix and transmission effects through soil. Initial analyses suggest that the technique is applicable to a number of hazardous materials such as trichloroethane and carbon tetrachloride.

252 (EGG-WTD-10878) Buried Waste Integrated Demonstration test objectives. Morrison, J.L.; Heard, R.E. EG and G Idaho, Inc., Idaho Falls, ID (United States). May 1993. 34p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94002845. Source: OSTI; NTIS; INIS; GPO Dep.

The mission of the Buried Waste Integrated Demonstration Program (BWID) is to support the development and demonstration of a suite of technologies that when integrated with commercially available baseline technologies form a comprehensive system for the effective and efficient remediation of buried waste throughout the US Department of Energy complex. To accomplish this mission of identifying technology solutions for remediation deficiencies, the Office of Technology Development initiated the BWID at the Idaho National Engineering Laboratory in fiscal year (FY) 1991. This document provides the test objectives against which the demonstrations will be tested during FY-93.

253 (EGG-WTD-10895) Full-scale retrieval of simulated buried transuranic waste. Valentich, D.J. (EG and G Idaho, Inc., Idaho Falls, ID (United States)). EG and G Idaho, Inc., Idaho Falls, ID (United States); Caterpillar, Inc., Peoria, IL (United States); Martin Marietta Corp., Baltimore, MD (United States). Sep 1993. 110p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94002847. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes the results of a field test conducted to determine the effectiveness of using conventional type construction equipment for the retrieval of buried transuranic (TRU) waste. A cold (nonhazardous and nonradioactive) test pit (1,100 yd³ volume) was constructed with boxes and drums filled with simulated waste materials, such as metal, plastic, wood, concrete, and sludge. Large objects, including truck beds, tanks, vaults, pipes, and beams, were also placed in the pit. These materials were intended to simulate the type of wastes found in TRU buried waste pits and trenches. A series of commercially available equipment items, such as excavators and tracked loaders outfitted with

different end effectors, were used to remove the simulated waste. Work was performed from both the abovegrade and belowgrade positions. During the demonstration, a number of observations, measurements, and analyses were performed to determine which equipment was the most effective in removing the waste. The retrieval rates for the various excavation techniques were recorded. The inherent dust control capabilities of the excavation methods used were observed. The feasibility of teleoperating reading equipment was also addressed.

254 (EGG-WTD-10931) End effectors and attachments for buried waste excavation equipment. King, R.H. EG and G Idaho, Inc., Idaho Falls, ID (United States). Sep 1993. 67p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94010777. Source: OSTI; NTIS; INIS; GPO Dep.

The Buried Waste Integrated Demonstration (BWID) supports the applied research, development, demonstration, and evaluation of a suite of advanced technologies that form a comprehensive remediation system for the effective and efficient remediation of buried waste. Their efforts are identified and coordinated in support of the U.S. Department of Energy (DOE), Environmental Restoration and Waste Management (ER&WM) Department's needs and objectives. The present focus of BWID is to support retrieval and ex-situ treatment configuration options. Future activities will explore and support containment, and stabilization efforts in addition to the retrieval/ex situ treatment options. This report presents a literature search on the state-of-the-art in end effectors and attachments in support of excavator of buried transuranic waste. Included in the report are excavator platforms and a discussion of the various attachments. Also included is it list of vendors and specifications.

255 (EGG-WTD-10988) Engineering scale electrostatic enclosure demonstration. Meyer, L.C. EG and G Idaho, Inc., Idaho Falls, ID (United States). Sep 1993. 49p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94010776. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents results from an engineering scale electrostatic enclosure demonstration test. The electrostatic enclosure is part of an overall in-depth contamination control strategy for transuranic (TRU) waste recovery operations. TRU contaminants include small particles of plutonium compounds associated with defense-related waste recovery operations. Demonstration test items consisted of an outer Perma-con enclosure, an inner tent enclosure, and a ventilation system test section for testing electrostatic curtain devices. Three interchangeable test fixtures that could remove plutonium from the contaminated dust were tested in the test section. These were an electret filter, a CRT as an electrostatic field source, and an electrically charged parallel plate separator. Enclosure materials tested included polyethylene, anti-static construction fabric, and stainless steel. The soil size distribution was determined using an eight stage cascade impactor. Photographs of particles containing plutonium were obtained with a scanning electron microscope (SEM). The SEM also provided a second method of getting the size distribution. The amount of plutonium removed from the aerosol by the electrostatic devices was determined by radiochemistry from input and output aerosol samplers. The inner and outer enclosures performed adequately for plutonium handling operations and could be used for full scale operations.

256 (ES/ER/TM-1/R2) Applicable or Relevant and Appropriate Requirements (ARARs) for Remedial Action at the Oak Ridge Reservation: A compendium of major environmental laws: Environmental Restoration Program. Etnier, E.L.; McDonald, E.P.; Houlberg, L.M. Oak Ridge National Lab., TN (United States). Jul 1993. 85p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400 ; AC05-76OR00001. Order Number DE93017754. Source: OSTI; NTIS; INIS; GPO Dep.

Section 121 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 specifies that remedial actions for cleanup of hazardous substances must comply with applicable or relevant and appropriate requirements (ARARS) or standards under federal and state environmental laws. The US Department of Energy (DOE) Oak Ridge Reservation (ORR) was placed on the National Priorities List by the US Environmental Protection Agency (EPA) on November 21, 1989, effective December 21, 1989. As a result of this listing, DOE, EPA, and the Tennessee Department of Environment and Conservation have signed a Federal Facility Agreement (FFA) for the environmental restoration of the ORR. Section XXI(F) of the FFA calls for the preparation of a draft listing of all ARARs as mandated by CERCLA §121. This report supplies a preliminary list of available federal and state ARARs that might be considered for remedial response at the ORR. A description of the terms "applicable" and "relevant and appropriate" is provided, as well as definitions of chemical, location-, and action-specific ARARS. ARARs promulgated by the federal government and by the state of Tennessee are listed in tables. In addition, the major provisions of the Resource Conservation and Recovery Act, the Safe Drinking Water Act, the Clean Water Act, the Clean Air and other acts, as they apply to hazardous waste cleanup, are discussed. In the absence of ARARS, CERCLA §121 provides for the use of nonpromulgated federal criteria, guidelines, and advisories in evaluating the human risk associated with remedial action alternatives. Such nonpromulgated standards are classified as "to-be-considered" (TBC) guidance. A list of available guidance is given; summary tables list the available federal standards and guidance information. In addition, the substantive contents of the DOE orders as they apply to remediation of radioactively contaminated sites are discussed as TBC guidance.

257 (ES/ER/TM-2) Remedial action measures. Swindle, D.W. Jr. Oak Ridge National Lab., TN (United States). Sep 1990. 29p. Sponsored by USDOE, Washington, DC (USA). DOE Contract AC05-84OR21400. Order Number DE91015059. Source: OSTI; NTIS; GPO Dep.

During the first decades of its existence, the Department of Energy (DOE) and its predecessor agencies created a legacy of waste management and disposal practices that, although meeting or exceeding accepted standards at the time, are no longer publicly, environmentally, or socially acceptable. These practices have been proven to have contaminated the air, soil, and groundwater, all of which are the essence of our environment. DOE is now engaged in an aggressive program, in cooperation with state and federal regulatory agencies and with public input, to remediate or restore the environment. The DOE Environmental Restoration Program is concerned with the assessment and cleanup of sites and facilities that are no longer a part of active operations. To accomplish this environmental restoration, remedial action measures will be employed to address and resolve this legacy. This paper provides some background

on how the environmental contamination occurred and describes the scope of DOE's environmental restoration challenge. The DOE generalized plan for remediation of its sites and facilities is also presented; this plan cites three measures for remediation: (1) no action; (2) containment; and (3) retrieval, treatment, storage, and disposal. In the summary, candidate remediation measures, the remediation process, and associated radiological assessment issues are described. 2 refs., 10 figs., 2 tabs.

258 (ES/ER/TM-4/R2) Environmental Restoration Quality Program Plan: Environmental Restoration Program. Colley, J.S. Oak Ridge National Lab., TN (United States). Aug 1992. 44p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92040849. Source: OSTI; NTIS; GPO Dep.

The Martin Marietta Energy Systems, Inc., Environmental Restoration (ER) Program was initially chartered on October 1, 1989, as a "central Environmental Restoration Division" to manage the investigation and remediation of inactive sites and facilities that have been declared surplus and have no further programmatic use. The Energy Systems ER Division was established to support the DOE Oak Ridge Field Office (DOE-OR) consolidated ER Program. The DOE-OR Assistant Manager for Environmental Restoration and Waste Management provides program and budget direction to the Energy Systems ER Program for environmental restoration activities at the sites operated by Energy Systems (Oak Ridge K-25 Site, Oak Ridge National Laboratory, Oak Ridge Y-12 Plant, Paducah Gaseous Diffusion Plant, Portsmouth Gaseous Diffusion Plant) and at the off-site locations. The Energy Systems ER Division is specifically charged with assessing these sites for potential contamination and managing the cleanup processes. The Energy Systems Environmental Restoration Division was chartered on October 1, 1989, as a central organization to manage the Remedial Action (RA) Program. The purpose of this document is to ensure that: senior ER management provides planning, organization, direction, control, and support to achieve the organization's objectives; the line organization achieves quality; and overall performance is reviewed and evaluated using a rigorous assessment process.

259 (ES/ER/TM-18) Methodology for generating waste volume estimates. Miller, J.Q.; Hale, T.; Miller, D. Oak Ridge National Lab., TN (United States). Sep 1991. 49p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92001785. Source: OSTI; NTIS; INIS; GPO Dep.

This document describes the methodology that will be used to calculate waste volume estimates for site characterization and remedial design/remedial action activities at each of the DOE Field Office, Oak Ridge (DOE-OR) facilities. This standardized methodology is designed to ensure consistency in waste estimating across the various sites and organizations that are involved in environmental restoration activities. The criteria and assumptions that are provided for generating these waste estimates will be implemented across all DOE-OR facilities and are subject to change based on comments received and actual waste volumes measured during future sampling and remediation activities. 7 figs., 8 tabs.

260 (ES/ER/TM-38) Approach and strategy for developing human health toxicity information for contaminants of concern at sites administered by the US

Department of Energy Oak Ridge Field Office, Environmental Restoration Program. Ross, R.H.; Redfearn, A.; White, R.K.; Shaw, R.A. Oak Ridge National Lab., TN (United States). Oct 1992. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93001933. Source: OSTI; NTIS; INIS; GPO Dep.

Toxicity assessment is an important part of the risk assessment effort presently under way at US Department of Energy Oak Ridge Field Office (DOE-OR) Environmental Restoration (ER) facilities. Four major tasks in the toxicity assessment process are (1) identification and prioritization of contaminants of concern at DOE-OR ER sites; (2) compilation and dissemination of toxicity values approved by the US Environmental Protection Agency for the contaminants of concern and identification of contaminants requiring toxicity value development (i.e., reference doses, reference concentrations, and slope factors); (3) development of toxicity summaries; and (4) development of toxicity values. Prioritization of chemicals was the first step because resources are limited and because the chemicals that pose the greatest risk of human exposure need immediate assessment. Identifying and disseminating the toxicity values for the chemicals of concern is also important because these toxicity values are the basis for determining whether environmental levels are of concern. It is very important that all parties conducting health risk assessment for DOE-OR ER sites have the most current toxicity values so that risk assessment will be consistent. The toxicity summaries for the chemicals of concern briefly summarize what is known concerning the toxicity of each chemical and present the information in a way that is useful for the risk assessor. After existing toxicity values are located and the toxicity summaries prepared, the chemicals that have sufficient information to derive missing toxicity values can be identified. Where toxicity values are missing and the information is deficient to derive the values by conventional means, predictive toxicology methods will be employed.

261 (ES/ER/TM-52) Technology needs for environmental restoration remedial action: Environmental Restoration Program. Watson, J.S. Oak Ridge National Lab., TN (United States). Nov 1992. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93005173. Source: OSTI; NTIS; INIS; GPO Dep.

This report summarizes the current view of the most important technology needs for the US Department of Energy (DOE) facilities operated by Martin Marietta Energy Systems, Inc. These facilities are the Oak Ridge National Laboratory, the Oak Ridge K-25 Site, the Oak Ridge Y-12 Plant, the Paducah Gaseous Diffusion Plant, and the Portsmouth Gaseous Diffusion Plant. The sources of information used in this assessment were a survey of selected representatives of the Environmental Restoration (ER) programs at each facility, results from a questionnaire distributed by Geotech CWM, Inc., for DOE, and associated discussions with individuals from each facility. This is not a final assessment, but a brief look at an ongoing assessment; the needs will change as the plans for restoration change and, it is hoped, as some technical problems are solved through successful development programs.

262 (ES/ER/TM-59) Environmental Restoration Program pollution prevention performance measures for FY 1993 and 1994 remedial investigations. Oak Ridge National Lab., TN (United States); Weston (Roy F.), Inc.,

Oak Ridge, TN (United States). Mar 1993. 42p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93010884. Source: OSTI; NTIS; INIS; GPO Dep.

The Martin Marietta Energy Systems, Inc., Environmental Restoration (ER) Program adopted a Pollution Prevention Program in March 1991. The program's mission is to minimize waste and prevent pollution in remedial investigations (RI), feasibility studies (FS), decontamination and decommissioning (D&D), and surveillance and maintenance (S&M) site program activities. Mission success will result in volume and/or toxicity reduction of generated waste. Energy Systems is producing a fully developed a Numerical Scoring System (NSS) and actually scoring the generators of Investigation Derived Waste (IDW) at six ER sites: Oak Ridge National Laboratory (ORNL), the Oak Ridge Y-12 Plant, the Oak Ridge K-25 site, Paducah Gaseous Diffusion Plant (Paducah), and Portsmouth Uranium Enrichment Complex (Portsmouth). This report summarizes the findings of this initial numerical scoring evaluation and shows where improvements in the overall ER Pollution prevention program may be required. This report identifies a number of recommendations that, if implemented, would help to improve site-performance measures. The continued development of the NSS will support generators in maximizing their Pollution Prevention/Waste Minimization efforts. Further refinements of the NSS, as applicable suggest comments and/or recommendations for improvement.

263 (ES/ER/TM-60) Environmental Restoration Program pollution prevention performance measures for FY 1993 and 1994 remedial investigations: Generator training manual. Oak Ridge National Lab., TN (United States); Weston (Roy F.), Inc., Oak Ridge, TN (United States). Mar 1993. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93010559. Source: OSTI; NTIS; INIS; GPO Dep.

This computer-based program is designed to help waste generators in the Environmental Restoration (ER) Program prevent pollution at the DOE Oak Ridge Field Office (DOE-OR) facilities in Oak Ridge, Paducah, and Portsmouth. The Numerical Scoring System (NSS) is an interactive system designed to maintain data on ER Program pollution prevention efforts and to measure the success of these efforts through the ER Program life cycle.

264 (ES/ER/TM-61) Environmental Restoration Program pollution prevention performance measures for FY 1993 and 1994 remedial investigations: Management training manual. Oak Ridge National Lab., TN (United States); Weston (Roy F.), Inc., Oak Ridge, TN (United States). Mar 1993. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400 ; AC05-76OR00001. Order Number DE93010833. Source: OSTI; NTIS; INIS; GPO Dep.

This computer-based program is designed to help waste generators in the Environmental Restoration (ER) Program prevent pollution at the DOE Oak Ridge Field Office (DOE-OR) facilities in Oak Ridge, Paducah, and Portsmouth. The Numerical Scoring System (NSS) is an interactive system designed to maintain data on ER Program pollution prevention efforts and to measure the success of these efforts through the ER Program life cycle.

265 (ES/ER/TM-75) Validation procedures used in the Background Soil Characterization Project on the

Oak Ridge Reservation, Oak Ridge, Tennessee: Environmental Restoration Program. Oak Ridge National Lab., TN (United States). Dec 1993. 178p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94006375. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this report is (1) to document the data validation process developed for the Background Soil Characterization Project (BSCP); (2) to offer members of other project teams and potential data users the benefit of the experience gained in the BSCP in the area of developing project-specific data validation criteria and procedures based on best available guidance and technical information; and (3) to provide input and guidance to the efforts under way within Martin Marietta Energy Systems, Inc., to develop standard operating procedures to streamline and optimize the analytical laboratory data validation process for general use by making it more technically rigorous, consistent, and cost effective. Lessons learned from the BSCP are also provided to meet this end (Sect. 1.3).

266 (ES/ER/TM-89) Environmental Restoration Program pollution prevention checklist guide for the feasibility study project phase. Martin Marietta Energy Systems, Inc., Oak Ridge, TN (United States). Sep 1993. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400 ; AC05-76OR00001. Order Number DE94001033. Source: OSTI; NTIS; INIS; GPO Dep.

Feasibility studies (FS) determine what remedial alternatives are presented to regulators for site cleanup. A key consideration in this process is the waste to be generated. Minimizing the volume and toxicity of this waste will ultimately contribute to the selection of the best remedial option. The purpose of this checklist guide is to assist the user in incorporating pollution prevention/waste minimization (PP/WM) in all FS phase projects of the Environmental Restoration (ER) Program. This guide will help users document PP/WM activities for technology transfer and reporting requirements. Automated computer screens will be created from the checklist data to assist users with implementing and evaluating waste reduction. Users can then establish numerical performance measures to measure progress in planning, training, self-assessments, field implementation, documentation, and technology transfer. Cost savings result as users train and assess themselves and perform preliminary waste assessments.

267 (ES/ER/TM-90) Environmental Restoration Program pollution prevention checklist guide for the surveillance and maintenance project phase. Martin Marietta Energy Systems, Inc., Oak Ridge, TN (United States). Sep 1993. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94001032. Source: OSTI; NTIS; INIS; GPO Dep.

DOE Order 5820.2 mandates that a surveillance and maintenance program be established in all shut-down facilities to ensure adequate containment of contamination, provide physical safety and security, and reduce potential public and environmental hazards. A key consideration in this process is the prevention of any waste to be generated from these activities. The purpose of this checklist guide is to assist the user with incorporating pollution prevention/waste minimization (PP/WM) in all Surveillance and Maintenance (S&M) phase projects of the Environmental Restoration (ER) Program. This guide will help users document their PP/WM activities for technology transfer and

reporting requirements. Automated computer screens will be created from the checklist data to assist users with implementing and evaluating waste reduction. Users can then establish numerical performance measures to measure progress in planning, training, self-assessments, field implementation, documentation, and technology transfer. Cost savings result as users train and assess themselves and perform preliminary waste assessments.

268 (ES/ER/TM-92) Environmental restoration program pollution prevention checklist guide for the evaluation of alternatives project phase. Oak Ridge National Lab., TN (United States). Sep 1993. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94001035. Source: OSTI; NTIS; INIS; GPO Dep.

Evaluation of alternative studies determine what decontamination and decommissioning (D&D) alternatives are presented to regulators for facility and site cleanup. A key consideration in this process is the waste to be generated. Minimizing the volume and toxicity of this waste will ultimately contribute to the selection of the best clean-up option. The purpose of this checklist guide is to assist the user with incorporating pollution prevention/waste minimization (PP/WM) in all Evaluation of Alternatives (EV) phase projects of the Environmental Restoration (ER) Program. This guide will assist users with documenting PP/WM activities for technology transfer and reporting requirements. Automated computer screens will be created from the checklist data to help users implement and evaluate waste reduction. Users can then establish numerical performance measures to measure progress in planning, training, self-assessments, field implementation, documentation, and technology transfer. Cost savings result as users train and assess themselves, eliminating expensive process waste assessments and audit teams.

269 (ES/ER/TM-102) Waste Generation Forecast for DOE-ORO's Environmental Restoration OR-1 Project: FY 1994-FY 2001: Environmental Restoration Program, September 1993 Revision. Martin Marietta Energy Systems, Inc., Oak Ridge, TN (United States). Dec 1993. 102p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94006323. Source: OSTI; NTIS; INIS; GPO Dep.

This Waste Generation Forecast for DOE-ORO's Environmental Restoration OR-1 Project. FY 1994-FY 2001 is the third in a series of documents that report current estimates of the waste volumes expected to be generated as a result of Environmental Restoration activities at Department of Energy, Oak Ridge Operations Office (DOE-ORO), sites. Considered in the scope of this document are volumes of waste expected to be generated as a result of remedial action and decontamination and decommissioning activities taking place at these sites. Sites contributing to the total estimates make up the DOE-ORO Environmental Restoration OR-1 Project: the Oak Ridge K-25 Site, the Oak Ridge National Laboratory, the Y-12 Plant, the Paducah Gaseous Diffusion Plant, the Portsmouth Gaseous Diffusion Plant, and the off-site contaminated areas adjacent to the Oak Ridge facilities (collectively referred to as the Oak Ridge Reservation Off-Site area). Estimates are available for the entire life of all waste generating activities. This document summarizes waste estimates forecasted for the 8-year period of FY 1994-FY 2001. Updates with varying degrees of change are expected throughout the refinement of restoration strategies currently in progress at each of the sites. Waste forecast

data are relatively fluid, and this document represents remediation plans only as reported through September 1993.

270 (FEMP-2248) Integrating innovative technology into remedial action at a US Department of Energy facility. Diggs, I.W. Westinghouse Environmental Management Co. of Ohio, Cincinnati, OH (United States). Fernald Environmental Management Project. 11 May 1992. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-86OR21600. (CONF-920658-3: Eco-world exhibition and conference on ecology, economics and engineering, Washington, DC (United States), 14-17 Jun 1992). Order Number DE92014913. Source: OSTI; NTIS; INIS; GPO Dep.

The US Atomic Energy Commission (AEC), predecessor to the US Department Energy (DOE), established a production complex in the early 1950's for processing uranium and its compounds from natural uranium ore concentrates for the purpose of producing high purity uranium metal for various uses in defense reactor and nuclear weapons programs. This complex, previously known as the Feed Materials Production Center (FMPC), is now known as the Fernald Environmental Management Project (FEMP). In 1989, production was stopped at the feed materials facility due to a decision by the DOE. In December of 1989, the site was placed on the US EPA's National Priorities List (NPL) of sites requiring environmental cleanup. As a result, in April of 1990 the DOE and the US EPA signed a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Consent Agreement which augmented the FFCA. The DOE recently decided that production at the facility would not be resumed, and therefore, the main scope of work would change to remediation and closure of the site. In response to the FFCA and consistent with the modifications agreed to in the amended Consent Agreement, a Remedial Investigation/Feasibility Study (RI/FS) is in progress pursuant to CERCLA, as amended by the Superfund Amendments and Reauthorization Act (SARA). A RI/FS is a comprehensive environmental investigation systematically conducted according to US EPA regulations and guidelines used to identify and select an action plan for the cleanup of CERCLA sites. The RI phase incorporates a broad-based study to evaluate as completely as possible existing environmental and public health risks associated with past or existing facility operations. The FS phase develops and evaluates corrective action alternatives to mitigate identified environmental concerns.

271 (FEMP-2266) Uranium in soils integrated demonstration: 1992 update. Nuhfer, K.R. Westinghouse Environmental Management Co. of Ohio, Cincinnati, OH (United States). Fernald Environmental Management Project. Apr 1992. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-86OR21600. (CONF-920851-13: Spectrum '92: nuclear and hazardous waste management international topical meeting, Boise, ID (United States), 23-27 Aug 1992). Order Number DE92014256. Source: OSTI; NTIS; INIS; GPO Dep.

The Uranium in Soils Integrated Demonstration (ID) was initiated in 1991. The Fernald Environmental Management Project (FEMP), previously known as the Feed Materials Production Center (FMPC), was selected as the host site for the Uranium in Soils ID. The principle focus in 1991 was to establish the management structure and objectives for the ID. In 1992 the technical activities in support of the ID goals were initiated. The emphasis this year has been on the development and demonstration of improved field screening

technologies, obtaining chemical and physical data on the uranium waste forms in the host site soils, and initiating the development of uranium/soil separation technologies. This document will discuss the established TSG charters, accomplishments to date, current activities and future activities in support of the 1992 emphasis and the long term goals of the ID.

272 (FEMP-2305) The role of Materials Control and Accountability (MC&A) in remediation of a DOE facility. Dunaway, D.L. Fernald Environmental Restoration Management Corp., Cincinnati, OH (United States). Oct 1993. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-92OR21972. (CONF-9310210-1: Institute of Nuclear Materials Management annual meeting, Oak Ridge, TN (United States), 28-29 Oct 1993). Order Number DE94002548. Source: OSTI; NTIS; INIS; GPO Dep.

Short communication. FEED MATERIALS PRODUCTION CENTER/radioactive waste management; FEED MATERIALS PRODUCTION CENTER/remedial action; SOILS/remedial action; GROUND WATER/remedial action; SOILS; NUCLEAR MATERIALS MANAGEMENT; LOW-LEVEL RADIOACTIVE WASTES

273 (FEMP-2312) Soils and groundwater cleanup at Fernald: A status update on Operable Unit No. 5. Yerca, P.J. (Westinghouse Environmental Management Co. of Ohio, Cincinnati, OH (United States). Fernald Environmental Management Project); Bomberger, A.K.; Brettschneider, D.J. Westinghouse Environmental Management Co. of Ohio, Cincinnati, OH (United States). Fernald Environmental Management Project. [1993]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-92OR21972. (CONF-931095-50: Department of Energy environmental remediation conference, Augusta, GA (United States), 24-28 Oct 1993). Order Number DE94002552. Source: OSTI; NTIS; GPO Dep.

This report discusses a status update on the cleanup operations at FERNALD. Discussed is the regulatory framework for FERNALD cleanup; overview of the FERNALD site; description of operable unit 5; remedial investigation; pattern of contamination; feasibility studies; and tangible progress to date.

274 (FEMP-93010810) Technology needs study: Fernald Environmental Management Project. Westinghouse Environmental Management Co. of Ohio, Cincinnati, OH (United States). Fernald Environmental Management Project. Sep 1992. 260p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-86OR21600. Order Number DE93010810. Source: OSTI; NTIS; INIS; GPO Dep.

The Fernald Environmental Management Project (FEMP), formerly known as the Feed Materials Production Center and located approximately 20 miles northwest of Cincinnati, Ohio, was shut down in 1989 after producing uranium products since 1953. In October 1990, the site was transferred from DOE's Office of Defense Programs (DP) to the Office of Environmental Restoration and Waste Management (EM). Currently, EM is planning and conducting environmental remediation at the site. Uranium in metallic or chemical form is present in groundwater, soils, disposal pits, storage silos, and production facilities. Remediation involves using physical and chemical methods to accumulate uranium and its associated decay products and to prepare them for disposal. Observations and recommendations in this study were made for FEMP, EM-40, and EM-50 activities.

275 (FEMP/SUB-064) Sitewide soil and debris management program for a DOE site under remediation. Harvey, B.F. (Parsons Environmental Services, Inc., Fairfield, OH (United States)). Fernald Environmental Restoration Management Corp., Cincinnati, OH (United States). Fernald Environmental Management Project; Parsons Environmental Services, Inc., Fairfield, OH (United States). [1993]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-92OR21972. (CONF-931095-45: Department of Energy environmental remediation conference, Augusta, GA (United States), 24-28 Oct 1993). Order Number DE94002557. Source: OSTI; NTIS; INIS; GPO Dep.

In 1986, the United States Department of Energy (DOE) and the United States Environmental Protection Agency (US EPA) entered into a Federal Facility Compliance Agreement (FFCA). The agreement included provisions to investigate and define the nature and extent of contamination and to determine the necessity for remediation at the Fernald Environmental Management Project (FEMP) near Cincinnati, Ohio. The agreement is also pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Uranium enrichment production activities at the facility ceased in 1989. The FEMP mission is now environmental clean-up and remediation under the management of the Fernald Environmental Restoration Management Corporation. This report describes objectives and activities of remediation efforts at FEMP.

276 (FEMP/SUB-068) Proceedings of the workshop on transite decontamination dismantlement and recycle/disposal. Fernald Environmental Restoration Management Corp., Cincinnati, OH (United States); Cincinnati Univ., OH (United States). Coll. of Engineering. [1993]. 45p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-92OR21972. (CONF-9302160-: Workshop on issues at the Fernald Environmental Management project, Cincinnati, OH (United States), 3-4 Feb 1993). Order Number DE94005364. Source: OSTI; NTIS; INIS; GPO Dep.

On February 3-4, 1993, a workshop was conducted to examine issues associated with the decontamination, dismantlement, and recycle/disposal of transite located at the US Department of Energy Fernald site near Cincinnati, OH. The Fernald Environmental Management Project (FEMP) is a Superfund Site currently undergoing remediation. A major objective of the workshop was to assess the state-of-the-art of transite remediation, and generate concepts that could be useful to the Fernald Environmental Restoration Management Co. (FERMCO) for remediation of transite. Transite is a building material consisting of asbestos fiber and cement and may be radioactively contaminated as a result of past uranium processing operations at the FEMP. Many of the 100 buildings within the former uranium production area were constructed of transite siding and roofing and consequently, over 180,000 m² of transite must be disposed or recycled. Thirty-six participants representing industry, academia, and government institutions such as the EPA and DOE assembled at the workshop to present their experience with transite, describe work in progress, and address the issues involved in remediating transite.

277 (IS-M-709) Laser decontamination: A new strategy for facility decommissioning. Pang, H.M.; Lipert, R.J.; Hamrick, Y.M.; Bayrakal, S.; Gaul, K.; Davis, B.; Baldwin, D.P.; Edelson, M.C. Ames Lab., IA (United States). [1992]. 7p. Sponsored by USDOE, Washington, DC (United

States). DOE Contract W-7405-ENG-82. (CONF-920851-12: Spectrum '92: nuclear and hazardous waste management international topical meeting, Boise, ID (United States), 23-27 Aug 1992). Order Number DE92014113. Source: OSTI; NTIS; INIS; GPO Dep.

Lasers can be employed to remove both surface and bulk contamination from metals. Experiments demonstrate that $\sim 5\mu\text{m}$ can be removed from an Al surface by one powerful laser pulse. Focusing with cylindrical lenses is shown to result in good surface coverage and reduced surface redeposition. High-resolution laser spectroscopy in a small atomic beam device is demonstrated and discussions of bulk decontamination by AVLIS-like methods are described. A plan for estimating the cost-effectiveness of laser decontamination technology is discussed.

278 (IS-M-730) Macroscopic surface cleaning using a high repetition rate ultraviolet laser. Pang, H.M.; Baldwin, D.; Edelson, M.C. Ames Lab., IA (United States). [1992]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-82. (CONF-921142-1: Society of Photo-Optical Instrumentation Engineers (SPIE) meeting, Boston, MA (United States), 15-20 Nov 1992). Order Number DE93002545. Source: OSTI; NTIS; INIS; GPO Dep.

The aim of the Ames Laboratory Laser Decontamination Project is to explore new decontamination methods to reduce waste volumes and achieve sufficiently high decontamination factors to permit the unrestricted release of metals for commercial use. This paper presents a discussion of recent experimental work designed to test the capabilities of ultraviolet lasers for large surface area ($\sim \text{m}^2$) cleaning. The potential benefits of applying laser technology to decontamination are the elimination of solvents, the potential for remote operation to reduce exposure of personnel and expensive equipment to radiation hazards, and the minimization of secondary wastes. High-repetition rate lasers can clean large surfaces ($\sim 1 \text{ m}^2$) in a reasonable amount of time. Proper selection of laser pulse energy, wavelength, repetition rate, and focusing lens is mandated to optimize process efficiency.

279 (IS-M-774) Chemical gas sensors and the characterization, monitoring and sensor technology needs of the US Department of Energy. Bastiaans, G.J.; Haas, W.J. Jr.; Junk, G.A. Ames Lab., IA (United States). [1993]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-82. (CONF-9309247-3: National Institute of Standards and Technology (NIST) workshop on gas sensors, Gaithersburg, MD (United States), 8-9 Sep 1993). Order Number DE94001805. Source: OSTI; NTIS; INIS; GPO Dep.

The Office of Technology Development within the Dept. of Energy (DOE) has the responsibility of providing new technologies to aid the environmental restoration and waste management (ER/WM) activities of the DOE. There is a perception that application and judicious development of chemical sensor technologies could result in large cost savings and reduced risk to the health and safety of ER/WM personnel. A number of potential gas sensor applications which exist within DOE ER/WM operations are described. The capabilities of several chemical sensor technologies and their potential to meet the needs of ER/WM applications in the present or near term future are discussed.

280 (K-2073-Vol.1) Oak Ridge K-25 Site Technology Logic Diagram: Volume 1, Technology evaluation. Fellows, R.L. (ed.). Oak Ridge K-25 Site, TN (United States). 26 Feb 1993. 383p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OT21400. Order Number DE93009485. Source: OSTI; NTIS; GPO Dep.

The Oak Ridge K-25 Technology Logic Diagram (TLD), a decision support tool for the K-25 Site, was developed to provide a planning document that relates environmental restoration and waste management problems at the Oak Ridge K-25 Site to potential technologies that can remediate these problems. The TLD technique identifies the research necessary to develop these technologies to a state that allows for technology transfer and application to waste management, remedial action, and decontamination and decommissioning activities. The TLD consists of four separate volumes-Vol. 1, Vol. 2, Vol. 3A, and Vol. 3B. This Volume, Volume 1 provides introductory and overview information about the TLD. Volume 2 contains logic diagrams. Volume 3 has been divided into two separate volumes to facilitate handling and use. This volume is divided into ten chapters. The first chapter is a brief introduction, and the second chapter details the technical approach of the TLD. These categories are the work activities necessary for successful decontamination and decommissioning, waste management, and remedial action of the K-25 Site. The categories are characterization, decontamination, dismantlement, robotics and automation, remedial action, and waste management. Materials disposition is addressed in Chap. 9. The final chapter contains regulatory compliance information concerning waste management, remedial action, and decontamination and decommissioning.

281 (K-2073-Vol.2) Oak Ridge K-25 Site Technology Logic Diagram: Volume 2, Technology Logic Diagrams. Fellows, R.L. (ed.). Oak Ridge K-25 Site, TN (United States). 26 Feb 1993. 372p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OT21400. Order Number DE93009486. Source: OSTI; NTIS; GPO Dep.

The Oak Ridge K-25 Technology Logic Diagram (TLD), a decision support tool for the K-25 Site, was developed to provide a planning document that relates environmental restoration and waste management problems at the Oak Ridge K-25 Site to potential technologies that can remediate these problems. The TLD technique identifies the research necessary to develop these technologies to a state that allows for technology transfer and application to waste management, remedial action, and decontamination and decommissioning activities. The TLD consists of four separate volumes-Vol. 1, Vol. 2, Vol. 3A, and Vol. 3B. Volume 1 provides introductory and overview information about the TLD. This volume, Volume 2, contains logic diagrams with an index. Volume 3 has been divided into two separate volumes to facilitate handling and use.

282 (K-2073-Vol.3A) Oak Ridge K-25 Site Technology Logic Diagram: Volume 3, Technology evaluation data sheets; Part A, Characterization, decontamination, dismantlement. Fellows, R.L. (ed.). Oak Ridge K-25 Site, TN (United States). 26 Feb 1993. 487p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OT21400. Order Number DE93009487. Source: OSTI; NTIS; GPO Dep.

The Oak Ridge K-25 Technology Logic Diagram (TLD), a decision support tool for the K-25 Site, was developed to provide a planning document that relates environmental restoration and waste management problems at the Oak

Ridge K-25 Site to potential technologies that can remediate these problems. The TLD technique identifies the research necessary to develop these technologies to a state that allows for technology transfer and application to waste management, remedial action, and decontamination and decommissioning activities. The TLD consists of four separate volumes-Vol. 1, Vol. 2, Vol. 3A, and Vol. 3B. Volume 1 provides introductory and overview information about the TLD. Volume 2 contains logic diagrams. Volume 3 has been divided into two separate volumes to facilitate handling and use. This report is part A of Volume 3 concerning characterization, decontamination, and dismantlement.

283 (K-2073-Vol.3B) Oak Ridge K-25 Site Technology Logic Diagram: Volume 3, Technology evaluation data sheets; Part B, Remedial action, robotics/automation, waste management. Fellows, R.L. (ed.). Oak Ridge K-25 Site, TN (United States). 26 Feb 1993. 423p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OT21400. Order Number DE93009488. Source: OSTI; NTIS; GPO Dep.

The Oak Ridge K-25 Technology Logic Diagram (TLD), a decision support tool for the K-25 Site, was developed to provide a planning document that relates environmental restoration (ER) and waste management (WN) problems at the Oak Ridge K-25 Site. The TLD technique identifies the research necessary to develop these technologies to a state that allows for technology transfer and application to waste management, remediation, decontamination, and decommissioning activities. The TLD consists of four separate volumes-Vol. 1, Vol. 2, Vol. 3A, and Vol. 3B. Volume 1 provides introductory and overview information about the TLD. Volume 2 contains logic diagrams. Volume 3 has been divided into two separate volumes to facilitate handling and use. This volume 3 B provides the Technology Evaluation Data Sheets (TEDS) for ER/WN activities (Remedial Action Robotics and Automation, Waste Management) that are referenced by a TEDS code number in Vol. 2 of the TLD. Each of these sheets represents a single logic trace across the TLD. These sheets contain more detail than each technology in Vol. 2. The TEDS are arranged alphanumerically by the TEDS code number in the upper right corner of each data sheet. Volume 3 can be used in two ways: (1) technologies that are identified from Vol. 2 can be referenced directly in Vol. 3 by using the TEDS codes, and (2) technologies and general technology areas (alternatives) can be located in the index in the front of this volume.

284 (K/ER-40) Data evaluation technical memorandum on the K-1407C Retention Basin at the Oak Ridge K-25 Site, Oak Ridge, Tennessee: Environmental Restoration Program. Beal, D. (Oak Ridge K-25 Site, TN (United States)); Bock, J.; Hatmaker, T.; Zolyniak, J.; Goddard, P.; Kucsmas, D. Oak Ridge K-25 Site, TN (United States). Oct 1991. 265p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OT21400. Order Number DE92006589. Source: OSTI; NTIS; INIS; GPO Dep.

The K-1407-C Retention Basin was a surface impoundment at the Oak Ridge K-25 Site. The basin was used primarily for storing potassium hydroxide scrubber sludge generated at the K-25 Site. In addition, from 1960 to 1973, metal hydroxide sludges that were removed from the K-1407-B Holding Pond were discharged to the K-1407-C Retention Basin. The sludge in the K-1407-B Pond contained discharge from the K-1420 Decontamination and Uranium Recovery, the K-1501 Steam Plant, the K-1413

Laboratory, and the K-1401 Maintenance Building. Radioactive material is also present in the K-1407-C Retention Basin, probably the result of cleaning and decontamination activities at some of the aforementioned facilities. The discharge of waste materials to K-1407-C was discontinued before November of 1988, and all sludge was removed from the retention basin. Some of the sludge was stored, and the remainder was fixed in concrete. This report is specific to the K-1407-C Retention Basin and includes information pertinent to the evaluation of soil contamination. The focus of this evaluation is the effectiveness of the Phase 1 investigation of the K-1407-C Retention Basin to define site conditions adequately to support decisions regarding appropriate closure alternatives. This includes the physical characterization of the site area and the characterization of the nature and extent of contamination at the site in relation to risk characterization and statistical evaluation.

285 (K/ER-47) Site descriptions of environmental restoration units at the Oak Ridge K-25 Site, Oak Ridge, Tennessee. Oak Ridge K-25 Site, TN (United States). Oct 1991. 404p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OT21400. Order Number DE92003315. Source: OSTI; NTIS; INIS; GPO Dep.

This report gives an overview of each of the 116 Solid Waste Management Units (SWMUs) under the purview of the K-25 Environmental Restoration Program. It is an update of three documents published in 1987: 3004.u 2.A.1 Assessment for the Oak Ridge Gaseous Diffusion Plant (K/HS-167), CERCLA Assessment for the Oak Ridge Gaseous Diffusion Plant (K/HS-168), and 3004.u 2.a.1 Assessment for Waste Accumulation Areas for the Oak Ridge Gaseous Diffusion Plant (K/HS-196). This document outlines the history and current condition of each SWMU. Information was gathered from visits to the sites, research into plant records, interviews with personnel associated with the operation of each unit, and published reports as noted in the "References" section for each SWMU. This document treats each SWMU as an individual unit grouped into one of 14 hydrogeological areas at the K-25 Site rather than one of the 16 Operable Units established in May 1991. This document is intended to meet the requirements of state and federal regulatory bodies as well as provide a reference source on all SWMUs at the K-25 Site. This report will be periodically updated to reflect the changing status of environmental restoration units at the K-25 Site. 9 refs.

286 (K/QT-407) Effluent testing for the Oak Ridge Toxic Substances Control Act mixed waste incinerator emissions tests of January 16 and 18, 1991. Shor, J.T. (Oak Ridge National Lab., TN (United States)); Bostick, W.D.; Coroneos, A.C.; Bunch, D.H.; Gibson, L.V.; Hoffmann, D.P.; Shoemaker, J.L. Oak Ridge K-25 Site, TN (United States). Feb 1992. 52p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OT21400. Order Number DE92008519. Source: OSTI; NTIS; INIS; GPO Dep.

On January 16 and 18, 1991, special emissions tests were conducted at the Oak Ridge, K-25 Site Toxic Substances Control Act (TSCA) Incinerator. Both tests were approximately 6 h long and were performed at TSCA temperatures [1200°C, secondary combustion chamber (SSC)]. Liquid feed and effluent samples were collected every 30 min. A filter was used to collect particles from stack gases to study morphology and composition during the first test. Isokinetic air samples were also taken during the second test. Metals emissions from the second test were evaluated using the Environmental Protection Agency (EPA) Method 5

sampling train. The aqueous waste was collected and fed in batches to the Central Neutralization Facility (CNF), where it was treated by iron coprecipitation and polymer flocculation and data were collected. In the first test (1-16-91), the aqueous and organic wastes were fed directly to the kiln or primary combustion chamber (PCC). In the second test (1-18-91), the remaining organic waste from the first test was fed into the SSC, and other organic waste was fed into the PCC. One objective of the two tests was to determine if feeding the same organic waste into the two combustion chambers made a difference in a partitioning of uranium and other metals. No evaluation of radionuclides other than uranium was made. The partition coefficient of uranium to the quench water was 0.3 on January 16 and 0.35 on January 18; so directing Tank 306A to the feed to the primary vs the secondary combustion chamber appears to have made little difference. The partition coefficient of uranium to the stack on January 18 was 0.0039. 5 refs., 15 figs., 26 tabs.

287 (K/TCD-1054) Electroosmotic decontamination of concrete. Bostick, W.D. (Oak Ridge K-25 Site, TN (United States)); Bush, S.A.; Marsh, G.C.; Henson, H.M.; Box, W.D.; Morgan, I.L. Oak Ridge K-25 Site, TN (United States). Mar 1993. 73p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OT21400. Order Number DE93010258. Source: OSTI; NTIS; INIS; GPO Dep.

A method is described for the electroosmotic decontamination of concrete surfaces, in which an electrical field is used to induce migration of ionic contaminants from porous concrete into an electrolyte solution that may be disposed of as a low-level liquid radioactive waste (LLRW); alternately, the contaminants from the solution can be sorbed onto anion exchange media in order to prevent contaminant buildup in the solution and to minimize the amount of LLRW generated. We have confirmed the removal of uranium (and infer the removal of ^{99}Tc) from previously contaminated concrete surfaces. In a typical experimental configuration, a stainless steel mesh is placed in an electrolyte solution contained within a diked cell to serve as the negative electrode (cathode) and contaminant collection medium, respectively, and an existing metal penetration (e.g., piping, conduit, or rebar reinforcement within the concrete surface) serves as the positive electrode (anode) to complete the cell. Typically we have achieved 70 to >90% reductions in surface activity by applying <400 V and <1 A for 1-3 h (energy consumption of 0.4-12 kWh/ft²).

288 (KY/ER-15) Evaluation of the proposed pilot groundwater pump and treat demonstration for the Paducah Gaseous Diffusion Plant: Environmental Restoration Program. Bodenstein, G.W.; Bonczek, R.R.; Early, T.O.; Hale, T.B.; Huff, D.D.; Nickelson, M.D.; Rightmire, C.T. Paducah Gaseous Diffusion Plant, KY (United States). Nov 1992. 90p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400; AC05-76OU00001. (ORNL/M-2542). Order Number DE93012077. Source: OSTI; NTIS; INIS; GPO Dep.

This report contains the evaluation and recommendations of a Groundwater Corrective Actions Review Team. The primary goal is to evaluate the technical merit of and the need to implement a proposed groundwater pump-and-treat demonstration project for the Northwest contaminant plume at Paducah, Kentucky. A key distinction recognized by the review team is that the proposed project is intended to be a full-scale hydraulic containment of contaminants migrating from the sources of the plume, not plume remediation. The key questions incorporated into this plan are whether (1)

dense, nonaqueous-phase liquids (DNAPLs) are present in the Regional Gravel Aquifer (RGA) at the source of the plume and (2) ^{99}Tc removal must be included as part of any groundwater treatment process. The first question cannot be answered until the contaminant sources are better defined; the second question requires further risk assessment and/or a policy decision by DOE. Technical evaluation by the review team suggests that the recommended course of action be to modify the proposed work plan to include accurate identification of the sources of contaminants and vertical distribution of contaminants within the Northwest plume before a decision is made on the preferred source-control option. If DNAPLs are not present in the RGA, removal or containment of the sources is recommended. If DNAPLs are present, then hydraulic containment will be required. Finally, the review team recognizes that it is necessary to initiate a more comprehensive analysis of sitewide remediation needs to create links between action taken for the Northwest plume and action taken for other contamination sites at PGPD.

289 (LA-SUB-93-264) Hazardous waste treatment and environmental remediation research. Los Alamos National Lab., NM (United States); Science Applications International Corp., San Diego, CA (United States). 29 Sep 1989. 51p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93040571. Source: OSTI; NTIS; INIS; GPO Dep.

Los Alamos National Laboratory (LANL) is currently evaluating hazardous waste treatment and environmental remediation technologies in existence and under development to determine applicability to remediation needs of the DOE facilities under the Albuquerque Operations Office and to determine areas of research need. To assist LANL in this effort, Science Applications International Corporation (SAIC) conducted an assessment of technologies and monitoring methods that have been demonstrated or are under development. The focus of this assessment is to: (1) identify existing technologies for hazardous waste treatment and environmental remediation of old waste sites; (2) identify technologies under development and the status of the technology; (3) assess new technologies that need development to provide adequate hazardous waste treatment and remedial action technologies for DOD and DOE sites; and (4) identify hazardous waste and remediation problems for environmental research and development. There are currently numerous research and development activities underway nationwide relating to environmental contaminants and the remediation of waste sites. To perform this effort, SAIC evaluated current technologies and monitoring methods development programs in EPA, DOD, and DOE, as these are the primary agencies through which developmental methods are being demonstrated. This report presents this evaluation and provides recommendations as to pertinent research needs or activities to address waste site contamination problems. The review and assessment have been conducted at a programmatic level; site-specific and contaminant-specific evaluations are being performed by LANL staff as a separate, related activity.

290 (LA-UR-91-1295) Opportunities for health and safety professionals in environmental restoration work. Norris, A.E. Los Alamos National Lab., NM (United States). [1991]. 8p. Sponsored by USDOE, Washington, DC (USA). DOE Contract W-7405-ENG-36. (CONF-9104204-4: First engineering and technology conference on waste management, San Juan (Puerto Rico), 24-26 Apr 1991). Order Number DE91011440. Source: OSTI; NTIS; INIS; GPO Dep.

The safety of workers in waste management and in environmental restoration work is regulated in large part by the Occupational Safety and Health Administration (OSHA). Many of the OSHA rules are given in Part 1910, Occupational Safety and Health Standards, of Title 29 of the Code of Federal Regulations (CFR). Section 120 of 29 CFR 1910 specifically addresses hazardous waste operations and emergency response operations. The remainder of this discussion focuses on clean-up operations. The purpose of this paper is to review areas of employment opportunity in environmental restoration work for health and safety professionals. Safety and health risk analyses are mentioned as one area of opportunity, and these analyses are required by the standards. Site safety and health supervisors will be needed during field operations. Those who enjoy teaching might consider helping to meet the training needs that are mandated. Finally, engineering help both to separate workers from hazards and to improve personal protective equipment, when it must be worn, would benefit those actively involved in environmental restoration activities.

291 (LA-UR-91-1303) Early implementation of the Los Alamos National Laboratory Environmental Restoration Program at Technical Area 54. Krueger, J.W. Los Alamos National Lab., NM (United States). [1991]. 16p. Sponsored by USDOE, Washington, DC (USA). DOE Contract W-7405-ENG-36. (CONF-9105175-1: Waste management: technology, technology transfer and training, San Juan (Puerto Rico), 24-26 May 1991). Order Number DE91011439. Source: OSTI; NTIS; GPO Dep.

The Los Alamos National Laboratory (LANL) Environmental Restoration (ER) Program at Technical Area (TA) 54 is currently in the RCRA Facility Investigation (RFI) phase of an expanded Resource, Conservation, and Recovery Act (RCRA) corrective action program. Site characterization will focus on filling data gaps in a conceptual model constructed from existing information. An interim remedial measure involving vacuum extraction of a known organic vapor vadose zone plume will be modeled this year and hopefully implemented in fiscal year 1993. Long-term environmental restoration will probably involve vadose zone monitoring to confirm modeling predictions on the performance of existing disposal unit caps. However, it is possible that removal or in-situ treatment of some isolated "bad actors" will be necessary to ensure the long-term success of vapor extraction, or to remove surface hot spots that are unacceptably contributing contaminants to the surface water on air pathways. Public sentiment related to the long-term dedication of TA 54 as a waste disposal facility will have to be factored in early in the process to ensure that the most appropriate data are gathered during site characterization, and to instill confidence, both internally and external to LANL, that the ER Program Office is headed in the right direction at TA 54. 7 refs., 5 figs.

292 (LA-UR-91-2875) Three-dimensional computer simulations of bioremediation and vapor extraction. Travis, B.; Trent, B. Los Alamos National Lab., NM (United States). [1991]. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-910981-19: Environmental remediation '91 conference, Pasco, WA (United States), 8-11 Sep 1991). Order Number DE92000309. Source: OSTI; NTIS; GPO Dep.

Numerical simulations of two remediation strategies are presented. These calculations are significant in they they will play a major role in the actual field implementation of two very different techniques. The first set of calculations

simulates the actual spill event of nearly 60,000 gallons of No. 2 diesel fuel oil and its subsequent flow toward the water table for 13 years. Hydrogen peroxide saturated water flooding is then performed and the bioremediation of the organic material is then calculated. The second set of calculations describes the vacuum extraction of organic vapors and indicates the sensitivity to various assumed formation properties and boundary conditions. 7 refs., 5 figs.

293 (LA-UR-92-2071) Cost performance assessment of in situ vitrification. Showalter, W.E. (Los Alamos National Lab., NM (United States)); Letellier, B.C.; Booth, S.R.; Barnes-Smith, P. Los Alamos National Lab., NM (United States). [1992]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9206233-1: 16. annual army environmental quality R&D symposium, Williamsburg, VA (United States), 23-25 Jun 1992). Order Number DE92018983. Source: OSTI; NTIS; INIS; GPO Dep.

In situ vitrification (ISV) is a thermal treatment technology with promise for the destruction or immobilization of hazardous materials in contaminated soils. It has developed over the past decade to a level of maturity where meaningful cost effectiveness studies may be performed. The ISV process melts 4 to 25 m² of undisturbed soil to a maximum depth of 6 m into an obsidian-like glass waste form by applying electric current (3750 kill) between symmetrically spaced electrodes. Temperatures of approximately 2000°C drive off and destroy complex organics which are captured in an off-gas treatment system, while radio-nuclides are incorporated into the homogeneous glass monolith. A comparative life-cycle cost evaluation between mobile rotary kiln incineration and ISV was performed to quantitatively identify appropriate performance regimes and components of cost which are sensitive to the implementation of each technology. Predictions of melt times and power consumption were obtained from an ISV performance model over ranges of several parameters including electrode spacing, soil moisture, melt depth, electrical resistivity, and soil density. These data were coupled with manpower requirements, capitalization costs, and a melt placement optimization routine to allow interpolation over a wide variety of site characteristics. For the purpose of this study, a single site scenario representative of a mixed waste evaporation pond was constructed. Preliminary comparisons between ISV and incineration show that while operating costs are comparable, ISV avoids secondary treatment and monitored storage of radioactive waste that would be required following conventional incineration. It is the long term storage of incinerated material that is the most expensive component.

294 (LA-UR-92-2425) Innovative technologies for removing toxic compounds from groundwater and air. Rosocha, L.A.; Allen, G.R.; Anderson, G.K.; Bechtold, L.A.; Coogan, J.J.; Heck, H.G.; Kang, M.; McCulla, W.H.; Secker, D.A.; Smith, J.D.; Tennant, R.A.; Wantuck, P.J. Los Alamos National Lab., NM (United States). [1992]. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9209164-1: New Mexico conference on the environment: toward a sustainable environment, Albuquerque, NM (United States), 13-15 Sep 1992). Order Number DE92018602. Source: OSTI; NTIS; INIS; GPO Dep.

Innovative waste treatment technologies are being developed to remove hazardous organic wastes from water and air. These technologies involve the generation of highly reactive free radicals and their reaction with organic compounds. Two efficient methods of producing these reactive

free radicals are radiolysis and electrical-discharge plasmas. Radiolytic technology involves the irradiation of contaminated media with high-energy electron beams or x rays generated from the beams (megavolt energies, hundreds of kilorad doses). This process is best understood in aqueous solutions, in which sizable quantities of the free radicals e_{aq}^- , OH^* , and H^* , as well as the more stable oxidant H_2O_2 , are produced. These highly reactive species react with organic contaminants to produce CO_2 , H_2O , and salts, which are no longer hazardous. Nonequilibrium electrical-discharge plasmas involve the generation of copious quantities of reactive free radicals from the dissociation of molecular oxygen by energetic electrons in the gas-based discharge. One of the most promising technologies for plasma processing is based upon the "silent electrical discharge" that has proven to be industrially dependable for the generation of large quantities of ozone.

295 (LA-UR-92-4053) Numerical simulations for the in situ bioremediation demonstration at Savannah River: Presentation of the model. Travis, B.J.; Rosenberg, N.D.; Birdsell, K.H. Los Alamos National Lab., NM (United States). [1992]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-930166-1: DOE Office of Technology Development meeting, Washington, DC (United States), 26-28 Jan 1993). Order Number DE93005446. Source: OSTI; NTIS; GPO Dep.

A series of environmental technology field tests, including in situ bioremediation, are being conducted at the Savannah River Integrated Demonstration (SRID) site near Aiken, South Carolina. This site is part of a larger area that was used to process fuel and target elements for use in reactors. Degreasing operations were included at several stages of the operations. Degreasers such as TCE and PCE were discharged to a seepage basin via a process sewer pipeline. In the early 1980s, inspections revealed that the process sewer line had extensive cracks, allowing solvents to leak into the subsurface environment. An in situ remediation technology designed to address this linear source term was tested in 1990. This technology involved air injection below the water table and vacuum extraction in the vadose zone using two horizontal wells [Looney et al., 1991]. Bioremediation experiments using these same horizontal wells were begun in 1992 [Hazen, 1992a]. This report describes the experiment, which is based on the expectation that the injected air and methane will stimulate the growth of naturally occurring methanotrophs at the site and these bacteria will co-metabolize the chlorinated solvents.

296 (LA-UR-93-656) Migration barrier covers for radioactive and mixed waste landfills. Hakonson, T.E. (Los Alamos National Lab., NM (United States)); Manies, K.L.; Warren, R.W.; Bostick, K.V.; Trujillo, G.; Kent, J.S.; Lane, L.J. Los Alamos National Lab., NM (United States). [1993]. 20p. Sponsored by USDOE, Washington, DC (United States); Department of Defense, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-930188-1: Environmental restoration technology transfer symposium, Salt Lake City, UT (United States), 26-28 Jan 1993). Order Number DE93008728. Source: OSTI; NTIS; INIS; GPO Dep.

Migration barrier cover technology will likely serve as the remediation alternative of choice for most of DOE's radioactive and mixed waste landfills simply because human and ecological risks can be effectively managed without the use of more expensive alternatives. However, very little testing and evaluation has been done, either before or after installation, to monitor how effective they are in isolating waste or

to develop data that can be used to evaluate model predictions of long term performance. Los Alamos National Laboratory has investigated the performance of a variety of landfill capping alternatives since 1981 using large field lysimeters to monitor the fate of precipitation falling on the cap surface. The objective of these studies is to provide the risk manager with a variety of field tested capping designs, of various complexities and costs, so that design alternatives can be matched to the need for hydrologic control at the site. Four different landfill cap designs, representing different complexities and costs, were constructed at Hill Air Force Base (AFB) in October and November, 1989. The designs were constructed in large lysimeters and instrumented to provide estimates of all components of water balance including precipitation, runoff (and soil erosion), infiltration, leachate production, evapotranspiration, and capillary/hydraulic barrier flow. The designs consisted of a typical soil cover to serve as a baseline, a modified EPA RCRA cover, and two versions of a Los Alamos design that contained erosion control measures, an improved vegetation cover to enhance evapotranspiration, and a capillary barrier to divert downward flow of soil water. A comprehensive summary of the Hill AFB demonstration will be available in October 1993, when the project is scheduled to terminate.

297 (LA-UR-93-1598) Field studies of engineered barriers for closure of low level radioactive waste landfills at Los Alamos, New Mexico, USA. Nyhan, J.W.; Langhorst, G.J.; Martin, C.E.; Martinez, J.L.; Schofield, T.G. Los Alamos National Lab., NM (United States). [1993]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-930906-8: '93 international conference on nuclear waste management and environmental remediation, Prague (Czech Republic), 5-11 Sep 1993). Order Number DE93012725. Source: OSTI; NTIS; INIS; GPO Dep.

The Los Alamos National Laboratory examined water balance relationships for four different landfill cover designs containing engineered barriers. These field experiments were performed at Los Alamos, New Mexico, USA, in 1.0-by 10.0-m plots with downhill slopes of 5, 10, 15, and 25%. Field measurements of seepage, precipitation, interflow, runoff, and soil water content were collected in each of the 16 plots representing four slopes each with four cover designs: Conventional, EPA, Loam Capillary Barrier and Clay Loam Capillary Barrier. A seepage collection system was installed beneath each cover design to evaluate the influence of slope length on seepage using a series of four metal pans filled with medium gravel that were placed end-to-end in the bottom of each field plot. An automated water flow data logging system was used to collect hourly seepage, interflow and runoff data and consisted of 100 100-liter tanks, each of which was equipped with an ultrasonic liquid-level sensor and a motor-operated ball valve used to drain the tank. Soil water content was routinely monitored every six hours at each of 212 locations throughout the 16 plots with time domain reflectometry (TDR) techniques using an automated and multiplexed measurement system. Field data is presented to show the effects of slope and slope length on the performance of each landfill cover design for the first 15 months of this field experiment.

298 (LA-UR-93-2516) High gradient magnetic separation applied to environmental remediation. Prenger, F.C. (Los Alamos National Lab., NM (United States)); Stewart, W.F.; Hill, D.D.; Avens, L.R.; Worl, L.A.; Schake, A.; de Aguiro, K.J.; Padilla, D.D.; Tolt, T.L. Los Alamos National

Lab., NM (United States). [1993]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-930703-14: International cryogenic materials conference (ICMC), Albuquerque, NM (United States), 12-16 Jul 1993). Order Number DE93018372. Source: OSTI; NTIS; INIS; GPO Dep.

High Gradient Magnetic Separation (HGMS) is an application of superconducting magnet technology to the separation of magnetic solids from other solids, liquids, or gases. The production of both high magnetic fields (>4 T) and large field gradients using superconducting magnet technology has made it possible to separate a previously unreachable but large family of paramagnetic materials. This is a powerful technique that can be used to separate widely dispersed contaminants from a host material and may be the only technique available for separating material in the colloidal state. Because it is a physical separation process, no additional waste is generated. We are applying this technology to the treatment of radioactive wastes for environmental remediation. We have conducted tests examining slurries containing nonradioactive, magnetic surrogates. Results from these studies were used to verify our analytical model of the separation process. The model describes the rate process for magnetic separation and is based on a force balance on the paramagnetic species. This model was used to support bench scale experiments and prototype separator design.

299 (LA-UR-94-400) **The use of the long-range alpha detector (LRAD) for alpha emission surveys at active and inactive firing sites.** Mason, C.F.V. (Los Alamos National Lab., NM (United States)); Allander, K.S.; Bounds, J.A.; Garner, S.E.; Walter, K.J. Los Alamos National Lab., NM (United States). [1994]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-940225-47: Waste management '94, Tucson, AZ (United States), 27 Feb - 3 Mar 1994). Order Number DE94007526. Source: OSTI; NTIS; INIS; GPO Dep.

Surveys were carried out at five different firing sites at Los Alamos National Laboratory to measure residual alpha emissions in earth contaminated with natural and depleted uranium. This contamination is caused by controlled experimental explosions during testing of the non fissile components of nuclear weapons. Two conclusions were reached: the first is that post shot clearing of the experimental areas is effective at removing contamination and the second is that the diminution of alpha emissions due to aging is small.

300 (LA-UR-94-1361) **Heap leach studies on the removal of uranium from soil: Report of laboratory-scale test results.** Turney, W.R.J.R.; York, D.A.; Mason, C.F.V.; Chisholm-Brause, C.J.; Dander, D.C.; Longmire, P.A.; Morris, D.E.; Strait, R.K.; Brewer, J.S. Los Alamos National Lab., NM (United States). May 1994. 85p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE94012885. Source: OSTI; NTIS; GPO Dep.

This report details the initial results of laboratory-scale testing of heap leach that is being developed as a method for removing uranium from uranium-contaminated soil. The soil used was obtained from the site of the Feed Materials Production Center (FMPC) near the village of Fernald in Ohio. The testing is being conducted on a laboratory scale, but it is intended that this methodology will eventually be enlarged to field scale where, millions of cubic meters of uranium-contaminated soil can be remediated. The laboratory scale experiments show that, using carbonate/

bicarbonate solutions, uranium can be effectively removed from the soil from initial values of around 600 ppm down to 100 ppm or less. The goal of this research is to selectively remove uranium from the contaminated soil, without causing serious changes in the characteristics of the soil. It is also hoped that the new technologies developed for soil remediation at FEMP will be transferred to other sites that also have uranium-contaminated soil.

301 (LBL-27170(1993)) **Annual Site Environmental Report of the Lawrence Berkeley Laboratory, Calendar year 1992.** Balgobin, D.A.; Javandel, I.; Pauer, R.O.; Schleimer, G.E.; Thorson, P.A. (eds.). Lawrence Berkeley Lab., CA (United States). May 1993. 212p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE93016704. Source: OSTI; NTIS; INIS; GPO Dep.

This Annual Site Environmental Report summarizes LBL environmental activities in calendar year (CY) 1992. The purpose of this Report is to present summary environmental information in order to characterize site environmental management performance, confirm compliance with environmental standards and requirements, and highlight significant programs and efforts. Its format and content are consistent with the requirements of the US Department of Energy (DOE) Order 5400.1, "General Environmental Protection Program."

302 (LBL-33252) **Bacterial chromate reduction and product characterization.** Mehlich, R.J. (Lawrence Berkeley Lab., CA (United States)); Buchanan, B.B.; Leighton, T. Lawrence Berkeley Lab., CA (United States). Nov 1992. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (WSRC-MS-93-018; CONF-930482-4: 2. international symposium in situ and on-site bioreclamation, San Diego, CA (United States), 5-8 Apr 1993). Order Number DE93007698. Source: OSTI; NTIS; INIS; GPO Dep.

Bacillus subtilis reduced hexavalent chromate to trivalent chromium under either aerobic or anaerobic conditions. Reduction of Cr(VI) and appearance of extracellular Cr(III) were demonstrated by electron spin resonance and spectrophotometry. Chromate reduction was stimulated more than five-fold by freeze-thawing, indicating that intracellular reductases or chemical reductants reduce chromate more rapidly than do intact cells. Moderately concentrated cells (10% pellet volume after centrifugation) reduced approximately 40 μ M chromate/min (2 mg Cr/1-min) when exposed to 100 μ M chromate (5 mg Cr/l). Highly concentrated cells (70% pellet volume) reduced more than 99.8% of 2 mM chromate (100 mg Cr/l) within 15 min. This rate of chromate reduction was of the same order of magnitude as the rate of respiration in aerobic cells. A substantial fraction of the reduction product (ca. 75%) was extracellular Cr(III), which could readily be separated from the cells by centrifugation. At high chromate concentrations, some fraction of reduced Cr(VI) appeared to be taken up by cells, consistent with a detection of intracellular paramagnetic products. At low chromate concentrations, undefined growth medium alone reduced Cr(VI), but at a slow rate, relative to cells. Under appropriate conditions, *B. subtilis* appears to be an organism of choice for detoxifying chromate-contaminated soil and water.

303 (NDPP-OSP-0052) **Pinellas Plant site specific plan: Environmental health and safety programs.** General Electric Co., Largo, FL (United States). Pinellas Plant.

Sep 1991. 124p. Sponsored by USDOE, Washington, DC (United States). Order Number DE91017857. Source: OSTI; NTIS; GPO Dep.

This Environmental Restoration/Waste Management Site Specific Plan describes the corrective action, environmental restoration, and waste management activities to be performed at the Pinellas Plant in FY 1992 (October 1, 1991, to September 30, 1992). These FY 1992 activities are further described in the Pinellas Plant United States Department of Energy Albuquerque Operations Office, Environmental Restoration Waste Management FY 1993-97 Five-Year Plan Activity Data Sheets, March 1991, and the Final Action Plan to resolve the findings of the Tiger Team Environmental, Safety and Health Assessment of the Pinellas Plant. The information used to prepare this plan reflects the best estimate of the project scope, schedules, regulatory, and funding requirements at the time of plan preparation. 18 figs., 32 tabs.

304 (ORNL-6762) Removal of uranium from uranium-contaminated soils - Phase 1: Bench-scale testing: Uranium in Soils Integrated Demonstration. Francis, C.W. Oak Ridge National Lab., TN (United States). Sep 1993. 148p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94001998. Source: OSTI; NTIS; INIS; GPO Dep.

To address the management of uranium-contaminated soils at Fernald and other DOE sites, the DOE Office of Technology Development formed the Uranium in Soils Integrated Demonstration (USID) program. The USID has five major tasks. These include the development and demonstration of technologies that are able to (1) characterize the uranium in soil, (2) decontaminate or remove uranium from the soil, (3) treat the soil and dispose of any waste, (4) establish performance assessments, and (5) meet necessary state and federal regulations. This report deals with soil decontamination or removal of uranium from contaminated soils. The report was compiled by the USID task group that addresses soil decontamination; includes data from projects under the management of four DOE facilities [Argonne National Laboratory (ANL), Los Alamos National Laboratory (LANL), Oak Ridge National Laboratory (ORNL), and the Savannah River Plant (SRP)]; and consists of four separate reports written by staff at these facilities. The fundamental goal of the soil decontamination task group has been the selective extraction/leaching or removal of uranium from soil faster, cheaper, and safer than current conventional technologies. The objective is to selectively remove uranium from soil without seriously degrading the soil's physicochemical characteristics or generating waste forms that are difficult to manage and/or dispose of. Emphasis in research was placed more strongly on chemical extraction techniques than physical extraction techniques.

305 (ORNL/ER-23) Tracer-level radioactive pilot-scale test of in situ vitrification technology for the stabilization of contaminated soil sites at ORNL: Environmental Restoration Program. Jacobs, G.K.; Spalding, B.P. Oak Ridge National Lab., TN (United States). Nov 1991. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92012589. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental Sciences Division Publication No. 3806.

This plan summarizes the activities to be performed during FY 1990 and FY 1991 for the tracer-level radioactive pilot-scale in situ vitrification (ISV) test. This test is the second step in evaluating ISV as a remedial action for the pits and trenches at Oak Ridge National Laboratory (ORNL). A

previous test used nonradioactive tracers for cesium and strontium. This new test will again use a one-half-scale model of trench 7 and the pilot-scale ISV equipment of Pacific Northwest Laboratory (PNL). A small and precisely known amount of waste from a liquid waste disposal pit will be used for the test. An actually contaminated waste site cannot be used for this test because of the necessity to use an exactly known inventory of radionuclides so that a precise measurement of the volatilization of various constituents to the off-gas can be determined.

306 (ORNL/ER-24) Task plan to evaluate the effectiveness of in situ grouting of an ORNL waste burial trench with a cement-based grout: Environmental Restoration Program. Francis, C.W. Oak Ridge National Lab., TN (United States). Environmental Sciences Div. Nov 1991. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92012588. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental Sciences Division Publication No. 3807.

This task will demonstrate the feasibility of using an in situ grouting technique with a particulate-grout formulation as a closure action to stabilize waste trenches in Solid Waste Storage Area (SWSA) 6. It also supports technology development for closure of other SWSAs. A particulate grout will be formulated using cement-bentonite and fly ash from a coal-fired power plant. The grout solids will be dry-blended, mixed with water, and injected (using ~5 to 10 lb/in.² pressure) into five injection wells per trench. After 28 days for setting, soil penetration resistance and hydraulic conductivity measurements will be repeated for comparison to pregrouting measurements. The primary objective of this task is to demonstrate the feasibility and effectiveness of the in situ injection of a particulate grout into waste burial trenches. Effectiveness is defined here as increased trench stability (characterized by trench penetration resistance tests) and decreased potential for leachate migration (characterized by hydraulic conductivity tests).

307 (ORNL/ER-30) A preliminary study of the controls on melting during in situ vitrification: Environmental Restoration Program. Solomon, A.D.; Nyquist, J.E.; Alexiades, V.; Jacobs, G.K.; Lenhart, S.M. Oak Ridge National Lab., TN (United States). Dec 1991. 39p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92008025. Source: OSTI; NTIS; GPO Dep.

Environmental Sciences Division Publication 3608.

In situ vitrification (ISV), developed by Pacific Northwest Laboratory and patented for the US Department of Energy, is one method used to stabilize contaminated soils in place. ISV involves inserting four electrodes in a square array into contaminated soil and applying an electrical potential to the electrodes. The soil is heated to above its melting point, and the molten zone expands with time to encompass the contaminated zone. After cooling, the resulting solid material is usually a mixture of glass and crystalline material that has a significantly higher resistance to leaching than did the original soils. Nonvolatile elements (most radionuclides and metals) are dissolved into the melt or encapsulated in glass if their solubility in the melt is low. Organic compounds tends to be pyrolyzed, with the decomposition products diffusing to the surface and combusting on exiting the molten zone. A hood is placed over the vitrification zone to collect off-gas particulates and volatiles into a processing trailer that scrubs contaminants from the off-gas. The current study identified

key parameters and processes in the ISV melt cycle and developed an improved understanding of ISV. Analytical approximations for several properties of molten soil were determined from available data. Using a simplified geometrical approximation for melt geometry, an analytical approximation for the rate of melting (depth) vs time was derived that is consistent with data from field experiments. At small times, the depth of melting increases linearly with time. After approximately 10 h in large-scale tests, however, the depth increases as the square root of time. Existing data is also consistent with a relationship that shows the volumetric growth rate of the melt to be directly proportional to time. These conclusions suggest that heat transfer processes controlling the ISV process may be at the transition between weak convection and conduction.

308 (ORNL/ER-46) Final report on the waste area grouping perimeter groundwater quality monitoring well installation program at Oak Ridge National Laboratory, Oak Ridge, Tennessee. Greene, J.A. Oak Ridge National Lab., TN (United States). Jun 1991. 72p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92002379. Source: OSTI; NTIS; INIS; GPO Dep.

A groundwater quality monitoring well installation program was conducted at Oak Ridge National Laboratory (ORNL) to meet the requirements of environmental regulations, including the Resource Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). A total of 173 wells were installed and developed at 11 different waste area groupings (WAGs) between June 1986 and November 1990. A location map of the wells is included.

309 (ORNL/ER-59) Preliminary investigation of processes that affect source term identification: Environmental Restoration Program. Wickliff, D.S.; Solomon, D.K.; Farrow, N.D. Oak Ridge National Lab., TN (United States). Sep 1991. 32p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92005316. Source: OSTI; NTIS; INIS; GPO Dep. ESD Publication 3772.

Solid Waste Storage Area (SWSA) 5 is known to be a significant source of contaminants, especially tritium (^3H), to the White Oak Creek (WOC) watershed. For example, Solomon et al. (1991) estimated the total ^3H discharge in Melton Branch (most of which originates in SWSA 5) for the 1988 water year to be 1210 Ci. A critical issue for making decisions concerning remedial actions at SWSA 5 is knowing whether the annual contaminant discharge is increasing or decreasing. Because (1) the magnitude of the annual contaminant discharge is highly correlated to the amount of annual precipitation (Solomon et al., 1991) and (2) a significant lag may exist between the time of peak contaminant release from primary sources (i.e., waste trenches) and the time of peak discharge into streams, short-term stream monitoring by itself is not sufficient for predicting future contaminant discharges. In this study we use ^3H to examine the link between contaminant release from primary waste sources and contaminant discharge into streams. By understanding and quantifying subsurface transport processes, realistic predictions of future contaminant discharge, along with an evaluation of the effectiveness of remedial action alternatives, will be possible. The objectives of this study are (1) to characterize the subsurface movement of contaminants (primarily ^3H) with an emphasis on the effects of matrix diffusion; (2) to determine the relative strength of primary vs

secondary sources; and (3) to establish a methodology capable of determining whether the ^3H discharge from SWSA 5 to streams is increasing or decreasing.

310 (ORNL/ER-62) Screening of contaminants in Waste Area Grouping 2 at Oak Ridge National Laboratory, Oak Ridge, Tennessee: Environmental Restoration Program. Blaylock, B.G.; Frank, M.L.; Hoffman, F.O.; Hook, L.A.; Suter, G.W.; Watts, J.A. Oak Ridge National Lab., TN (United States). Environmental Restoration Div. Jul 1992. 204p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92018401. Source: OSTI; NTIS; INIS; GPO Dep.

Waste Area Grouping 2 (WAG 2) of the Oak Ridge National Laboratory (ORNL) is located in the White Oak Creek Watershed and is composed of White Oak Creek Embayment, White Oak Lake and associated floodplain, and portions of White Oak Creek (WOC) and Melton Branch downstream of ORNL facilities. Contaminants leaving other ORNL WAGs in the WOC watershed pass through WAG 2 before entering the Clinch River. Health and ecological risk screening analyses were conducted on contaminants in WAG 2 to determine which contaminants were of concern and would require immediate consideration for remedial action and which contaminants could be assigned a low priority or further study. For screening purposes, WAG 2 was divided into four geographic reaches: Reach 1, a portion of WOC; Reach 2, Melton Branch; Reach 3, White Oak Lake and the floodplain area to the weirs on WOC and Melton Branch; and Reach 4, the White Oak Creek Embayment, for which an independent screening analysis has been completed. Screening analyses were conducted using data bases compiled from existing data on carcinogenic and noncarcinogenic contaminants, which included organics, inorganics, and radionuclides. Contaminants for which at least one sample had a concentration above the level of detection were placed in a detectable contaminants data base. Those contaminants for which all samples were below the level of detection were placed in a nondetectable contaminants data base.

311 (ORNL/ER-62/R1) Screening of contaminants in Waste Area Grouping 2 at Oak Ridge National Laboratory, Oak Ridge, Tennessee: Environmental Restoration Program. Blaylock, B.G.; Frank, M.L.; Hoffman, F.O.; Hook, L.A.; Suter, G.W.; Watts, J.A. Oak Ridge National Lab., TN (United States). Environmental Restoration Div. Sep 1992. 272p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93000549. Source: OSTI; NTIS; GPO Dep.

Environmental Sciences Division Publication 3804.

The purpose of this report is to present the results of a health risk and ecological risk screening analysis for Waste Area Grouping 2 (WAG 2) using available data to identify contaminants and environmental pathways that will require either further investigation or immediate consideration for remediation based on the screening indices. The screening analysis will also identify contaminants that can be assigned a low priority for further investigation and those that require additional data.

312 (ORNL/ER-63) Surveillance and maintenance activities of waste area groupings at Oak Ridge National Laboratory: Annual summary report for period ending September 30, 1991: Environmental Restoration Program. Ford, M.K.; Holder, L. Jr.; Jones, R.G. Oak Ridge

National Lab., TN (United States). Dec 1991. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92008762. Source: OSTI; NTIS; INIS; GPO Dep.

Surveillance and maintenance (S & M) of 75 sites were conducted by the Remedial Action Section for the Environmental Restoration Program for surplus facilities and sites contaminated with radioactive materials and/or hazardous chemicals. S & M activities on these sites were conducted from the end of their operating life until final facility disposal or site stabilization. The objectives of the Waste Area Grouping S & M Program are met by maintaining a program of routine S & M as well as by implementing interim corrective maintenance when deemed necessary as a result of site surveillance. This report briefly presents this program's activities and includes tables indicating tank levels and dry well data for FY 1991.

313 (ORNL/ER-65) Monitoring and modeling contaminated sediment transport in the White Oak Creek watershed: Environmental Restoration Program. Fontaine, T.A. Oak Ridge National Lab., TN (United States). Nov 1991. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92004585. Source: OSTI; NTIS; GPO Dep.

Environmental Sciences Publication No. 3787.

Over the past 47 years, operations and waste disposal activities at Oak Ridge National Laboratory have resulted in the contamination of the White Oak Creek drainage system. The containments presenting the highest risk to human health and the environment are particle reactive and are associated with the soils and sediments in White Oak Creek. During floods, the erosion of these sediments results in the transport of contaminants out of the catchment into the Clinch River. A long-term strategy is required to monitor the movement of contaminated sediments and to predict the transport of these sediments that could occur during major floods. A monitoring program will provide the information required to (1) evaluate the existing off-site transport of contaminated sediments, (2) evaluate the need for short-term control measures, (3) set priorities for remediation of contaminated areas in White Oak Creek (4) verify the success of completed remedial actions intended to control the movement of contaminated sediments, and (5) develop a computer model to simulate the transport of contaminated sediments in White Oak Creek. A contaminant-transport model will be developed to (1) evaluate the potential for the off-site transport of contaminated sediments during major floods, (2) develop long term control measures and remediation solutions, (3) predict the impact of future land-use changes in White Oak Creek on the transport of contaminated sediment. This report contains a plan for the monitoring and modeling activities required to accomplish these objectives.

314 (ORNL/ER-82) Well plugging and abandonment plan for Waste Area Grouping 6 at Oak Ridge National Laboratory, Oak Ridge, Tennessee: Environmental Restoration Program. Stansfield, R.G.; Huff, D.D. Oak Ridge National Lab., TN (United States). Jun 1992. 99p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92018076. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental Sciences Division Publication No. 3823.

Site environmental characterization and remediation require data obtained from the installation and sampling of

wells. When these wells are no longer needed or not producing reliable information, or are damaged and can act as conduits for contaminant migration, they should be identified and properly decommissioned. This is most important for wells of sufficient depth to create the potential for exchange of fluids between different hydrologic units. This plan presents the strategy and detailed approach for well plugging and abandonment (P&A) at Waste Area Grouping 6 (WAG 6). An inventory of 768 wells, the total number known to have been installed in WAG 6 based on a combined review of data and direct field inventory, is provided in Appendix A. All wells that are no required for closure or postclosure surveillance of WAG 6 will be decommissioned. A listing of 69 existing WAG 6 wells that will be maintained for postclosure surveillance is provided in Appendix B, and their locations are shown in Fig. 1. Appendix C contains a list of all WAG 6 wells that will be decommissioned, although some may no longer exist. Their locations are shown in Fig. 2. It is likely that some new wells will be drilled as part of postclosure monitoring of Solid Waste Area 6 (SWSA), but they are beyond the scope of this report. It is intended that this plan provide a basis for developing contracts for cost and schedule determinations for the P&A process.

315 (ORNL/ER-85) Functional requirements of the borrow area and haul route for the Waste Area Grouping projects at Oak Ridge National Laboratory, Oak Ridge, Tennessee. Miller, D.G. Oak Ridge National Lab., TN (United States). Sep 1992. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93000977. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes the mission and functional requirements for the development of a borrow area and the associated haul route to support closure and/or remediation of Waste Area Grouping (WAG) 6 and other WAGs at Oak Ridge National Laboratory. This document specifies the basic functional requirements that must be met by the borrow area and haul route developed to produce low-permeability soil for the covers or caps at WAG 6.

316 (ORNL/ER-90) Model of the PCB and mercury exposure of mink and great blue heron inhabiting the off-site environment downstream from the US Department of Energy Oak Ridge Reservation: Environmental Restoration Program. MacIntosh, D.L. (Indiana Univ., Bloomington, IN (United States). School of Public and Environmental Affairs); Suter, G.W. II; Hoffman, F.O. Oak Ridge National Lab., TN (United States). Sep 1992. 65p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93001297. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental Sciences Division Publication 3934.

This report presents a pair of wildlife exposure models developed for use in investigating the risks to wildlife of releases of mercury and PCBs. The species modeled are the great blue heron and mink. The models may be used to estimate the exposure experienced by mink and herons, to help establish remedial action goals and to identify research needs. Because mercury and PCBs bioaccumulate through dietary uptake, the models simulate the food webs supporting the two species. Sources of contaminants include surface water, sediment, sediment pore water, and soil. The model are stochastic equilibrium models. Two types of variance in the input parameters are distinguished: stochastic variance among individual mink and herons and ignorance

concerning true parameter values. The variance in the output due to stochastic parameters indicates the expected variance among the receptors. The variance due to ignorance indicates the extent to which the model outputs could be unpaved by additional sampling and measurement. The results of the models were compared to concentrations measured in great blue heron eggs and nestlings from colonies on the Clinch and Tennessee Rivers. The predicted concentrations agreed well with the measured concentrations. In addition, the variances in measured values among individuals was approximately equal to the total stochastic variance predicted by the models.

317 (ORNL/ER-116) Work plan to assess treatment of trench water from Waste Area Grouping 6 at Oak Ridge National Laboratory, Oak Ridge, Tennessee: Environmental Restoration Program. Taylor, P.A. Oak Ridge National Lab., TN (United States). Mar 1992. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92013478. Source: OSTI; NTIS; GPO Dep.

Water from a selected waste disposal trench in Waste Area Grouping (WAG) 6 will be used to conduct a pilot-scale treatment assessment. The experiment will be designed to demonstrate whether adding WAG 6 trench water to the wastewater treatment facilities at Oak Ridge National Laboratory (ORNL) will change the regulatory status of the solid wastes produced by these facilities. Laboratory-scale treatability tests conducted in 1990 showed that the existing ORNL wastewater treatment facilities could successfully treat the WAG 6 trench water to meet discharge requirements, but the tests did not address the regulatory status of the solid wastes produced by the treatment processes. A longer-term, larger-scale test will be performed to determine if these solid wastes will become hazardous as defined by the Resource Conservation and Recovery Act when WAG 6 trench water is mixed with the existing process wastewater. These data are needed to determine the feasibility of adding the WAG 6 trench water to the treatment facilities.

318 (ORNL/ER-117) Summary of activities of the life cycle costing workshop conducted by the Environmental Restoration Program of Oak Ridge National Laboratory: Environmental Restoration Program. Oak Ridge National Lab., TN (United States); Bechtel National, Inc., Oak Ridge, TN (United States); CH2M Hill Southeast, Inc., Oak Ridge, TN (United States); Peer Consultants, Inc., Oak Ridge, TN (United States); Ogden Environmental and Energy Services Co., Oak Ridge, TN (United States). Aug 1992. 265p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (CONF-9110457-Summ.: Life cycle costing workshop, Oak Ridge, TN (United States), 14-18 Oct 1991). Order Number DE93000823. Source: OSTI; NTIS; INIS; GPO Dep.

A five-day life cycle workshop was conducted by the Environmental Restoration (FR) Program of Oak Ridge National Laboratory (ORNL) to develop appropriate remediation scenarios for each Waste Area Grouping (WAG) at ORNL and to identify associated data needs (e.g., remedial investigations, special studies, and technology demonstrations) and required interfaces. Workshop participants represented the Department of Energy, Martin Marietta Energy Systems, Inc., Bechtel National, Radian Corporation, EBASCO Corporation, and M-K Ferguson. The workshop was used to establish a technical basis for remediation activities at each WAG. The workshop results are documented in this report and provide the baseline for estimating the technical scope

for each WAG. The scope and associated budgets and schedules will be summarized in baseline reports for each WAG, which, in turn, will be compiled into an overall strategy document for ORNL ER.

319 (ORNL/ER-125) Construction and Installation summary for fiscal year 1992 of the hydraulic head monitoring stations at Oak Ridge National Laboratory, Oak Ridge, Tennessee: Environmental Restoration Program. Dreier, R.B.; Switek, J.; Couzens, B.A. Oak Ridge National Lab., TN (United States). Dec 1992. 106p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (ESD-4006). Order Number DE93005176. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental Services Division Publication No. 4006.

During FY 1992, as part of the Hydraulic Head Monitoring Station (HHMS) Project, three multiport wells (HHMS 12, 13, and 14) were constructed along or near the boundaries of Waste Area Grouping (WAG) 2 at Haw Ridge water gap. The purpose of this report is to document well construction and multiport component installation activities. The hydraulic head monitoring stations (HHMS) are well clusters and single multiport wells that provide data required for evaluation of the transition between shallow and deep groundwater systems and of the nature of these systems. This information is used for required characterization of the hydrologic framework as dictated by state and federal regulatory agencies. Groundwater contaminants may move laterally across WAG boundaries or offsite; they may also move in a vertical direction. Because the HHMS Project was designed to address potential contamination problems, the project provides a means for defining the bounds of the uppermost aquifer; identifying potential pathways for offsite contamination for shallow; intermediate, and deep groundwater flow; and evaluating the capacity for contaminant transport in intermediate and deep groundwater flow systems.

320 (ORNL/ER-126) Migration of a groundwater contaminant plume by stratabound flow in Waste Area Grouping 1 at Oak Ridge National Laboratory, Oak Ridge, Tennessee: Environmental Restoration Program. Kettle, R.H.; Lee, R.R. Oak Ridge National Lab., TN (United States). Aug 1992. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92019509. Source: OSTI; NTIS; INIS; GPO Dep.

The discovery of radiologically contaminated groundwater in core hole CH-8 in the western portion of Waste Area Grouping (WAG) 1 at Oak Ridge National Laboratory (ORNL) prompted a detailed investigation to identify the contaminant plume. Utilizing a working hypothesis of stratabound groundwater flow and contaminant transport, investigators analyzed existing subsurface geologic data to predict the contaminant plume discharge location in first Creek and locations of contaminated groundwater seepage into storm drains. The hypothesis states that differential lithologic/fracture conditions lead to the development of preferred flow and transport pathways, of discrete vertical extent, which may not be coincident with the hydraulic gradient. Leakage out of the stratabound pathway is a minor component of the overall plume configuration.

321 (ORNL/ER-134) Quality Assurance Plan for the remedial investigation of Waste Area Grouping 2 at Oak Ridge National Laboratory, Oak Ridge, Tennessee: Environmental Restoration Program. Atwood, G.P. (Automated Sciences Group, Inc., Oak Ridge, TN (United

States)); Miller, D.E. Oak Ridge National Lab., TN (United States); Automated Sciences Group, Inc., Oak Ridge, TN (United States). Dec 1992. 36p. Sponsored by US-DOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (QAP-X-92-ES-085). Order Number DE93006723. Source: OSTI; NTIS; GPO Dep.

Environmental Sciences Division Publication No. 3978.

The Oak Ridge National Laboratory (ORNL) Waste Area Grouping (WAG) 2 Site Investigation (SI) includes the lower portion of the White Oak Creek (WOC) drainage and embayment, and associated floodplain and subsurface environment. The ORNL main plant and the major waste storage and disposal facilities at ORNL are located in the WOC watershed and are drained by the WOC system to the Clinch River, located off-site. Environmental media are contaminated and continue to receive contaminants from hydrologically upgradient WAGS. WAG 2 is important as a conduit from upgradient areas to the Clinch River. The general objectives of the WAG 2 SI Project are to conduct a multimedia monitoring and characterization program to define and monitor the input of contaminants from adjacent WAGS, monitor and gather sufficient information for processes controlling or driving contaminant fluxes to construct an appropriate conceptual model for WAG 2, and prepare for the eventual remediation of WAG 2.

322 (ORNL/ER-136) Design report on the test system used to assess treatment of trench water from Waste Area Grouping 6 at Oak Ridge National Laboratory, Oak Ridge, Tennessee: Environmental Restoration Program. Kent, T.E.; Taylor, P.A. Oak Ridge National Lab., TN (United States). Environmental Restoration Div. Sep 1992. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92041014. Source: OSTI; NTIS; GPO Dep.

New liquid waste streams will be generated as a consequence of closure activities at Waste Area Grouping (WAG) 6 at Oak Ridge National Laboratory (ORNL). It is proposed that these waste streams be treated for removal of contaminants by adding them to the ORNL wastewater treatment facilities. Previous bench-scale treatability studies indicate that ORNL treatment operations will adequately remove the contaminants, although additional study is required to characterize the secondary waste materials produced as a result of the treatment. A larger scale treatment system was constructed to produce secondary wastes in the quantities necessary for characterization and US Environmental protection Agency toxicity characteristic leaching procedure (TCLP) testing. The test system is designed to simulate the operation of the ORNL process waste treatment facilities and to treat a mixture of ORNL process wastewater and WAG 6 wastewater at a combined flow rate of 0.5 L/min. The system is designed to produce the necessary quantities of waste sludges and spent carbon for characterization studies and TCLP testing.

323 (ORNL/ER-143) A radiological and chemical investigation of the 7500 Area Contamination Site at Oak Ridge National Laboratory, Oak Ridge, Tennessee. Williams, J.K.; Foley, R.D.; Tiner, P.F.; Hatmaker, T.L.; Uziel, M.S.; Swaja, R.E. Oak Ridge National Lab., TN (United States). May 1993. 214p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94002751. Source: OSTI; NTIS; INIS; GPO Dep.

A radiological and chemical investigation of the 7500 Area Contamination Site at Oak Ridge National Laboratory

(ORNL) was conducted intermittently from February 1992 through May 1992. The investigation was performed by the Measurement Applications and Development Group of the Health and Safety Research Division of ORNL at the request of the US Department of Energy's Oak Ridge Operations Office and the ORNL Environmental Restoration Program. Results of this investigation indicate that the source of radioactive contamination at the point of the contamination incident is from one of the underground abandoned lines. The contamination in soil is likely the result of residual contamination from years of waste transport and maintenance operations (e.g., replacement of degraded joints, upgrading or replacement of entire pipelines, and associated landscaping activities). However, because (1) there is currently an active LLW line positioned in the same subsurface trench with the abandoned lines and (2) the physical condition of the abandoned lines may be brittle, this inquiry could not determine which abandoned line was responsible for the subsurface contamination. Soil sampling at the location of the contamination incident and along the pipeline route was performed in a manner so as not to damage the active LLW line and abandoned lines. Recommendations for corrective actions are included.

324 (ORNL/ER-150) Water quality monitoring report for the White Oak Creek Embayment: Environmental Restoration Program. Ford, C.J. (Oak Ridge National Lab., TN (United States)); Wefer, M.T. Oak Ridge National Lab., TN (United States); Automated Sciences Group, Inc., Oak Ridge, TN (United States). Jan 1993. 178p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (ESD-4039). Order Number DE93006841. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental Sciences Division Publication No. 4039.

Water quality monitoring activities that focused on the detection of resuspended sediments in the Clinch River were conducted in conjunction with the White Oak Creek Embayment (WOCE) time-critical Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) removal action to construct a sediment-retention structure at the mouth of White Oak Creek (WOC). Samples were collected by use of a 24-h composite sampler and through real-time water grab sampling of sediment plumes generated by the construction activities. Sampling stations were established both at the WOC mouth, immediately adjacent to the construction site, and at K-1513, the Oak Ridge K-25 Site drinking water intake approximately 9.6 km downstream in the Clinch River. Results are described.

325 (ORNL/ER-154) Investigation of groundwater flow zones and contaminant transport in Solid Waste Storage Area 5 at Oak Ridge National Laboratory, Oak Ridge, Tennessee: Environmental Restoration Program. Hicks, D.S.; Solomon, D.K.; Farrow, N.D. Oak Ridge National Lab., TN (United States). Sep 1992. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93000548. Source: OSTI; NTIS; GPO Dep.

Environmental Sciences Division Publication 3977.

An understanding of subsurface transport processes is essential to produce realistic predictions of future contaminant discharge from Solid Waste Storage Areas (SWSAs) at Oak Ridge National Laboratory (ORNL). Locating groundwater flow zones (permeable pathways) and determining the relative contributions of primary vs secondary contaminant sources are critical to the proper selection and evaluation of remedial actions. Because groundwater discharge from

SWSA 5 contributes significant amounts of ^3H and ^{90}Sr to the White Oak Creek watershed, an area on the southeastern edge of SWSA 5 was chosen for an investigation aimed at understanding and characterizing the subsurface movement of contaminants. Preliminary data collected in 1991 indicated that the vertical distribution of ^3H (0.02 to 279 $\mu\text{Ci/L}$) observed over the sampled interval (0 to 10 ft deep) may be a result of upward diffusion from a hydraulically dominant fracture (or fractured zone) below the sampled interval. The investigation continued this year (1992) with the primary objective of defining where the most permeable zones exist in the subsurface and how they relate to the vertical extent of ^3H . An open borehole was drilled on the southeastern edge of SWSA 5 through the upper zones of soil and saprolite and then through interbedded shales and limestones to a depth of about 26 ft. Two methods were used to determine permeable zones within the borehole. In addition, samples were collected monthly from a nearby well and seep (where tritiated groundwater discharges) to determine seasonal variability in the transport of ^3H and ^{90}Sr from the study area.

326 (ORNL/ER-155) Phase 1 data summary report for the Clinch River Remedial Investigation: Health risk and ecological risk screening assessment: Environmental Restoration Program. Cook, R.B.; Adams, S.M.; Beauchamp, J.J.; Bevelhimer, M.S.; Blaylock, B.G.; Brandt, C.C.; Ford, C.J.; Frank, M.L.; Gentry, M.J.; Holladay, S.K.; Hook, L.A.; Levine, D.A.; Longman, R.C.; McGinn, C.W.; Skiles, J.L.; Suter, G.W.; Williams, L.F. Oak Ridge National Lab., TN (United States). Environmental Sciences Div. Dec 1992. 466p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93006272. Source: OSTI; NTIS; INIS; GPO Dep.

The Clinch River Remedial Investigation (CRRI) is designed to address the transport, fate, and distribution of waterborne contaminants released from the US Department of Energy's (DOE's) Oak Ridge Reservation (ORR) and to assess potential risks to human health and the environment associated with these contaminants. The contaminants released since the early 1940s include a variety of radionuclides, metals, and organic compounds. The purpose of this report is to summarize the results of Phase 1 of the CRRI. Phase 1 was designed to (1) obtain high-quality data to confirm existing historical data for contaminant levels in fish, sediment, and water from the CR/WBR; (2) determine the in the range of contaminant concentrations present river-reservoir system; (3) identify specific contaminants of concern; and (4) establish the reference (background) concentrations for those contaminants.

327 (ORNL/ER-165) Source Areas Investigation Plan and Recommendation for Removal Actions at Waste Area Grouping 5 at Oak Ridge National Laboratory, Oak Ridge, Tennessee: Environmental Restoration Program. Newsom, T.J.; Blair, S.; Hicks, D.S.; Kettle, R.H. Oak Ridge National Lab., TN (United States). May 1993. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93015478. Source: OSTI; NTIS; GPO Dep.

This Source Area Investigation Plan and Recommendation for Removal Action (SAIP/RRA) was prepared in support of the regulatory working group for Oak Ridge National Laboratory (ORNL) Waste Area Grouping (WAG) 5. The purpose of the plan is to focus the investigation of and initiate potential groundwater seepage control actions for contaminant source areas at WAG 5. The SAIP/RRA addresses four discrete groundwater discharge areas (seeps) in or near WAG

5 that have been identified as significant contributors to the contaminant flux released from ORNL at White Oak Dam. Combined, these four seeps (designated Areas A, B, C, and D) contribute 25–50% and 20–45% of the total flux of tritium and strontium-90, respectively, in the White Oak Creek watershed. To reduce the release of contaminants from these areas and prevent further degradation of surface water, non-time-critical removal actions are proposed at the two areas characterized by discrete seeps: Areas C and D. An Engineering–Evaluation/Cost Analysis will be initiated to identify and evaluate feasible removal actions for these areas. Further investigation activities are planned at all four areas, and will emphasize, identifying and characterizing the contaminant source terms and migration pathways.

328 (ORNL/ER-166) Hydrologic data summary for the White Oak Creek Watershed at Oak Ridge National Laboratory, Oak Ridge, Tennessee, January–December 1992: Environmental Restoration Program. Borders, D.M.; Watts, J.A.; Clapp, R.B.; Frederick, B.J.; Gregory, S.M.; Moore, T.D. Oak Ridge National Lab., TN (United States). Jun 1993. 168p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93016912. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental Sciences Division Publication No. 4088.

This report summarizes, for the 12-month period (January through December 1992), the available dynamic hydrologic data collected, primarily, on the White Oak Creek (WOC) watershed along with information collected on the surface flow systems which affect the quality or quantity of surface water. The collection of hydrologic data is one component of numerous, ongoing Oak Ridge National Laboratory (ORNL) environmental studies and monitoring programs and is intended to: characterize the quantity and quality of water in the flow system; assist with the planning and assessment of remedial action activities; and provide long-term availability of data and quality assurance.

329 (ORNL/ER-169) Health and safety plan for the Remedial Investigation and Site Investigation of Waste Area Grouping 2 at the Oak Ridge National Laboratory, Oak Ridge, Tennessee: Environmental Restoration Program. Cofer, G.H.; Holt, V.L.; Roupe, G.W. Oak Ridge National Lab., TN (United States). Nov 1993. 91p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94003175. Source: OSTI; NTIS; GPO Dep.

This health and safety plan (HASP) was developed by the members of the Measurement Applications and Development Group of the Health Science Research Division at the Oak Ridge National Laboratory (ORNL). This plan was prepared to ensure that health and safety related items for the Waste Area Grouping (WAG) 2 Remedial Investigation (RI)/Feasibility Study and Site Investigation projects conform with the requirements of 29 CFR 1910.120 (April 18, 1992). The RI Plan calls for the characterization, monitoring, risk assessment, and identification of remedial needs and alternatives that have been structured and staged with short-term and long-term objectives. In early FY 1992, the WAG 2 RI was integrated with the ORNL Environmental Restoration (ER) Site Investigations program in order to achieve the complimentary objectives of the projects more effectively by providing an integrated basis of support. The combined effort was named the WAG 2 Remedial Investigation and Site Investigations Program (WAG 2 RI&SI). The Site Investigation activities are a series of monitoring efforts

and directed investigations that support other ER activities by providing information about (1) watershed hydrogeology; (2) contaminants, pathways, and fluxes for groundwater at ORNL; (3) shallow subsurface areas that can act as secondary sources of contaminants; and (4) biological populations and contaminants in biota, in addition to other support and coordination activities.

330 (ORNL/ER-169/S1) WAG 2 remedial investigation and site investigation site-specific work plan/health and safety checklist for the soil and sediment task: Environmental Restoration Program. Holt, V.L.; Burgoa, B.B. Oak Ridge National Lab., TN (United States). Dec 1993. 56p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94005996. Source: OSTI; NTIS; INIS; GPO Dep.

This document is a site-specific work plan/health and safety checklist (WP/HSC) for a task of the Waste Area Grouping 2 Remedial Investigation and Site Investigation (WAG 2 RI&SI). Title 29 CFR Part 1910.120 requires that a health and safety program plan that includes site- and task-specific information be completed to ensure conformance with health- and safety-related requirements. To meet this requirement, the health and safety program plan for each WAG 2 RI&SI field task must include (1) the general health and safety program plan for all WAG 2 RI&SI field activities and (2) a WP/HSC for that particular field task. These two components, along with all applicable referenced procedures, must be kept together at the work site and distributed to field personnel as required. The general health and safety program plan is the Health and Safety Plan for the Remedial Investigation and Site Investigation of Waste Area Grouping 2 at the Oak Ridge National Laboratory, Oak Ridge, Tennessee (ORNL/ER-169). The WP/HSCs are being issued as supplements to ORNL/ER-169.

331 (ORNL/ER-173) Surface radiological investigations at two creek receiving runoff from White Wing Scrap Yard, Oak Ridge Reservation, Oak Ridge, Tennessee: Environmental Restoration Program. Uziel, M.S.; Tiner, P.F.; Williams, J.K. Oak Ridge National Lab., TN (United States). Feb 1994. 72p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94009445. Source: OSTI; NTIS; INIS; GPO Dep.

A surface radiological investigation was conducted intermittently from August 1992 July 1993 at two creeks receiving runoff from White Wing Scrap Yard. In this report, the two creeks (both unnamed tributaries of Bear Creek) are, referred to as the east creek and the west creek based on their respective locations relative to White Wing Scrap Yard. The radiological survey of accessible areas at the east creek revealed no detectable gamma exposure rates above typical background levels (8 to 12 $\mu\text{R/h}$). The very slight elevations in gamma and beta-gamma levels found along the creek were generally associated with outcroppings of shale and typical of naturally occurring radionuclides present in such material. No radiological anomalies were associated with an oily sheen observed on the water at three locations, three 55-gal metal drums in or near the creek, a small pile of metal debris near the creek, or several enclosures used in a 1969 study of animal excretion rates. Radionuclide analysis of three soil samples collected at the east creek demonstrated typical of ^{60}Co , ^{137}Cs , gross alpha activity, gross beta activity, and ^{40}K .

332 (ORNL/ER-186) Results of two- and three-dimensional groundwater flow modeling for the design criteria studies in Waste Area Grouping 6 at Oak Ridge National Laboratory, Oak Ridge, Tennessee: Environmental Restoration Program. Oak Ridge National Lab., TN (United States); Ebasco Services, Inc., Oak Ridge, TN (United States). Dec 1993. 242p. Sponsored by US-DOE, Washington, DC (United States). DOE Contract AC05-84OR21400 ; AC05-91OR21928. Order Number DE94009443. Source: OSTI; NTIS; INIS; GPO Dep.

This report combines results from 2-D and 3-D groundwater flow simulations. An overview of the hydrogeologic setting of WAG 6 located at ORNL is presented followed by a discussion of the numerical models used. Model development is discussed for both the 3-D and 2-D models. Results are then presented for the 3-D models followed by results from the 2-D models. The report concludes with an integrated summary of conclusions. This report contains many figures because graphics are advantageous in effectively portraying modeling results.

333 (ORNL/ER-199) Groundwater level monitoring sampling and analysis plan for environmental monitoring in Waste Area Grouping 6 at Oak Ridge National Laboratory, Oak Ridge, Tennessee. Oak Ridge National Lab., TN (United States); CDM Federal Programs Corp., Oak Ridge, TN (United States). Apr 1994. 101p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94010812. Source: OSTI; NTIS; INIS; GPO Dep.

This Sampling and Analysis Plan addresses groundwater level monitoring activities that will be conducted in support of the Environmental Monitoring Plan for Waste Area Grouping (WAG) 6. WAG 6 is a shallow-burial land disposal facility for low-level radioactive waste at the Oak Ridge National Laboratory, a research facility owned by the US Department of Energy and managed by Martin Marietta Energy Systems, Inc. Groundwater level monitoring will be conducted at 129 sites within the WAG. All of the sites will be manually monitored on a semiannual basis. Forty-five of the 128 wells, plus one site in White Oak Lake, will also be equipped with automatic water level monitoring equipment. The 46 sites are divided into three groups. One group will be equipped for continuous monitoring of water level, conductivity, and temperature. The other two groups will be equipped for continuous monitoring of water level only. The equipment will be rotated between the two groups. The data collected from the water level monitoring will be used to support determination of the contaminant flux at WAG 6.

334 (ORNL/ER-200) Meteorological Monitoring Sampling and Analysis Plan for Environmental Monitoring in Waste Area Grouping 6 at Oak Ridge National Laboratory, Oak Ridge, Tennessee. Oak Ridge National Lab., TN (United States); CDM Federal Programs Corp., Oak Ridge, TN (United States). Dec 1993. 62p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94009504. Source: OSTI; NTIS; INIS; GPO Dep.

This Sampling and Analysis Plan addresses meteorological monitoring activities that will be conducted in support of the Environmental Monitoring Plan for Waste Area Grouping (WAG) 6. WAG 6 is a shallow-burial land disposal facility for low-level radioactive waste at the Oak Ridge National Laboratory (ORNL). Meteorological monitoring of various climatological parameters (eg., temperature, wind speed, humidity) will be collected by instruments installed at WAG

6. Data will be recorded electronically at frequencies varying from 5-min intervals to 1-h intervals, dependent upon parameter. The data will be downloaded every 2 weeks, evaluated, compressed, and uploaded into a WAG 6 data base for subsequent use. The meteorological data will be used in water balance calculations in support of the WAG 6 hydrogeological model.

335 (ORNL/ER-209) Surveillance Plan for environmental monitoring in Waste Area Grouping 6 at Oak Ridge National Laboratory, Oak Ridge, Tennessee. Oak Ridge National Lab., TN (United States); Gilbert/Commonwealth, Inc., Knoxville, TN (United States). Dec 1993. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94004790. Source: OSTI; NTIS; INIS; GPO Dep.

This Surveillance Plan has been developed as part of the Environmental Monitoring Plan for Waste Area Grouping 6 at Oak Ridge National Laboratory, Oak Ridge, Tennessee. Environmental monitoring will be conducted in two phases: the baseline monitoring phase and the routine annual monitoring phase. The baseline monitoring phase will be conducted to establish the baseline contaminant release conditions at the Waste Area Grouping (WAG), to confirm the site-related chemicals of concern (COC), and to gather data to confirm the site hydrologic model. The baseline monitoring phase is expected to begin in 1994 and continue for 12-18 months. The routine annual monitoring phase will consist of continued sampling and analyses of COC to determine off-WAG contaminant flux, to identify trends in releases, and to confirm the COC. The routine annual monitoring phase will continue for ~4 years after completion of the baseline monitoring phase. This Surveillance Plan presents the technical and quality assurance surveillance activities for the various WAG 6 environmental monitoring and data evaluation plans and implementing procedures.

336 (ORNL/ER/Sub-87/99053/5/V1) RCRA Facility Investigation report for Waste Area Grouping 6 at Oak Ridge National Laboratory, Oak Ridge, Tennessee: Volume 1, Sections 1 through 3: Environmental Restoration Program. Oak Ridge National Lab., TN (United States); Bechtel National, Inc., Oak Ridge, TN (United States); CH2M Hill Southeast, Inc., Oak Ridge, TN (United States); ERC Environmental and Energy Services Co., Oak Ridge, TN (United States); Peer Consultants, Inc., Oak Ridge, TN (United States). Sep 1991. 348p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (ES/ER-22/V1/D1). Order Number DE92007763. Source: OSTI; NTIS; INIS; GPO Dep.

WAG 6 comprises a shallow land burial facility used for disposal of low-level radioactive wastes (LLW) and, until recently, chemical wastes. As such, the site is subject to regulation under RCRA and the Comprehensive Environmental Response Compensation and Liability Act (CERCLA). To comply with these regulations, DOE, in conjunction with the Environmental Protection Agency (EPA) and the Tennessee Department of Environment and Conservation (TDEC), developed a strategy for closure and remediation of WAG 6 by 1997. A key component of this strategy was to complete an RFI by September 1991. The primary objectives of the RFI were to evaluate the site's potential human health and environmental impacts and to develop a preliminary list of alternatives to mitigate these impacts. The WAG 6 one of three solid waste management units evaluated Oak Ridge National Laboratory (ORNL)

existing waste disposal records and sampling data and performed the additional sampling and analysis necessary to: describe the nature and extent of contamination; characterize key contaminant transport pathways; and assess potential risks to human health and the environment by developing and evaluating hypothetical receptor scenarios. Estimated excess lifetime cancer risks as a result for exposure to radionuclides and chemicals were quantified for each hypothetical human receptor. For environmental receptors, potential impacts were qualitatively assessed. Taking into account regulatory requirements and base line risk assessment results, preliminary site closure and remediation objectives were identified, and a preliminary list of alternatives for site closure and remediation was developed.

337 (ORNL/ER/Sub-87/99053/5/V2) RCRA Facility Investigation report for Waste Area Grouping 6 at Oak Ridge National Laboratory, Oak Ridge, Tennessee: Volume 2, Sections 4 through 9: Environmental Restoration Program. Oak Ridge National Lab., TN (United States); Bechtel National, Inc., Oak Ridge, TN (United States); CH2M Hill Southeast, Inc., Oak Ridge, TN (United States); ERC Environmental and Energy Services Co., Oak Ridge, TN (United States); Peer Consultants, Inc., Oak Ridge, TN (United States). Sep 1991. 591p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (ES/ER-22/V2/D1). Order Number DE92007764. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents compiled information concerning a facility investigation of waste area group 6 (WAG-6), of the solid waste management units (SWMU's) at Oak Ridge National Laboratory (ORNL). The WAG is a shallow ground disposal area for low-level radioactive wastes and chemical wastes. The report contains information on hydrogeological data, contaminant characterization, radionuclide concentrations, risk assessment and baseline human health evaluation including a toxicity assessment, and a baseline environmental evaluation.

338 (ORNL/ER/Sub-87/99053/5/V3) RCRA Facility Investigation report for Waste Area Grouping 6 at Oak Ridge National Laboratory, Oak Ridge, Tennessee: Volume 3, Appendixes 1 through 8: Environmental Restoration Program. Oak Ridge National Lab., TN (United States); Bechtel National, Inc., Oak Ridge, TN (United States); CH2M Hill Southeast, Inc., Oak Ridge, TN (United States); ERC Environmental and Energy Services Co., Oak Ridge, TN (United States); Peer Consultants, Inc., Oak Ridge, TN (United States). Sep 1991. 701p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (ES/ER-22/V3/D1). Order Number DE92007771. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents compiled information concerning a facility investigation of waste area group 6 (WAG-6), of the solid waste management units (SWMU'S) at Oak Ridge National Laboratory (ORNL). The WAG is a shallow ground disposal area for low-level radioactive wastes and chemical wastes. The report contains information on hydrogeological data, contaminant characterization, radionuclide concentrations, risk assessment from doses to humans and animals and associated cancer risks, exposure via food chains, and historical data. (CBS)

339 (ORNL/ER/Sub-87/99053/5/V4) RCRA Facility Investigation report for Waste Area Grouping 6 at Oak Ridge National Laboratory, Oak Ridge, Tennessee: Volume 4, Technical memorandums 06-03A, 06-04A, 06-05A,

and 06-08A: **Environmental Restoration Program.** Oak Ridge National Lab., TN (United States); Bechtel National, Inc., Oak Ridge, TN (United States); CH2M Hill Southeast, Inc., Oak Ridge, TN (United States); ERC Environmental and Energy Services Co., Oak Ridge, TN (United States); Peer Consultants, Inc., Oak Ridge, TN (United States). Sep 1991. 250p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92007772. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents data and information related to remedial investigation studies for Oak Ridge National Laboratory (ORNL). Information is included on a soil gas survey, surface radiological investigations of waste areas, and well installation for ground water monitoring. (CBS)

340 (ORNL/ER/Sub-87/99053/5/V5) **RCRA Facility Investigation report for Waste Area Grouping 6 at Oak Ridge National Laboratory, Oak Ridge, Tennessee: Volume 5, Technical Memorandums 06-09A, 06-10A, and 06-12A: Environmental Restoration Program.** Oak Ridge National Lab., TN (United States); Bechtel National, Inc., Oak Ridge, TN (United States); CH2M Hill Southeast, Inc., Oak Ridge, TN (United States); ERC Environmental and Energy Services Co., Oak Ridge, TN (United States); Peer Consultants, Inc., Oak Ridge, TN (United States). Sep 1991. 581p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (ES/ER-22/V5/D1). Order Number DE92007773. Source: OSTI; NTIS; INIS; GPO Dep.

This report provides a detailed summary of the activities carried out to sample groundwater at Waste Area Grouping (WAG) 6. The analytical results for samples collected during Phase 1, Activity 2 of the WAG 6 Resource Conservation and Recovery Act Facility Investigation (RFI) are also presented. In addition, analytical results for Phase 1, activity sampling events for which data were not previously reported are included in this TM. A summary of the groundwater sampling activities of WAG 6, to date, are given in the Introduction. The Methodology section describes the sampling procedures and analytical parameters. Six attachments are included. Attachments 1 and 2 provide analytical results for selected RFI groundwater samples and ORNL sampling event. Attachment 3 provides a summary of the contaminants detected in each well sampled for all sampling events conducted at WAG 6. Bechtel National Inc. (BNI)/IT Corporation Contract Laboratory (IT) RFI analytical methods and detection limits are given in Attachment 4. Attachment 5 provides the Oak Ridge National Laboratory (ORNL)/Analytical Chemistry Division (ACD) analytical methods and detection limits and Resource Conservation and Recovery Act (RCRA) quarterly compliance monitoring (1988-1989). Attachment 6 provides ORNL/ACD groundwater analytical methods and detection limits (for the 1990 RCRA semi-annual compliance monitoring).

341 (ORNL/ER/Sub-87/99053/5/V6) **RCRA Facility Investigation report for Waste Area Grouping 6 at Oak Ridge National Laboratory, Oak Ridge, Tennessee: Volume 6, Technical memorandums 06-13, 06-14, and 06-15: Environmental Restoration Program.** Oak Ridge National Lab., TN (United States); Bechtel National, Inc., Oak Ridge, TN (United States); CH2M Hill Southeast, Inc., Oak Ridge, TN (United States); ERC Environmental and Energy Services Co., Oak Ridge, TN (United States); Peer Consultants, Inc., Oak Ridge, TN (United States). Sep 1991. 531p. Sponsored by USDOE, Washington, DC (United States). DOE

Contract AC05-84OR21400. (ES/ER-22/V6/D1). Order Number DE92007774. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes the borehole geophysical logging performed at selected monitoring wells at waste area grouping (WAG) 6 of Oak Ridge National Laboratory in support of the WAG 6 Resource Conservation and Recovery Act Facility Investigation (RFI). It identifies the locations and describes the methods, equipment used in the effort, and the results of the activity. The actual logs for each well logged are presented in Attachment 1 through 4 of the TM. Attachment 5 provide logging contractor service literature and Attachment 6 is the Oak Ridge National Laboratory (ORNL) Procedure for Control of a Nuclear Source Utilized in Geophysical logging. The primary objectives of the borehole geophysical logging program were to (1) identify water-bearing fractured bedrock zones to determine the placement of the screen and sealed intervals for subsequent installation, and (2) further characterize local bedrock geology and hydrogeology and gain insight about the deeper component of the shallow bedrock aquifer flow system. A secondary objective was to provide stratigraphic and structural correlations with existing logs for Hydraulic Head Monitoring Station (HHMS) wells, which display evidence of faulting.

342 (ORNL/ER/Sub-87-99053/56) **Environmental, safety, and health plan for the remedial investigation of Waste Area Grouping 10, Operable Unit 3, at Oak Ridge National Laboratory, Oak Ridge, Tennessee: Environmental Restoration Program.** Bechtel National, Inc., Oak Ridge, TN (United States); Oak Ridge National Lab., TN (United States). Oct 1993. 145p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94005480. Source: OSTI; NTIS; INIS; GPO Dep.

This document outlines the environmental, safety, and health (ES&H) approach to be followed for the remedial investigation of Waste Area Grouping (WAG) 10 at Oak Ridge National Laboratory. This ES&H Plan addresses hazards associated with upcoming Operable Unit 3 field work activities and provides the program elements required to maintain minimal personnel exposures and to reduce the potential for environmental impacts during field operations. The hazards evaluation for WAG 10 is presented in Sect. 3. This section includes the potential radiological, chemical, and physical hazards that may be encountered. Previous sampling results suggest that the primary contaminants of concern will be radiological (cobalt-60, europium-154, americium-241, strontium-90, plutonium-238, plutonium-239, cesium-134, cesium-137, and curium-244). External and internal exposures to radioactive materials will be minimized through engineering controls (e.g., ventilation, containment, isolation) and administrative controls (e.g., procedures, training, postings, protective clothing).

343 (ORNL/ER/Sub-87-99053/64) **Waste management plan for the remedial investigation/feasibility study of Waste Area Grouping 5 at Oak Ridge National Laboratory, Oak Ridge, Tennessee: Environmental Restoration Program.** Oak Ridge National Lab., TN (United States); Bechtel National, Inc., Oak Ridge, TN (United States). Dec 1992. 32p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93009335. Source: OSTI; NTIS; INIS; GPO Dep.

This plan defines the criteria and methods to be used for managing waste generated during activities associated with Waste Area Grouping (WAG) 5 at Oak Ridge National Laboratory (ORNL). WAG 5 is located in Melton Valley, south of the main ORNL plant area. It contains 17 solid waste

management units (SWMUs) to be evaluated during the remedial investigation. The SWMUs include three burial areas, two hydrofracture facilities, two settling ponds, eight tanks, and two low-level liquid waste leak sites. These locations are all considered to be within the WAG 5 area of contamination (AOC). The plan contains provisions for safely and effectively managing soils, rock cuttings, development and sampling water, decontamination fluids, and disposable personal protective equipment (PPE) consistent with the Environmental Protection Agency (EPA) guidance of May 1991 (EPA 1991). Consistent with EPA guidance, this plan is designed to protect the environment and the health and safety of workers and the public.

344 (ORNL/ER/Sub-90-KA931/2) **Floodplain and wetlands assessment of the White Oak Creek Embayment.** Oak Ridge National Lab., TN (United States); CDM Federal Programs Corp., Oak Ridge, TN (United States). Jul 1991. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92003674. Source: OSTI; NTIS; GPO Dep.

This report describes the proposed methods for dealing with contaminants that have accumulated in White Oak Creek, White Oak Lake, and the White Oak Creek Embayment as a result of process releases and discharges from the Oak Ridge National Laboratory. Alternative methods of cleaning up the area which were considered in accordance with regulatory guidelines are listed, and information supporting the selected methods is provided. Also included are results of a site survey conducted at the White Oak Creek Embayment and the expected effects of the proposed control structures on the floodplain and wetlands. The appendix contains figures showing the nine cross-sections of the stream channel surveyed during studies of the White Oak Creek area.

345 (ORNL/ER/Sub-91-KA931/4) **White Oak Creek Embayment time-critical CERCLA removal action sediment-retention structure: Environmental Restoration Program.** Oak Ridge National Lab., TN (United States). Environmental Restoration Div.; CDM Federal Programs Corp., Oak Ridge, TN (United States). Sep 1992. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93001420. Source: OSTI; NTIS; GPO Dep.

Over a 20-month period between September 1990 and April 1992, the Department of Energy (DOE), acting through Martin Marietta Energy Systems, Inc., managing contractor for the DOE Oak Ridge Field Office (DOE-OR), conducted a DOE-lead and DOE-funded time-critical removal action at the White Oak Creek Embayment (WOCE), pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The time-critical removal action specifically consisted of the design and construction of a sediment-retention structure across the mouth of WOCE to prevent off-site migration of sediments contaminated by cesium (^{137}Cs) into the Clinch River. Construction of a sediment-retention structure was completed in mid-April 1992. The purpose of this report is to meet the substantive requirements of 40 CFR 300.165 describing "a complete report on the removal operation and the actions taken." This section of the NCP specifically addresses on-scene coordinator reports for the Environmental Protection Agency (EPA) Superfund-lead actions and includes several elements that are not applicable to this DOE-lead action. Only those sections that are pertinent and applicable are addressed in this final report.

346 (ORNL/GWPO-006) **A case study of optimization in the decision process: Siting groundwater monitoring wells.** Cardwell, H.; Huff, D.; Douthitt, J.; Sale, M. Oak Ridge National Lab., TN (United States). Dec 1993. 45p. Sponsored by USDOE, Washington, DC (United States); Oak Ridge Inst. for Science and Education, TN (United States). DOE Contract AC05-84OR21400. (ORNL/M-3221). Order Number DE94005444. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental Science Division Publication No. 4183.

Optimization is one of the tools available to assist decision makers in balancing multiple objectives and concerns. In a case study of the siting decision for groundwater monitoring wells, we look at the influence of the optimization models on the decisions made by the responsible groundwater specialist. This paper presents a multi-objective integer programming model for determining the location of monitoring wells associated with a groundwater pump-and-treat remediation. After presenting the initial optimization results, we analyze the actual decision and revise the model to incorporate elements of the problem that were later identified as important in the decision-making process. The results of a revised model are compared to the actual siting plans, the recommendations from the initial optimization runs, and the initial monitoring network proposed by the decision maker.

347 (ORNL/M-3183) **Active sites environmental monitoring program: Annual report FY 1992.** Morrissey, C.M.; Ashwood, T.L.; Hicks, D.S. Oak Ridge National Lab., TN (United States). Apr 1994. 64p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94010119. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental Sciences Division Publication No. 4002.

This report summarizes the activities of the Active Sites Environmental Monitoring Program (ASEMP) at ORNL from October 1991 through September 1992. Solid Waste Operations and the Environmental Sciences Division established ASEMP in 1989 to provide early detection and performance monitoring at active low-level waste (LLW) disposal sites in Solid Waste Storage Area (SWSA) 6 and transuranic (TRU) waste storage sites in SWSA 5 as required by Chapter 2 and 3 of US Department of Energy Order 5820.2A. The Interim Waste Management Facility (IWMF) began operation in December 1991. Monitoring results from the tumulus and IWMF disposal pads continue to indicate that no LLW is leaching from the storage vaults. Storm water falling on the IWMF active pad was collected and transported to the Process Waste Treatment Plant while operators awaited approval of the National Pollutant Discharge Elimination System (NPDES) permit. Several of the recent samples collected from the active IWMF pad had pH levels above the NPDES limit of 9.0 because of alkali leached from the concrete. The increase in gross beta activity has been slight; only 1 of the 21 samples collected contained activity above the 5.0 Bq/L action level. Automated sample-collection and flow-measurement equipment has been installed at IWMF and is being tested. The flume designed to electronically measure flow from the IWMF pads and underpads is too large to be of practical value for measuring most flows at this site. Modification of this system will be necessary. A CO_2 bubbler system designed to reduce the pH of water from the pads is being tested at IWMF.

348 (ORNL/TM-11793) **Evaluation of 1985-1986 corrective actions at ORNL liquid waste disposal trench 7.** Spalding, B.P. Oak Ridge National Lab., TN (United

States). Apr 1991. 159p. Sponsored by USDOE, Washington, DC (USA). DOE Contract AC05-84OR21400. Order Number DE91013001. Source: OSTI; NTIS; INIS; GPO Dep.

Several corrective actions were taken in 1985-1986 at the site of ORNL radioactive liquid waste seepage trench 7 in an effort to reduce the discharge of radionuclides, mostly ^{60}Co , from a groundwater seep on the eastern side of the site. First, the size of the asphalt cap over the trench was doubled, and cap runoff was diverted away from the site to the west. Second, the buried waste transfer line to the trench was excavated and plugged and its pipe trench was dammed with clay backfill. These actions were designed to reduce groundwater recharge in the area that might be the source of water to the seep. Third, a series of grout injections was carried out at 5-ft intervals along a perimeter line on the eastern and northern edges of the site. A total of 65,500 gal of lime-fly-ash grout was injected at 303 locations at depths up to 40 ft in an effort to seal relict contaminated strata with probable hydrologic connection to the seep. However, the grout formulation specified in the contract would not set to a detectable compressive strength nor would the grout samples exhibit a reduction in hydraulic conductivity during over a year of observation. Thus, the material specification for the grout was inappropriate for the desired effect of in situ hydrologic isolation. Core sampling at the site revealed that the grout flowed into the soil formation along discrete thin layers. Only three grout layers, with a maximum thickness of 0.25 in., were found in over 90 ft of core from three locations along the grout injection line. Thus, this grouting action would have little potential to influence containment of radionuclides that leach from contaminated strata. 11 refs., 14 figs., 7 tabs.

349 (ORNL/TM-11838) In situ grouting of low-level burial trenches with a cement-based grout at Oak Ridge National Laboratory. Francis, C.W.; Spence, R.D.; Tamura, T.; Spalding, B.P. Oak Ridge National Lab., TN (United States). Jan 1993. 92p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93012513. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental Sciences Division Publication No. 3872.

A technology being evaluated for use in the closure of one of the low-level radwaste burial grounds at ORNL is trench stabilization using a cement-based grout. To demonstrate the applicability and effectiveness of this technology, two interconnecting trenches in SWSA 6 were selected as candidates for in situ grouting with a particulate grout. The primary objective was to demonstrate the increased trench stability (characterized by trench penetration tests) and the decreased potential for leachate migration (characterized by hydraulic conductivity tests) following in situ injection of a particulate grout into the waste trenches. Stability against trench subsidence is a critical issue. For example, construction of impermeable covers to seal the trenches will be ineffectual unless subsequent trench subsidence is permanently suspended. A grout composed of 39% Type 1 Portland cement, 55.5% Class F fly ash, and 5.5% bentonite mixed at 12.5 lb/gal of water was selected. Before the trenches were grouted, the primary characteristics relating to physical stability, hydraulic conductivity, and void volume of the trenches were determined. Their physical stability was evaluated using soil-penetration tests.

350 (ORNL/TM-11979) Development of remedial process options: Phase II, Feasibility study: Installation Restoration Program, Naval Air Station Fallon, Fallon, Nevada. Cronk, T.A. (Oak Ridge National Lab., TN (United

States)); Smuin, D.R.; Schlosser, R.M. Oak Ridge National Lab., TN (United States). Nov 1991. 218p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92007787. Source: OSTI; NTIS; GPO Dep.

This technical memorandum develops process options which are appropriate for environmental restoration activities at Naval Air Station Fallon (NAS Fallon), Nevada. Introduction of contaminants to the environment has resulted from deliberate disposal activities (both through dumping and landfilling) and accidental spills and leaks associated with normal activities at NAS Fallon over its lifetime of operation. Environmental sampling results indicate that the vast majority of contaminants of concern are petroleum hydrocarbon related. These contaminants include JP-4, JP-5, leaded and unleaded gasoline, waste oils and lubricants, hydraulic fluids, and numerous solvents and cleaners. The principal exposure pathways of concern associated with NAS Fallon contaminants appear to be the surface flows and shallow drainage systems to which the base contributes. Available data indicate NAS Fallon IR Program sites are not contributing excessive contamination to surface flows emanating from the base. Contaminants appear to be contained in a relatively immobile state in the shallow subsurface with little or no contaminant migration off site.

351 (ORNL/TM-11980) Characterization of uranium contaminated soils from DOE Fernald Environmental Management Project Site: Results of Phase 1 characterization. Lee, S.Y.; Marsh, J.D. Jr. Oak Ridge National Lab., TN (United States). Jan 1992. 57p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92007403. Source: OSTI; NTIS; GPO Dep.

Environmental Sciences Division Publication No. 3786.

The Integrated Demonstration (ID) for remediation of uranium- contaminated soils has been established by the DOE Office of Technology Development. The Fernald (Feed Materials Production Center) site was selected as the DOE facility for the field demonstration. The principle objective of this ID is to evaluate and compare the versatility, efficiency, and economics of various technologies that may be combined into systems for the removal of uranium from contaminated soils. Several leaching solutions were employed to determine their effectiveness in extracting uranium from the soil. The extractants and their means of preparation were: 0.1 N nitric acid [HNO_3]: 6.25 mL of concentrated nitric acid was diluted to 1 L with distilled water; 2% ammonium carbonate [$(\text{NH}_4)_2\text{CO}_3$]: 20 g of $(\text{NH}_4)_2\text{CO}_3$ was dissolved in distilled water and diluted to 1 L; 5% sodium hypochlorite (NaOCl): 50 mL of NaOCl reagent ($\text{Cl} < 6\%$) was diluted to 1 L with distilled water; 0.1 M ethylenediaminetetraacetic acid, disodium salt (EDTA): 37.224 g EDTA was dissolved in distilled water and diluted to 1 L; 2% citric acid monohydrate solution ($\text{H}_3\text{C}_6\text{H}_5\text{O}_7 \cdot \text{H}_2\text{O}$): 20 g of citric acid was diluted to 1 L with distilled water; 0.1 M hydroxylamine-hydrochloride ($\text{NH}_2\text{OH} \cdot \text{HCl}$) in 0.01 N nitric acid: 6.95 g ($\text{NH}_2\text{OH} \cdot \text{HCl}$) was dissolved and diluted to 1 L with 0.01 N HNO_3 . The 0.01 N nitric acid was prepared by diluting 3 mL concentrated nitric acid to 5 L with distilled water; and the sodium citrate-bicarbonate-dithionite (CBD) method: 0.3 M sodium citrate (88 g tribasic sodium citrate, $\text{Na}_3\text{C}_6\text{H}_5\text{O}_7 \cdot 2\text{H}_2\text{O}$, per liter); 1 M sodium bicarbonate (84 g NaHCO_3 per liter); and 5 g sodium dithionite, $\text{Na}_2\text{S}_2\text{O}_4$.

352 (ORNL/TM-12017) Comparative plant uptake and microbial degradation of trichloroethylene in the

rhizospheres of five plant species— implications for bioremediation of contaminated surface soils. Anderson, T.A. (Tennessee Univ., Knoxville, TN (United States)); Walton, B.T. Oak Ridge National Lab., TN (United States). Jan 1992. 204p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92007780. Source: OSTI; NTIS; GPO Dep.

Thesis submitted by T.A. Anderson to Univ. Tennessee, Knoxville, TN: ORNL Environmental Sciences Division Publication No. 3809.

The objective of this study was to collect data that would provide a foundation for the concept of using vegetation to enhance in situ bioremediation of contaminated surface soils. Soil and vegetation (*Lespedeza cuneata*, *Paspalum notatum*, *Pinus taeda*, and *Solidago* sp.) samples from the Miscellaneous Chemicals Basin (MCB) at the Savannah River Site were used in tests to identify critical plant and microbiological variables affecting the fate of trichloroethylene (TCE) in the root zone. Microbiological assays including phospholipid acid analyses, and ^{14}C -acetate incorporation were conducted to elucidate differences in rhizosphere and nonvegetated soil microbial communities from the MCB. The microbial activity, biomass, and degradation of TCE in rhizosphere soils were significantly greater than corresponding nonvegetated soils. Vegetation had a positive effect on microbial degradation of ^{14}C -TCE in whole-plant experiments. Soils from the MCB containing *Lespedeza cuneata*, *Pinus taeda*, and *Glycine max* mineralized greater than 25% of the ^{14}C -TCE added compared with less than 20% in nonvegetated soils. Collectively, these results provide evidence for the positive role of vegetation in enhancing biodegradation.

353 (ORNL/TM-12101) ORNL results for Test Case 1 of the International Atomic Energy Agency's research program on the safety assessment of Near-Surface Radioactive Waste Disposal Facilities. Thorne, D.J. (Oak Ridge National Lab., Grand Junction, CO (United States)); McDowell-Boyer, L.M.; Kocher, D.C.; Little, C.A.; Roemer, E.K. Oak Ridge National Lab., Grand Junction, CO (United States). [1993]. 53p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93016654. Source: OSTI; NTIS; INIS; GPO Dep.

The International Atomic Energy Agency (IAEA) started the Coordinated Research Program entitled "The Safety Assessment of Near-Surface Radioactive Waste Disposal Facilities." The program is aimed at improving the confidence in the modeling results for safety assessments of waste disposal facilities. The program has been given the acronym NSARS (Near-Surface Radioactive Waste Disposal Safety Assessment Reliability Study) for ease of reference. The purpose of this report is to present the ORNL modeling results for the first test case (i.e., Test Case 1) of the IAEA NSARS program. Test Case 1 is based on near-surface disposal of radionuclides that are subsequently leached to a saturated-sand aquifer. Exposure to radionuclides results from use of a well screened in the aquifer and from intrusion into the repository. Two repository concepts were defined in Test Case 1: a simple earth trench and an engineered vault.

354 (ORNL/TM-12169) RIVER-RAD: A computer code for simulating the transport of radionuclides in rivers. Hetrick, D.M.; McDowell-Boyer, L.M.; Sjoreen, A.L.; Thorne, D.J.; Patterson, M.R. Oak Ridge National Lab., TN (United States). Nov 1992. 71p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93007796. Source: OSTI; NTIS; INIS; GPO Dep.

A screening-level model, RIVER-RAD, has been developed to assess the potential fate of radionuclides released to rivers. The model is simplified in nature and is intended to provide guidance in determining the potential importance of the surface water pathway, relevant transport mechanisms, and key radionuclides in estimating radiological dose to man. The purpose of this report is to provide a description of the model and a user's manual for the FORTRAN computer code.

355 (ORNL/TM-12177) Selective leaching of uranium from uranium-contaminated soils: Progress report 1. Francis, C.W.; Mattus, A.J.; Farr, L.L.; Elles, M.P.; Lee, S.Y. Oak Ridge National Lab., TN (United States). Feb 1993. 59p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93010428. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental Sciences Division Publication No. 3980.

Three soils and a sediment contaminated with uranium were used to determine the effectiveness of sodium carbonate and citric acid leaching to decontaminate or remove uranium to acceptable regulatory levels. Two of the soils were surface soils from the DOE facility formerly called the Feed Materials Production Center (FMPC) at Fernald, Ohio. This facility is presently called the Fernald Environmental Management Project (FEMP). Carbonate extractions generally removed from 70 to 90% of the uranium from the Fernald storage pad soil. Uranium was slightly more difficult to extract from the Fernald incinerator and the Y-12 landfarm soils. Very small amounts of uranium could be extracted from the storm sewer sediment. Extraction with carbonate at high solution-to-soil ratios were as effective as extractions at low solution-to-soil ratios, indicating attrition by the paddle mixer was not significantly different than that provided in a rotary extractor. Also, pretreatments such as milling or pulverizing the soil sample did not appear to increase extraction efficiency when carbonate extractions were carried out at elevated temperatures (60°C) or long extraction times (23 h). Adding KMnO_4 in the carbonate extraction appeared to increase extraction efficiency from the Fernald incinerator soil but not the Fernald storage pad soil. The most effective leaching rates (> 90 % from both Fernald soils) were obtained using a citrate/dithionite extraction procedure designed to remove amorphous (noncrystalline) iron/aluminum sesquioxides from surfaces of clay minerals. Citric acid also proved to be a very good extractant for uranium.

356 (ORNL/TM-12201) Tracer-level radioactive pilot-scale test of in situ vitrification for the stabilization of contaminated soil sites at ORNL. Spalding, B.P. (Oak Ridge National Lab., TN (United States)); Jacobs, G.K.; Naney, M.T.; Dunbar, N.W.; Tixier, J.S.; Powell, T.D. Oak Ridge National Lab., TN (United States). Nov 1992. 199p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93007790. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental Sciences Division Publication No. 3962.

A field demonstration of in situ vitrification (ISV) was completed in May 1991, and produced approximately 12 Mg of melted earthen materials containing 12.7 mCi of radioactivity within 500 g of sludge in a model of an old seepage trench waste disposal unit. Past waste disposal operations at Oak Ridge National Laboratory have left several contaminated seepage sites. In planning for remediation of such sites, ISV technology has been identified as a leading candidate because of the high risks associated with any retrieval option and because of the usual high quality of vitreous waste

form. Major isotopes placed in the test trench were ^{137}Cs and ^{90}Sr , with lesser amounts of ^{60}Co , ^{241}Am , and $^{239,240}\text{Pu}$. A total of 29 MWh of electrical power was delivered to the ground over a 5-day period producing a melt depth of 8.5 ft. During melting, 2.4% of the ^{137}Cs volatilized from the melt into an off-gas containment hood and was captured quantitatively on a high efficiency particulate air filter. No volatilization of ^{90}Sr , ^{241}Am , or $^{239,240}\text{Pu}$ was detected and > 99.993% retention of these isotopes in the melt was estimated. The use of added rare earth tracers (Ce, La, and Nd), as surrogates for transuranic isotopes, led to estimated melt retentions of >99.9995% during the test. The molten material, composed of the native soil and dolomitic limestone used for filling the test trench, reached a processing temperature of 1500°C. Standardized leaching procedures using Product Consistency Testing indicated that the ISV product has excellent characteristics relative to other vitreous nuclear waste forms.

357 (ORNL/TM-12217) Pilot uranium lysimeter studies at the Oak Ridge Y-12 plant. Francis, C.W.; Hyder, L.K.; Howard, S.C.; Cline, J.E.; Clapp, R.B. Oak Ridge National Lab., TN (United States). Aug 1993. 76p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93019361. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental Sciences Division Publication No. 3981.

A field lysimeter test facility has been constructed at the Oak Ridge Y-12 plant to evaluate land burial of wastes containing depleted uranium. The principal objective in the construction of such a facility is to provide a means for monitoring waste leachate characteristics over time, in particular uranium concentrations in leachate. The design of the field lysimeter test facility allows, via the portals along the side walls of the lysimeter, the collection of leachate as a function of depth in the lysimeter. The methodology to collect leachate from within the field lysimeter has not been clearly defined. Thus, before wastes were loaded into the field lysimeter facility, a pilot lysimeter study was initiated to test several design concepts for the collection of in situ leachate. The primary objective of this pilot study was to demonstrate the feasibility and quality assurance of proposed instrumentation used to monitor leachate generation and characteristics in the full-scale field lysimeter. Secondary objectives included gaining experience in the handling/packing of wastes, installation/operation of the leachate collection devices, and waste leachate characterization.

358 (ORNL/TM-12235) Pilot-scale field tests for the methanotrophic technology cometabolic bioreactor demonstration at the Oak Ridge K-25 Site. Donaldson, T.L.; Lucero, A.J.; Jennings, H.L.; Herbes, S.E. Oak Ridge National Lab., TN (United States). Jun 1993. 59p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93017955. Source: OSTI; NTIS; GPO Dep.

This report describes a demonstration of cometabolic technology for bioremediation of groundwater contaminated with trichloroethylene (TCE) and other chlorinated and aromatic solvents conducted by Oak Ridge National Laboratory (ORNL). The technology demonstration is located at a seep from the K-1070-C/D Classified Burial Ground at the Oak Ridge K-25 Site. Funding for this demonstration is provided by the US Department of Energy (DOE), Environmental Restoration/Waste Management Program, Office of Technology Development.

359 (ORNL/TM-12260) X-231B technology demonstration for in situ treatment of contaminated soil: Laboratory evaluation of in situ vapor stripping. West, O.R. (Oak Ridge National Lab., TN (US)); Siegrist, R.L.; Jennings, H.L.; Lucero, A.J.; Greene, D.W.; Schmunk, S.W. Oak Ridge National Lab., TN (United States). Jun 1993. 99p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93019397. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental Sciences Division Publication No. 4105.

The goal of the study described in this report was to determine the efficiency of vapor stripping coupled with soil mixing for removing volatile organic compounds (VOCs) from clay soils such as those that underlie the PORTS X-231B Solid Waste Management Unit. This was accomplished by conducting experiments wherein contaminated soil cores were treated in the laboratory using a system that simulated a field-scale vapor stripping/soil mixing treatment process. Treatment efficiencies obtained using several sets of process conditions, such as air temperature and flow rate, were determined through subsampling of the soil cores to establish pre- and posttreatment levels of VOCs in the soil. Two series of experiments were conducted under this study. In the first series, laboratory treatment was performed on intact soil cores that were taken from contaminated zones within the PORTS X-231B Unit using sampler liners that could be adapted as reaction lysimeters. Since soil core disturbance was minimized using this approach, the treatability experiments were conducted on soil that was fairly close to in situ conditions in terms of both soil structure and contaminant levels. The second series of experiments were performed on cores that were packed using X-231B soil and spiked with known amounts of trichloroethylene (TCE). This approach was taken for the second series because the VOC levels in the intact cores were found to be much lower than field values. In addition, the packed cores were smaller than the intact soil cores, with treatment volumes that were about a fifth of the treatment volumes in the intact soil cores. The smaller packed cores were not only easier to handle but were also more reliably characterized due to smaller treatment volumes from which samples were taken.

360 Method and apparatus for removing ions from soil. Bibler, J.P. To Dept. of Energy. 1992. U.S. Patent Application 7-841,108. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE94007344. Source: OSTI; NTIS; GPO Dep.

This invention is comprised of a method and apparatus for selectively removing species of ions from an area of soil. Permeable membranes and impregnated with an ion exchange resin that is specific to one or more species of chemical ions are inserted into ground in close proximity to, and on opposing sides of, a soil area of interest. An electric potential is applied across electrodes and to cause the migration of ions out of soil area toward the membranes. Preferably, the resin exchanges ions of sodium or hydrogen for ions of mercury that it captures from soil area. Once membranes and become substantially saturated with mercury ions, the potential applied across electrodes and is discontinued and membranes and are preferably removed from soil for storage or recovery of the ions. The membranes are also preferably impregnated with a buffer to inhibit the effect of the hydrolysis of water by current from the electrodes.

361 (PNL-7866) Characteristics of the volatile organic compounds - Arid Integrated Demonstration Site.

Last, G.V.; Lenhard, R.J.; Bjornstad, B.N.; Evans, J.C.; Roberson, K.R.; Spane, F.A.; Amonette, J.E.; Rockhold, M.L. Pacific Northwest Lab., Richland, WA (United States). Oct 1991. 103p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92003882. Source: OSTI; NTIS; INIS; GPO Dep.

The Volatile Organic Compounds - Arid Integrated Demonstration Program (VOC-Arid ID) is targeted at demonstration and testing of technologies for the evaluation and cleanup of volatile organic compounds and associated contaminants at arid DOE sites. The initial demonstration site is an area of carbon tetrachloride (CCl₄) contamination located near the center of the Hanford Site. The movement of CCl₄ and other volatile organic contaminants in the subsurface is very complex. The problem at the Hanford Site is further complicated by the concurrent discharge of other waste constituents including acids, lard oil, organic phosphates, and transuranic radionuclides. In addition, the subsurface environment is very complex, with large spatial variabilities in hydraulic properties. A thorough understanding of the problem is essential to the selection of appropriate containment, retrieval, and/or in situ remedial technologies. The effectiveness of remedial technologies depends on knowing where the contaminants are, how they are held up in a given physical and chemical subsurface environment; and knowing the physical, chemical, and microbiological changes that are induced by the various remedial technologies.

362 (PNL-7872) Ground-water sample collection and analysis plan for the ground-water surveillance project. Bryce, R.W.; Evans, J.C.; Olsen, K.B. Pacific Northwest Lab., Richland, WA (United States). Dec 1991. 52p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92007842. Source: OSTI; NTIS; INIS; GPO Dep.

The Pacific Northwest Laboratory performs ground-water sampling activities at the US Department of Energy's (DOE's) Hanford Site in support of DOE's environmental surveillance responsibilities. The purpose of this document is to translate DOE's General Environmental Protection Program (DOE Order 5400.1) into a comprehensive ground-water sample collection and analysis plan for the Hanford Site. This sample collection and analysis plan sets forth the environmental surveillance objectives applicable to ground water, identifies the strategy for selecting sample collection locations, and lists the analyses to be performed to meet those objectives.

363 (PNL-8219) Technology status report: In situ vitrification applied to buried wastes. Thompson, L.E. (Pacific Northwest Lab., Richland, WA (United States)); Bates, S.O.; Hansen, J.E. Pacific Northwest Lab., Richland, WA (United States). Sep 1992. 80p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93000481. Source: OSTI; NTIS; GPO Dep.

This document is a technical status report on In Situ Vitrification (ISV) as applied to buried waste; the report takes both technical and institutional concerns into perspective. The ISV process involves electrically melting such contaminated solid media as soil, sediment, sludge, and mill tailings. The resultant product is a high-quality glass-and-crystalline waste form that possesses high resistance to corrosion and leaching and is capable of long-term environmental exposure without significant degradation. The process also significantly reduces the volume of the treated solid media due to the removal of pore spaces in the soil.

364 (PNL-8294) Standard and modified electrode engineering-scale in situ vitrification tests. Thompson, L.E. (Pacific Northwest Lab., Richland, WA (United States)); Tixier, J.S.; Winkelman, R.G. Pacific Northwest Lab., Richland, WA (United States). Sep 1992. 42p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93000479. Source: OSTI; NTIS; GPO Dep.

This report describes engineering-scale in situ vitrification (ISV) electrode tests conducted by Pacific Northwest Laboratory (PNL) for the US Department of Energy (DOE). (a) The purpose of these tests was to establish baseline data to serve as a foundation on which to improve the design of standard graphite rod electrodes, which are currently used in all applications. Changes in electrode design are proposed as one method to increase ISV melt depths that typically reach about 5 m. Melt depths of 10 m are needed to remediate some contaminated soil sites within the DOE complex. To establish baseline data, we performed a thermal distribution analysis and tested three electrode designs: (1) the standard graphite rod electrodes, (2) a modified design referred to as the composite graphite/molybdenum electrode, and (3) a second modified design, the dilated-tip graphite electrode. In total we performed six tests, two of each design. Within the scope of these tests, there were four specific objectives. Our first objective was to determine the influence of electrode design on monolith mass and shape. Our second objective was to determine the correlation between the actual test results and the results of the numerical heat distribution analysis using the TEMPEST code. Our third objective was to qualitatively evaluate the melt resistance and the electrode contact resistance that resulted from the three electrode designs. Finally, our fourth objective was to verify the reproducibility of the engineering-scale test results.

365 (PNL-8332) Status report on the development of a three-dimensional conceptual model for the Hanford Site unconfined aquifer system. Thorne, P.D.; Chamness, M.A. Pacific Northwest Lab., Richland, WA (United States). Nov 1992. 52p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93004483. Source: OSTI; NTIS; GPO Dep.

This report presents the status of development of a three-dimensional conceptual model for the unconfined aquifer system at Hanford. A conceptual model is needed to support development of a realistic three-dimensional numerical model for predicting ground-water flow and the transport of contaminants. The report focuses on developing a hydrogeologic framework, assessing available hydraulic property data, describing flow-system boundaries, and evaluating areal recharge and leakage. Geologic descriptions of samples obtained during well drilling were used to prepare cross sections that correlate relatively continuous layers. The layers were defined based on textural differences that are expected to reflect differences in hydraulic properties. Assigning hydraulic properties to the layers is a critical part of the conceptual model. Available hydraulic property data for the study area were compiled and were correlated with the geologic layers where possible. Flow-system boundaries are present within the study area at basalt outcrops and at the Columbia River. Boundary conditions have been evaluated for these areas. Available estimates of areal recharge from precipitation were compiled.

366 (PNL-8333) Preliminary evaluation of selected in situ remediation technologies for Volatile Organic Compound contamination at Arid sites. Lenhard, R.J.;

Gerber, M.A.; Amonette, J.E. Pacific Northwest Lab., Richland, WA (United States). Oct 1992. 65p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93002182. Source: OSTI; NTIS; GPO Dep.

To support the Volatile Organic Compounds-Arid Site (VOC-Arid) Integrated Demonstration (ID) in its technical, logistical, institutional, and economical testing of emerging environmental management and restoration technologies. Pacific Northwest Laboratory(a) is evaluating several in situ remediation technologies for possible inclusion in the demonstration. The evaluations are made with respect to the initial focus of the VOC-Arid ID: the carbon tetrachloride contamination at the Hanford Site, where it was disposed to the vadose zone along with other volatile and nonvolatile organic wastes, heavy metals, acids, and radionuclides. The purposes of this report are (1) to identify candidate in situ technologies for inclusion in the program, (2) to evaluate the candidate technologies based on their potential applicability to VOC contamination at arid sites and geologic conditions representative of the ID host site (i.e., Hanford Site), and (3) to prioritize those technologies for future US Department of Energy (DOE) support.

367 (PNL-8334) Cost/benefit analysis comparing ex situ treatment technologies for removing carbon tetrachloride from Hanford groundwater. Truex, M.J.; Brown, D.R.; Elliott, D.B. Pacific Northwest Lab., Richland, WA (United States). May 1993. 42p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93013934. Source: OSTI; NTIS; INIS; GPO Dep.

Pacific Northwest Laboratory conducted a cost/benefit and performance analysis to compare ex situ technologies that can be used to destroy the carbon tetrachloride (CCl_4) in the ground water of Hanford's 200 West Area. The objective of this work was to provide a direct quantitative and qualitative comparison of competing technologies. The technologies examined included a biological system, the Thermochemical Environmental Energy System II (TEES II), and a UV/oxidation system. The factors examined included key system operation parameters, impact on inorganic contaminants in the ground water, and secondary waste production. The cost effectiveness of these destruction technologies was also compared to the cost for an air stripping/granular activated carbon (AS/GAC) system. While the AS/GAC system appeared to be more cost effective at many levels than the CCl_4 destruction technologies, the secondary waste produced by this system may lead to significant cost and/or regulatory problems. The factors with the greatest influence on cost for each destruction technology are as follows: nutrient requirements for both of the biological systems, electricity requirements and the type of unit operations for the TEES II process, and electricity requirements for UV/oxidation.

368 (PNL-8358) Evaluating long-term performance of in situ vitrified waste forms: Methodology and results. McGrail, B.P.; Olson, K.M. Pacific Northwest Lab., Richland, WA (United States). Nov 1992. 74p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93004277. Source: OSTI; NTIS; INIS; GPO Dep.

In situ vitrification (ISV) is an emerging technology for the remediation of hazardous and radioactive waste sites. The concept relies on the principle of Joule heating to raise the temperature of a soil between an array of electrodes above

the melting temperature. After cooling, the melt solidifies into a massive glass and crystalline block similar to naturally occurring obsidian. Determining the long-term performance of ISV products in a changing regulatory environment requires a fundamental understanding of the mechanisms controlling the dissolution behavior of the material. A series of experiments was performed to determine the dissolution behavior of samples produced from the ISV processing of typical soils from the Idaho National Engineering Laboratory subsurface disposal area. Dissolution rate constant measurements were completed at 90°C over the pH range 2 to 11 for one sample obtained from a field test of the ISV process.

369 (PNL-8478) Soil erosion rates caused by wind and saltating sand stresses in a wind tunnel. Ligothe, M.W. Pacific Northwest Lab., Richland, WA (United States). Feb 1993. 83p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93009154. Source: OSTI; NTIS; INIS; GPO Dep.

Wind erosion tests were performed in a wind tunnel in support of the development of long-term protective barriers to cap stabilized waste sites at the Hanford Site. Controlled wind and saltating sand erosive stresses were applied to physical models of barrier surface layers to simulate worst-case eolian erosive stresses. The goal of these tests was to provide information useful to the design and evaluation of the surface layer composition of an arid-region waste site barrier concept that incorporates a deep fine-soil reservoir. A surface layer composition is needed that will form an armor resistant to eolian erosion during periods of extreme dry climatic conditions, especially when such conditions result in the elimination or reduction of vegetation by water deprivation or wildfire. Because of the life span required of Hanford waste barriers, it is important that additional work follow these wind tunnel studies. A modeling effort is planned to aid the interpretation of test results with respect to the suitability of pea gravel to protect the finite-soil reservoir during long periods of climatic stress. It is additionally recommended that wind tunnel tests be continued and field data be obtained at prototype or actual barrier sites. Results will contribute to barrier design efforts and provide confidence in the design of long-term waste site caps for arid regions.

370 (PNL-SA-19511) Remedial action assessment system: Decision support for environmental cleanup. Pennock, K.A.; Bohn, S.; Franklin, A.L. Pacific Northwest Lab., Richland, WA (United States). Nov 1991. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9111176-1: International symposium on artificial intelligence, Cancun (Mexico), 13-15 Nov 1991). Order Number DE92006507. Source: OSTI; NTIS; GPO Dep.

A large number of hazardous waste sites across the United States await treatment. Waste sites can be physically complex entities composed of multiple, possibly interacting contaminants distributed throughout one or more media. The sites may be active as well with contaminants escaping through one or more potential escape paths. Treatment of these sites requires a long and costly commitment involving the coordination of activities among several waste treatment professionals. In order to reduce the cost and time required for the specification of treatment at these waste sites, The Remedial Action Assessment System (RAAS) was proposed. RAAS is an automated information management system which utilizes a combination of expert reasoning and numerical models to produce the combinations of treatment technologies, known as treatment trains, which satisfy the

treatment objectives of a particular site. In addition, RAAS supports the analysis of these trains with regard to effectiveness and cost so that the viable treatment trains can be measured against each other. The Remedial Action Assessment System is a hybrid system designed and constructed using object-oriented tools and techniques. RAAS is advertised as a hybrid system because it combines, in integral fashion, numerical computing (primarily quantitative models) with expert system reasoning. An object-oriented approach was selected due to many of its inherent advantages, among these the naturalness of modeling physical objects and processes.

371 (PNL-SA-19646) **Bioremediation of Hanford groundwater.** Brouns, T.M.; Anderson, D.B.; Fredrickson, J.K.; Luttrell, S.P.; Skeen, R.S.; Workman, D.J. Pacific Northwest Lab., Richland, WA (United States). Sep 1991. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-910981-25: Environmental remediation '91 conference, Pasco, WA (United States), 8-11 Sep 1991). Order Number DE92000799. Source: OSTI; NTIS; INIS; GPO Dep.

Liquid wastes containing radioactive, hazardous, and regulated chemicals have been generated throughout the 40 years of operations at the US Department of Energy's (DOE) Hanford Site. Some of these wastes were discharged to the soil column and many of the waste components, including nitrate (NO_3), carbon tetrachloride (CCl_4), and several radionuclides, have been detected in the Hanford groundwater. Current DOE policy prohibits the disposal of contaminated liquids directly to the environment, and remediation of existing contaminated groundwaters may be required. A research and development program is underway to develop bioremediation technologies for both ex situ and in situ groundwater treatment. 16 refs., 2 figs., 3 tabs.

372 (PNL-SA-19908) **Potential for using a six-phase alternating current power supply system for in situ vitrification.** Richardson, R.L. Pacific Northwest Lab., Richland, WA (United States). Sep 1991. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-910981-15: Environmental remediation '91 conference, Pasco, WA (United States), 8-11 Sep 1991). Order Number DE92000057. Source: OSTI; NTIS; INIS; GPO Dep.

In situ vitrification (ISV) has been identified as a potential treatment technology for stabilizing underground tanks at Hanford and other US Department of Energy (DOE) sites. A key requirement for this application is an electrical system that can supply the power needed to vitrify a tank in a single setting. This paper describes an engineering-scale test conducted at the Pacific Northwest Laboratory (PNL) to assess the efficiency of a six-electrode, six-phase energy supply system in melting soil. The test was conducted with a 30-kW six-phase system. Based on the test results, a six-electrode, six-phase system shows potential for scaleup to larger systems. 5 refs., 5 figs., 2 tabs.

373 (PNL-SA-19974) **In situ vitrification of buried waste: Containment issues and suppression systems.** Luey, J.; Powell, T.D. Pacific Northwest Lab., Richland, WA (United States). Mar 1992. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-920307-57: Waste management '92, Tucson, AZ (United States), 1-5 Mar 1992). Order Number DE92010489. Source: OSTI; NTIS; INIS; GPO Dep.

Pacific Northwest Laboratory (PNL) and Idaho National Engineering Laboratory (INEL) are developing a remedial action technology for buried waste through the adaptation of the in situ vitrification (ISV) process. The ISV process is a thermal treatment process originally developed for the US Department of Energy (DOE) to stabilize soils contaminated with transuranic waste. ISV tests with buried waste forms have demonstrated that the processing of buried waste is more dynamic than the processing of soils. This paper will focus on the issue of containment of the gases released during the processing of buried waste and on engineered suppression systems to alleviate transient events associated with dynamic off-gassing from the ISV melt.

374 (PNL-SA-20486) **Multivariate methods in nuclear waste remediation: Needs and applications.** Pulsipher, B.A. Pacific Northwest Lab., Richland, WA (United States). May 1992. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9205174-1: 7. international conference on multivariate statistics, University Park, PA (United States), 5-9 May 1992). Order Number DE92015094. Source: OSTI; NTIS; INIS; GPO Dep.

The United States Department of Energy (DOE) has developed a strategy for nuclear waste remediation and environmental restoration at several major sites across the country. Nuclear and hazardous wastes are found in underground storage tanks, containment drums, soils, and facilities. Due to the many possible contaminants and complexities of sampling and analysis, multivariate methods are directly applicable. However, effective application of multivariate methods will require greater ability to communicate methods and results to a non-statistician community. Moreover, more flexible multivariate methods may be required to accommodate inherent sampling and analysis limitations. This paper outlines multivariate applications in the context of select DOE environmental restoration activities and identifies several perceived needs.

375 (PNL-SA-20508) **In situ vitrification: Technology status and a survey of new applications.** Thompson, L.E. Pacific Northwest Lab., Richland, WA (United States). Feb 1992. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-920220-1: International specialty conference: in situ treatment of contaminated soil and water, Cincinnati, OH (United States), 4-6 Feb 1992). Order Number DE92010866. Source: OSTI; NTIS; GPO Dep.

Pacific Northwest Laboratory (PNL) is developing a thermal treatment process called in situ vitrification (ISV) for remediating contaminated soils, underground structures such as tanks, and buried wastes. ISV was initially developed for contaminated soil applications in 1980 and has since become a mature technology for these applications. Relatively new applications of ISV to underground structures and buried wastes are currently in the development stages. This paper will outline the development progress of the ISV technology, including the results of demonstrations and other field-scale testing performed to date, and examine the key remaining issues associated with new ISV applications. Progress on issues attendant to waste form performance and economics will be addressed.

376 (PNL-SA-20510) **Office of Technology Development's integrated program for development of in situ remediation technologies.** Peterson, M.E. (Pacific Northwest Lab., Richland, WA (United States)); Shupe, M.;

Walker, J.; Ellis, B. Pacific Northwest Lab., Richland, WA (United States). Mar 1992. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-920307-52: Waste management '92, Tucson, AZ (United States), 1-5 Mar 1992). Order Number DE92010495. Source: OSTI; NTIS; INIS; GPO Dep.

The In-Situ Remediation Integrated Program (ISR IP) was initiated in FY 1991 and is progressing through the planning stages. The ISR IP currently plans to invest in the development of in situ bioremediation for the cleanup of volatile organics in the vadose zone and in groundwater, and in R&D activities to support the development of electrokinetics. Additional investment decisions will be made as a result of convening technical support groups to evaluate and recommend R&D activities for other in situ remediation technologies. The major activities for this fiscal year include the overall planning for the ISR IP. A five-year program plan to be prepared later this year will establish the long-term goals for the program. To support the preparation of this plan, interfaces with the integrated demonstrations, environmental restoration and waste operations have been formed to assure that the R&D activities are focused on the priority problem descriptions and technology needs.

377 (PNL-SA-20547) Vitrification of underground storage tanks: Technology development, regulatory issues, and cost analysis. Tixier, J.S.; Corathers, L.A.; Anderson, L.D. Pacific Northwest Lab., Richland, WA (United States). Mar 1992. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-920307-56: Waste management '92, Tucson, AZ (United States), 1-5 Mar 1992). Order Number DE92010490. Source: OSTI; NTIS; INIS; GPO Dep.

In situ vitrification (ISV), developed by the Pacific Northwest Laboratory (PNL) for the US Department of Energy (DOE), is a thermal treatment process for the remediation of hazardous, radioactive, or mixed waste sites. The process has been broadly patented both domestically and abroad. Since the inception of ISV in 1980, developmental activities have been focused on applications to contaminated soils, and more recently the potential for application to buried wastes and underground structures (tanks). Research performed to date on the more advanced ISV applications (i.e., application to buried wastes and underground tanks) shows that significant technical and economic potential exists for using ISV to treat buried wastes and underground structures containing radionuclides and/or hazardous constituents. Present ISV applications are directed to the treatment of contaminated soils; the likelihood of using ISV to treat underground tanks depends on the resolution of significant technical and institutional issues related to this advanced application. This paper describes the ISV process and summarizes the technical progress of underground tank vitrification (UTV), discusses pertinent regulatory issues facing the use of UTV, and presents the potential cost of UTV relative to other remedial action alternatives.

378 (PNL-SA-20622) Effects of lag and maximum growth in contaminant transport and biodegradation modeling. Wood, B.D. (Pacific Northwest Lab., Richland, WA (United States)); Dawson, C.N. Pacific Northwest Lab., Richland, WA (United States). Jun 1992. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9206116-4: 9. international conference on computational methods in water resources, Denver, CO (United States), 9-12 Jun 1992). Order Number DE92019125. Source: OSTI; NTIS; INIS; GPO Dep.

The effects of time lag and maximum microbial growth on biodegradation in contaminant transport are discussed. A mathematical model is formulated that accounts for these effects, and a numerical case study is presented that demonstrates how lag influences biodegradation.

379 (PNL-SA-20623) Kinetics of in situ bioremediation of Hanford groundwater. Skeen, R.S. (Pacific Northwest Lab., Richland, WA (United States)); Cote, S.M.; Truex, M.J.; Petersen, J.N. Pacific Northwest Lab., Richland, WA (United States). Apr 1992. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-920851-82: Spectrum '92: nuclear and hazardous waste management international topical meeting, Boise, ID (United States), 23-27 Aug 1992). Order Number DE93001380. Source: OSTI; NTIS; INIS; GPO Dep.

Liquid wastes containing radioactive, hazardous, and regulated chemicals have been generated throughout the 40+ years of operations at the US Department of Energy's (DOE) Hanford Site. Some of these wastes were discharged to the soil column and many of the waste components, including nitrate, carbon tetrachloride (CCl_4), and several radionuclides, have been detected in the Hanford groundwater. Current DOE policy prohibits the disposal of contaminated liquids directly to the environment, and may require the remediation of existing contaminated groundwaters. In situ bioremediation is one technology currently being developed at Hanford to meet the need for cost effective technologies to clean groundwater contaminated with CCl_4 , nitrate, and other organic and inorganic contaminants. This paper focuses on the latest results of an on-going effort to quantify the biological and chemical reactions that would occur during in situ bioremediation.

380 (PNL-SA-20825) Investigation of electric fields for low-temperature treatment of soils and liquids. Heath, W.O.; Goheen, S.C.; Miller, M.C.; Richardson, R.L. Pacific Northwest Lab., Richland, WA (United States). Feb 1992. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-920220-2: International specialty conference: in situ treatment of contaminated soil and water, Cincinnati, OH (United States), 4-6 Feb 1992). Order Number DE94004288. Source: OSTI; NTIS; INIS; GPO Dep.

Work was performed to assess the feasibility of an in situ technology for decomposing and removing hazardous organic waste compounds from soils. The technology is based on conductive soil heating and partial electrical discharges (corona) combined with soil-vapor extraction. A pilot-scale facility was developed and used to evaluate the ability to heat and dry soils using polyphase electricity applied through inserted pipes. Uniform heating ($100 \pm 2^\circ\text{C}$) and drying to 1.2-wt % moisture were observed. Heating and resultant in situ steam formation have been demonstrated in previous studies to be effective in removing volatile and semivolatile compounds. Corona reactors were constructed to investigate decomposition of organic compounds by oxidants produced in a point-to-liquid corona discharge in ambient air at room temperature and pressure. Point-to-liquid corona was found to be capable of destroying a wide variety of organics, including three aromatics, two polyaromatics, a pcn, a pcb, an alkane, an alkene, an amide, a complexant, a chelator, and an organic dye. Tests with trichloroethylene demonstrated a decontamination factor of 2×10^5 (equal to a destruction efficiency of 99.999995%) and nearly complete (99.7%) mineralization, with the main byproduct being aqueous chloride ions. Real-time data on

the decolorization kinetics of aqueous methylene blue were obtained using in situ probe colorimetry. Reaction rates were directly proportional to the amount of unreacted dye present and the square of electrode current. Other exploratory tests were performed to investigate concepts for generating ac corona discharges in soil and the ability of those discharges to decompose adsorbed organic compounds. All findings are discussed in relation to a conceptual soil-treatment scenario that includes a description of the basic hardware requirements.

381 (PNL-SA-20853) The In Situ Vitrification Integrated Program: Focusing an innovative solution on environmental restoration needs. Buelt, J.L.; Thompson, L.E. Pacific Northwest Lab., Richland, WA (United States). Aug 1992. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-920851-88: Spectrum '92: nuclear and hazardous waste management international topical meeting, Boise, ID (United States), 23-27 Aug 1992). Order Number DE93008915. Source: OSTI; NTIS; GPO Dep.

The objective of the In Situ Vitrification (ISV) Integrated Program is to ensure that ISV is a viable alternative for DOE environmental restoration applications. The program focuses ISV development activities upon DOE-wide environmental remediation needs and resolves issues inhibiting timely implementation on DOE sites. Currently the ISV Integrated Program is focused on contaminated soil sites but is also resolving some key issues that are common to soils and to potential future applications such as buried waste and underground structures. This paper describes the status and current focus of the ISV Integrated Program.

382 (PNL-SA-20868) Office of Technology Development integrated program for development of in situ remediation technologies. Peterson, M. Pacific Northwest Lab., Richland, WA (United States). Aug 1992. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-920851-81: Spectrum '92: nuclear and hazardous waste management international topical meeting, Boise, ID (United States), 23-27 Aug 1992). Order Number DE93001312. Source: OSTI; NTIS; INIS; GPO Dep.

The Department of Energy's Office of Technology Development has instituted an integrated program focused on development of in situ remediation technologies. The development of in situ remediation technologies will focus on five problem groups: buried waste, contaminated soils, contaminated groundwater, containerized wastes and underground detonation sites. The contaminants that will be included in the development program are volatile and non volatile organics, radionuclides, inorganics and highly explosive materials as well as mixtures of these contaminants. The In Situ Remediation Integrated Program (ISR IP) has defined the fiscal year 1993 research and development technology areas for focusing activities, and they are described in this paper. These R&D topical areas include: nonbiological in situ treatment, in situ bioremediation, electrokinetics, and in situ containment.

383 (PNL-SA-20984) Assessing the public regulatory acceptability of deploying new cleanup technologies: A case study of the integrated demonstration for Remediation of Volatile Organic Compounds at Arid Sites. McCabe, G.H. (Battelle Seattle Research Center, WA (United States)); Stein, S.L. Pacific Northwest

Lab., Richland, WA (United States). Aug 1992. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-920851-87: Spectrum '92: nuclear and hazardous waste management international topical meeting, Boise, ID (United States), 23-27 Aug 1992). Order Number DE93008261. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy (DOE) is funding several integrated demonstrations (IDs) around the United States in an effort to improve the pace and effectiveness of cleaning up its sites. The objective of these IDs is to demonstrate an array of innovative cleanup technologies that address the specific needs at a site and to provide deployable technologies to all DOE sites with similar environmental problems. This approach eliminates the need to redemonstrate these technologies at multiple sites, thereby minimizing technology development cost and schedule requirements. However, for an ID to be truly successful, the technologies must be technically sound, acceptable to the various interested or concerned individuals and groups who feel they have a stake in the case (often referred to as stakeholders), and acceptable to the regulators responsible for approving the technologies' deployment. As a result, the ID for Remediation of Volatile Organic Compounds at Arid Sites (VOC-Arid ID) has instituted a process for assessing public and regulatory acceptability of the technologies that it is developing. As part of this process, an information system has been developed that describes the innovative technologies being supported under the VOC-Arid ID. It also compares innovative technologies with the baseline technologies currently in use by environmental restoration personnel.

384 (PNL-SA-21257) In situ vitrification: Providing a comprehensive solution for remediation of contaminated soils. Tixier, J.S.; Thompson, L.E. Pacific Northwest Lab., Richland, WA (United States). Sep 1993. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830 ; AC05-84OR21400. (CONF-930906-16: '93 international conference on nuclear waste management and environmental remediation, Prague (Czech Republic), 5-11 Sep 1993). Order Number DE94004316. Source: OSTI; NTIS; INIS; GPO Dep.

In situ vitrification is a thermal treatment technology being developed for remediation of contaminated soils. The process transforms easily leached, contaminated soils into a leach-resistant, vitreous and crystalline monolith. The process is applicable to a wide range of soil types and conditions that include virtually any combination of radioactive, hazardous, and mixed waste contaminants. The process is currently applicable to sites that are less than 5-m deep and that do not contain sealed containers. The range of capabilities and limitations of the process is discussed in the paper. Also discussed are the results of two recent demonstrations, one a pilot-scale test on a model radioactive site at Oak Ridge, TN, the other a full-scale test on a mixed waste disposal crib at Hanford, WA. These and other successful tests have led to preparation for three near-term future demonstrations at these sites; a discussion of the plans and expectations for the demonstrations is also included in the paper.

385 (PNL-SA-21537) Field test of Six-Phase Soil Heating and evaluation of engineering design code. Bergsman, T.M.; Roberts, J.S.; Lessor, D.L.; Heath, W.O. Pacific Northwest Lab., Richland, WA (United States). Feb 1993. 11p. Sponsored by USDOE, Washington, DC (United

States). DOE Contract AC06-76RL01830. (CONF-930205-34: Waste management '93, Tucson, AZ (United States), 28 Feb - 4 Mar 1993). Order Number DE93009477. Source: OSTI; NTIS; INIS; GPO Dep.

A field test was conducted to evaluate the performance of Six-Phase Soil Heating to enhance the removal of contaminants. The purpose of the test was to determine the scale-up characteristics of the Six-Phase Soil Heating technology and to evaluate a computer process simulator developed for the technology. The test heated a 20-ft diameter cylinder of uncontaminated soil to a 10-ft depth. Six-phase ac power was applied at a rate of 30–35 kW using a power system built from surplus electrical components. The test ran unattended, using a computer-based system to record data, alert staff of any excursions in operating conditions via telephone, and provide automatic shut-off of power depending on the type of excursion. The test data included in situ soil temperatures, voltage profiles, and moisture profiles (using a neutron-probetechnique). After 50 days of heating, soil in the center of the array at the 6-ft depth reached 80°C. Soil temperatures between the two electrodes at this depth reached approximately 75°C. Data from this test were compared with those predicted by a computer process simulator. The computer process simulator is a modified version of the TOUGH2 code, a thermal porous media code that can be used to determine the movement of air and moisture in soils. The code was modified to include electrical resistive heating and configured such that an application could be run quickly on a workstation (approximately 5 min for 1 day of field operation). Temperature and soil resistance data predicted from the process simulations matched actual data fairly closely. A series of parametric studies was performed to assess the effect of simulation assumptions on predicted parameters.

386 (PNL-SA-21706) In situ vitrification: Demonstrated capabilities and potential applications. Luey, J.K. Pacific Northwest Lab., Richland, WA (United States). Jan 1993. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-930160-10: 2. semi-annual Office of Technology Development (OTD) information meeting, Houston, TX (United States), 26-28 Jan 1993). Order Number DE93007880. Source: OSTI; NTIS; INIS; GPO Dep.

A large-scale demonstration of the in situ vitrification (ISV) process was performed in April 1990 on the 116-B-6A Crib in the 100 Area of the Hanford Site in southeastern Washington. The 116-B-6A Crib is a radioactive mixed waste site and was selected to demonstrate the applicability of ISV to soils contaminated with mixed wastes common to many US Department of Energy (DOE) sites. Results from the demonstration show that the ISV process is a viable remediation technology for contaminated soils. The demonstration of the ISV process on an actual contaminated soil site followed research and development efforts by the Pacific Northwest Laboratory (PNL) over the last 10 years. PNL's research has led to the development of the ISV process as a viable remediation technology for contaminated soils and the creation of a commercial supplier of ISV services, Geosafe Corporation. Development efforts for ISV applications other than treatment of contaminated soils, by PNL and in collaboration with Oak Ridge National Laboratory (ORNL) and Idaho National Engineering Laboratory (INEL), show the ISV process has potential applicability for remediating buried waste sites, remediating underground storage tanks, and enabling the placement of subsurface vitrified barriers and engineered structures. This paper discusses the results from the April 1990 large-scale demonstration and provides a

general overview of the current capabilities of the ISV process for contaminated soils. In addition, this paper outlines some of the technical issues associated with other ISV applications and provides a qualitative discussion of the level of effort needed to resolve these technical issues.

387 (PNL-SA-21710) Tunable hybrid plasma decomposition of dilute concentrations of CC14 in air. Truex, M.J. (Pacific Northwest Lab., Richland, WA (United States)); Bromberg, L.; Cohn, D.R.; Koch, M.; Patrick, R.M.; Thomas, P. Pacific Northwest Lab., Richland, WA (United States). Jan 1993. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-930160-7: 2. semi-annual Office of Technology Development (OTD) information meeting, Houston, TX (United States), 26-28 Jan 1993). Order Number DE93007993. Source: OSTI; NTIS; GPO Dep.

At the Department of Energy Hanford site, a large quantity of the industrial solvent carbon tetrachloride (CC14) was used and subsequently disposed of in leaching fields. Efforts under the Volatile Organic Compound - Arid Integrated Demonstration Program (VOC-Arid ID) are directed at vapor extraction of carbon tetrachloride from the ground and its subsequent decomposition in the contaminated humid air stream. We are developing a mobile electron-beam driven plasma reactor for versatile efficient on-site decomposition of CC14 and other VOCs in carrier gases at atmospheric pressure. The decomposition of the VOCs could result in the generation of CO₂, light hydrocarbons, and reactive chlorine compounds. The latter dissolve and/or dissociate in aqueous solutions.

388 (PNL-SA-21730) Bioremediation of nitrates and carbon tetrachloride in groundwater. Brouns, T.M. Pacific Northwest Lab., Richland, WA (United States). Jan 1993. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-930160-9: 2. semi-annual Office of Technology Development (OTD) information meeting, Houston, TX (United States), 26-28 Jan 1993). Order Number DE93007878. Source: OSTI; NTIS; INIS; GPO Dep.

A development and demonstration program is presently underway to test an in situ bioremediation technology for treating nitrates and carbon tetrachloride in contaminated Hanford groundwaters. Several key technical issues have prevented widespread use of bioremediation for cleanup of organic and inorganic subsurface contaminants, including the development of adequate nutrient delivery systems; effective mixing technologies for contacting microorganisms, nutrients, and contaminants; methods to control biofouling or excessive microbial growth; and adequate tools for designing, predicting, and monitoring the performance of in situ technologies in heterogeneous subsurface environments. The goal of this program is to address these technical issues in an integrated laboratory-, bench-, and field-scale demonstration by stimulating native microorganisms and accelerating the natural degradation of NO₃⁻, CCl₄, and chloroform.

389 (PNL-SA-21731) In situ redox manipulation: Enhancement of contaminant destruction and immobilization. Fruchter, J.S. Pacific Northwest Lab., Richland, WA (United States). Jan 1993. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-930160-8: 2. semi-annual Office of

Technology Development (OTD) information meeting, Houston, TX (United States), 26-28 Jan 1993). Order Number DE93007877. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses a project to develop, test, and evaluate in situ methods for immobilizing inorganic contaminants (metals, inorganic ions, and radionuclides) and destroying nitrates organic contaminants, (primarily chlorinated hydrocarbons). This research work is being performed for the US Department of Energy through the In situ Remediation Integrated Program.

390 (PNL-SA-21763) Comparative efficiency of microbial systems for destroying carbon tetrachloride contamination in Hanford groundwater. Truex, M.J.; Skeen, R.S.; Caley, S.M.; Workman, D.J. Pacific Northwest Lab., Richland, WA (United States). Apr 1993. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-930482-12: 2. international symposium in situ and on-site bioreclamation, San Diego, CA (United States), 5-8 Apr 1993). Order Number DE94004319. Source: OSTI; NTIS; INIS; GPO Dep.

Past waste disposal practices at the US Department of Energy's (DOE) Hanford site have resulted in carbon tetrachloride (CCl_4) and nitrate contamination in the groundwater. In situ bioremediation is currently being investigated as a cost effective means to destroy these groundwater contaminants. The cost effectiveness of bioremediation is significantly influenced by the nutrient amendments required to sustain the contaminant destruction reactions. This is particularly important for bioremediation of CCl_4 because its biodestruction is the result of a cometabolic process. Nutrient amendments are also important in controlling the growth characteristics of the bacteria to prevent biofouling. Current and previous research has focused on determining the reaction kinetics and microbial processes for CCl_4 destruction using acetate as the electron donor for indigenous microbes. This study was conducted to determine if electron donors other than acetate may be more cost effective, or may provide a better means of process control, for in situ bioremediation of CCl_4 contamination. Three alternative electron donors, glycerol, methanol, and ethanol, were screened for their ability to stimulate CCl_4 destruction. Detailed reaction kinetic experiments using an indigenous microbial consortium with these substrates and with acetate were conducted to determine the efficiency of each in destroying CCl_4 .

391 (PNL-SA-21891) Graphite electrode dc arc technology development for treatment of buried wastes. Surma, J.E. (Pacific Northwest Lab., Richland, WA (United States)); Cohn, D.R.; Smatlak, D.L.; Thomas, P.; Woskov, P.P.; Titus, C.H.; Wittle, J.K.; Hamilton, R.A. Pacific Northwest Lab., Richland, WA (United States). Feb 1993. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-930205-1: Waste management '93, Tucson, AZ (United States), 28 Feb - 4 mar 1993). Order Number DE93009814. Source: OSTI; NTIS; INIS; GPO Dep.

A "National Laboratory-University-Industrial" three-way partnership has been established between the Pacific Northwest Laboratory (PNL), Massachusetts Institute of Technology (MIT), and Electro-Pyrolysis, Inc. (EPI) to develop graphite electrode DC arc technology for the treatment of buried wastes. This paper outlines the PNL-MIT-EPI program describing a series of engineering-scale DC arc furnace tests conducted in an EPI furnace at the Plasma Fusion Center at MIT, and a description of the second phase of this program involving the design, fabrication, and

testing of a pilot-scale DC arc furnace. Included in this work is the development and implementation of diagnostics to evaluate and optimize high temperature thermal processes such as the DC arc technology.

392 (PNL-SA-21987) Implementation of in situ vitrification technology for remediation of Oak Ridge contaminated soil sites: Past results and future plans. Tixier, J.S. (Pacific Northwest Lab., Richland, WA (United States)); Powell, T.D.; Spalding, B.P.; Jacobs, G.K. Pacific Northwest Lab., Richland, WA (United States). Feb 1993. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830 ; AC05-84OR21400. (CONF-930205-52: Waste management '93, Tucson, AZ (United States), 28 Feb - 4 mar 1993). Order Number DE93010172. Source: OSTI; NTIS; INIS; GPO Dep.

In situ vitrification is a thermal treatment technology being developed for remediation of contaminated soils. The process transforms easily leached, contaminated soils into a durable, leach-resistant, vitreous and crystalline monolith. This paper presents the results of the recent highly successful ISV demonstration conducted jointly by PNL and ORNL on a tracer-level quantity of radioactive sludge in a model trench at ORNL. A retention of ^{90}r in the vitreous and crystalline product of greater than 99.9999% was measured with a reduction in potential environmental mobility of more than two orders of magnitude. The paper also presents the current plans for continued collaboration on a two-setting treatability test on one portion of an old seepage pit at ORNL.

393 (PNL-SA-22008) Implementation of in situ vitrification for contaminated soils. Luey, J. (Pacific Northwest Lab., Richland, WA (United States)); Roberts, J.S.; Timmerman, C.L. Pacific Northwest Lab., Richland, WA (United States). Aug 1993. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9308137-10: 1993 summer national American Institute of Chemical Engineers (AIChE) conference, Seattle, WA (United States), 15-18 Aug 1993). Order Number DE94004361. Source: OSTI; NTIS; INIS; GPO Dep.

Geosafe Corporation will be implementing the in situ vitrification (ISV) technology commercially at a Superfund site in Michigan. In preparation for the Michigan site, Geosafe Corporation performed two operational acceptance tests (OATs) at the Geosafe Test Site in Richland, Washington. The objectives were to test the performance of the equipment and to train operating personnel. In addition, Geosafe cooperated with the Pacific Northwest Laboratory and the US Department of Energy, Office of Technology Development in a full-scale field data collection effort to obtain data characterizing the dynamic conditions in the soil created by the advancing ISV melt. This full-scale information provides empirical data to support the current understanding of the ISV technology for contaminated soil applications and provides verification of the accuracy of computational modeling tools being used to evaluate the applicability of the ISV technology to different soil sites.

394 (PNL-SA-22070) UV and IR laser ablation for inductively coupled plasma mass spectrometry. Smith, M.R.; Koppenaal, D.W.; Farmer, O.T. Pacific Northwest Lab., Richland, WA (United States). Jun 1993. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9304144-9: 2. international conference on laser ablation: mechanisms and applications, Knoxville, TN (United States), 19-22 Apr 1993).

Order Number DE93017124. Source: OSTI; NTIS; INIS; GPO Dep.

Laser ablation particle plume compositions are characterized using inductively coupled plasma mass spectrometry (ICP/MS). This study evaluates the mass response characteristics peculiar to ICP/MS detection as a function of laser fluence and frequency. Evaluation of the ICP/MS mass response allows deductions to be made concerning how representative the laser ablation produced particle plume composition is relative to the targeted sample. Using a black glass standard, elemental fractionation was observed, primarily for alkalis and other volatile elements. The extent of elemental fractionation between the target sample and the sampled plume varied significantly as a function of laser fluences and IR and UV laser frequency.

395 (PNL-SA-22251) Environmental restoration using plant-microbe bioaugmentation. Kingsley, M.T.; Fredrickson, J.K.; Metting, F.B.; Seidler, R.J. Pacific Northwest Lab., Richland, WA (United States). Apr 1993. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-930482-6: 2. international symposium in situ and on-site bioreclamation, San Diego, CA (United States), 5-8 Apr 1993). Order Number DE93013160. Source: OSTI; NTIS; INIS; GPO Dep.

Land farming, for the purpose of bioremediation, refers traditionally to the spreading of contaminated soil, sediments, or other material over land; mechanically mixing it; incorporating various amendments, such as fertilizer or mulch; and sometimes inoculating with degradative microorganisms. Populations of bacteria added to soils often decline rapidly and become metabolically inactive. To efficiently degrade contaminants, microorganisms must be metabolically active. Thus, a significant obstacle to the successful use of microorganisms for environmental applications is their long-term survival and the expression of their degradative genes in situ. Rhizosphere microorganisms are known to be more metabolically active than those in bulk soil, because they obtain carbon and energy from root exudates and decaying root matter. Rhizosphere populations are also more abundant, often containing 10^8 or more culturable bacteria per gram of soil, and bacterial populations on the rhizoplane can exceed 10^9 /g root. Many of the critical parameters that influence the competitive ability of rhizosphere bacteria have not been identified, but microorganisms have frequently been introduced into soil (bioaugmentation) as part of routine or novel agronomic practices. However, the use of rhizosphere bacteria and their in situ stimulation by plant roots for degrading organic contaminants has received little attention. Published studies have demonstrated the feasibility of using rhizobacteria (*Pseudomonas putida*) for the rapid removal of chlorinated pesticides from contaminated soil, and to promote germination of radish seeds in the presence of otherwise phytotoxic levels of the herbicide 2,4-dichlorophenoxyacetic acid (2,4-D), and phenoxyacetic acid (PAA). The present investigation was undertaken to determine if these strains (*Pseudomonas putida* PPO301/pRO101 and PPO301/pRO103) could be used to bioremediate 2,4-D-amended soil via plant-microbe bioaugmentation.

396 (PNL-SA-22817) Identifying and prioritizing contamination problems and technology development needs at Hanford. Weakley, S.A.; Fassbender, L.L. Pacific Northwest Lab., Richland, WA (United States). Aug 1993. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9308137-11:

1993 summer national American Institute of Chemical Engineers (AIChE) conference, Seattle, WA (United States), 15-18 Aug 1993). Order Number DE94004784. Source: OSTI; NTIS; INIS; GPO Dep.

This paper presents background and an overview of the process used to obtain the FY 1993 Hanford Site-specific science and technology (S&T) needs for cleanup of the Site as developed via the Hanford Integrated Planning Process (HIPP). An overview of some results is also presented.

397 (PNL-SA-23164) The Atmospheric Radiation Measurement Program and interfaces with external data sources. Stokes, G.M.; Cress, T.S.; Melton, R.B. Pacific Northwest Lab., Richland, WA (United States). Oct 1993. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9310241-1: 9. American Institute of Aeronautics and Astronautics (AIAA) computing in aerospace conference, San Diego, CA (United States), 19-21 Oct 1993). Order Number DE94003699. Source: OSTI; NTIS; INIS; GPO Dep.

The Atmospheric Radiation Measurement (ARM) Program is the Department of Energy's major field project in support of its global change research program. Its objective is to improve the performance of cloud and radiation models and parameterizations in general circulation models (GCMs) used for climate research. The data produced by ARM will be handled and maintained to satisfy the research needs of the program and to be accessible and usable by the general research and academic communities. In addition to data from field instrumentation, ARM Science Team needs include a substantial amount of data from outside the ARM Program ("external data"), which will be acquired and provided routinely through the ARM data system. With respect to data archival and sharing, the ARM Program reflects the objectives delineated by the US Global Change. The purpose of this presentation is to summarize the conceptual designs embodied in the ARM data system and the status of its implementation.

398 (PNL-SA-23721) Methodology and data used for estimating the complex-wide impacts of alternative environmental restoration clean-up goals. Shay, M.R.; Short, S.M.; Stiles, D.L. Pacific Northwest Lab., Richland, WA (United States). Mar 1994. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-940225-96: Waste management '94, Tucson, AZ (United States), 27 Feb - 3 Mar 1994). Order Number DE94009882. Source: OSTI; NTIS; INIS; GPO Dep.

This paper describes the methodologies and data used for estimating the complex-wide impacts of alternative strategies for conducting remediation of all DOE sites and facilities, but does not address issues relating to Waste Management capabilities. Clean-up strategies and their corresponding goals for contaminated media may be driven by concentration-based regulatory standards, land-use standards (e.g., residential, industrial, wild life reserve, or totally restricted), risk-based standards, or other standards determined through stakeholder input. Strategies implemented to achieve these goals usually require the deployment of (a) clean-up technologies to destroy, remove, or contain the contaminants of concern; (b) institutional controls to prevent potential receptors from coming into contact with the contaminants; or (c) a combination of the above.

399 (SAND-91-2742) Crosshole shear-wave seismic monitoring of an in situ air stripping waste remediation process. Elbring, G.J. Sandia National Labs.,

Albuquerque, NM (United States). Feb 1992. 55p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE92008974. Source: OSTI; NTIS; INIS; GPO Dep.

Crosshole shear-wave seismic surveys have been used to monitor the distribution of injected air in the subsurface during an in situ air stripping waste remediation project at the Savannah River site in South Carolina. To remove the contaminant, in this case TCE's from a leaking sewer line, two horizontal wells were drilled at depths of 20 m and 52 m. Air was pumped into the lower well and a vacuum was applied to the upper well to extract the injected air. As the air passed through the subsurface, TCE's were dissolved into the gas and brought out the extraction well. Monitoring of the air injection by crosshole shear wave seismics is feasible due to the changes in soil saturation during injection resulting in a corresponding change in seismic velocities. Using a downhole shear-wave source and clamped downhole receiver, two sets of shear-wave data were taken. The first data were taken before the start of air injection, and the second taken during. The difference in travel times between the two data sets were tomographically inverted to obtain velocity differences. Velocity changes ranging up to 3% were mapped corresponding to saturation changes up to 24%. The distribution of these changes shows a desaturation around the position of the injection well with a plume extending in the direction of the extraction well. Layers with higher clay content show distinctively less change in saturation than the regions with higher sand content.

400 (SAND-92-0817C) Electrokinetic remediation of unsaturated soils. Lindgren, E.R. (Sandia National Labs., Albuquerque, NM (United States)); Kozak, M.W.; Mattson, E.D. Sandia National Labs., Albuquerque, NM (United States). [1992]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9209229-2: Industrial and engineering chemistry (I&EC) special symposium of the American Chemical Society (ACS), Atlanta, GA (United States), 21-23 Sep 1992). Order Number DE93000741. Source: OSTI; NTIS; INIS; GPO Dep.

Heavy-metal contamination of soil and groundwater is a widespread problem in the DOE weapons complex, and for the nation as a whole electrokinetic remediation is one possible technique for in situ removal of such contaminants from unsaturated soils. Large spills and leaks can contaminate both the soil above the water table as well as the aquifer itself. Electrodes are implanted in the soil, and a direct current is imposed between the electrodes. The application of direct current leads to a number of effects: ionic species and charged particles in the soil water will migrate to the oppositely charged electrode (electromigration and electrophoresis), and concomitant with this migration, a bulk flow of water is induced, usually toward the cathode (electroosmosis). The combination of these phenomena leads to a movement of contaminants toward the electrodes. The direction of contaminant movement will be determined by a number of factors, among which are type and concentration of contaminant, soil type and structure, interfacial chemistry of the soil-water system, and the current density in the soil pore water. Contaminants arriving at the electrodes may potentially be removed from the soil by one of several methods, such as electroplating or adsorption onto the electrode, precipitation or co-precipitation at the electrode, pumping of water near the electrode, or complexing with ion-exchange resins. Experimental results are described on the removal of sodium dichromate and food dye from soil.

401 (SAND-92-0818C) Electrokinetic remediation of anionic contaminants from unsaturated soils. Lindgren, E.R. (Sandia National Labs., Albuquerque, NM (United States)); Kozak, M.W.; Mattson, E.D. Sandia National Labs., Albuquerque, NM (United States). [1992]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9210194-7: International symposium on environmental contamination in Central and Eastern Europe, Budapest (Hungary), 12-16 Oct 1992). Order Number DE93002479. Source: OSTI; NTIS; INIS; GPO Dep.

Heavy-metal contamination of soil and groundwater is a widespread problem in the DOE weapons complex, and for the nation as a whole. Electrokinetic remediation is one possible technique for in situ removal of such contaminants from unsaturated soils. In previous studies at Sandia National Laboratories, the electromigration of chromate ions and anionic dye ions have been demonstrated. This paper reports on a series of experiments that were conducted to study the effect of moisture content on the electromigration rate of anionic contaminants in unsaturated soil and determine the limiting moisture content for which electromigration occurs.

402 (SAND-92-1161C) Thermal enhanced vapor extraction system-cooperative ER/OTD technology development. Phelan, J.M. (Sandia National Labs., Albuquerque, NM (United States)); Ardito, C.P.; Booher, W. Sandia National Labs., Albuquerque, NM (United States). [1992]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-920851-43: Spectrum '92: nuclear and hazardous waste management international topical meeting, Boise, ID (United States), 23-27 Aug 1992). Order Number DE92016331. Source: OSTI; NTIS; INIS; GPO Dep.

An improved technology to extract VOCs from the unsaturated zone has developed into a cooperative Environmental Restoration and Technology Development effort. This cooperation is important because the timing of an innovative technology demonstration is critical to the transfer of that technology into an ER remedial action decision. The Mixed-Waste Landfill Integrated Demonstration (MWLID) Program will be demonstrating a Thermal Enhanced Vapor Extraction System that will improve existing vacuum vapor extraction technology by applying in-situ soil heating. Combined demonstrations of vacuum vapor extraction and both power-line frequency and radiofrequency soil heating technologies began in FY92.

403 (SAND-92-1541C) Portable acoustic wave sensors for volatile organic compounds. Frye, G.C.; Cernosek, R.W.; Martin, S.J. Sandia National Labs., Albuquerque, NM (United States). [1992]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-920791-5: Information exchange meeting on characterization sensors and monitoring technologies, Dallas, TX (United States), 15-16 Jul 1992). Order Number DE92018263. Source: OSTI; NTIS; GPO Dep.

Portable acoustic wave sensor (PAWS) systems are being developed for real-time, on-line monitoring of volatile organic compounds (VOC's). These systems are built around acoustic wave (SAW) devices coated with viscoelastic polymers. Two independent responses of the SAW sensor, wave velocity and wave attenuation, are measured to provide information about the chemical species sorbed by the coating. Rapid, reversible detection of gas phase volatile organics has been demonstrated for process monitoring and waste minimization in environmentally conscious manufacturing

(ECM) applications and for documenting contaminant concentrations in remediation efforts.

404 (SAND-92-2312C) Crosswell seismic imaging of an in-situ air stripping waste remediation process. Elbring, G.J. Sandia National Labs., Albuquerque, NM (United States). [1992]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9304109-3: SAGEEP '93: symposium on the application of geophysics to environmental and engineering problems, San Diego, CA (United States), 18-21 Apr 1993). Order Number DE93009831. Source: OSTI; NTIS; INIS; GPO Dep.

The restoration of environmentally contaminated sites at DOE facilities has become a major effort in the past several years. The variety of wastes involved and the differing characteristics have driven the development of new restoration and monitoring technologies. One of the new remediation technologies is being demonstrated at the Savannah River Site near Aiken, South Carolina. In conjunction with this demonstration, a new technology for site characterization and monitoring of the remediation process has been applied by Sandia National Laboratories.

405 (SAND-92-2727C) Destruction of UST organics and nitrates, polymeric organic wastes, and chlorocarbon solvents by steam reforming. Galloway, T.R. (Synthetica Technologies, Inc., Richmond, CA (United States)); Sprung, J.L. Sandia National Labs., Albuquerque, NM (United States). [1992]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-930160-3: 2. semi-annual Office of Technology Development (OTD) information meeting, Houston, TX (United States), 26-28 Jan 1993). Order Number DE93005344. Source: OSTI; NTIS; INIS; GPO Dep.

In support of the UST, WeDID, VOC/Non-Arid, and VOC/Arid, and VOC/Arid Integrated Demonstrations, organic contaminants and nitrates in Hanford Underground Storage Tank (UST) wastes, polymeric organics in weapon components, and chlorocarbon soil contaminants have been destroyed by exposure to high-temperature steam during bench tests with a quartz reactor and full-scale tests that used the Synthetica Detoxifier, a commercial one-ton-per-day steam reforming waste destruction system. Reactivation of Granular Activated Carbon (GAC) in the Detoxifier and Thermal Gravimetric Analyses (TGA) of the decomposition of sodium nitrate have also been performed.

406 (SAND-92-2773C) Thermal Enhanced Vapor Extraction System. Phelan, J.M. Sandia National Labs., Albuquerque, NM (United States). [1992]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-930160-5: 2. semi-annual Office of Technology Development (OTD) information meeting, Houston, TX (United States), 26-28 Jan 1993). Order Number DE93005343. Source: OSTI; NTIS; INIS; GPO Dep.

At some landfills, hazardous wastes were placed into disposal pits with other waste oils. Volatile organic wastes, such as cleaning solvents, when combined with oil are much more difficult to remove from the soils because the oil makes the volatile organic chemical evaporate much slower. The typical vacuum extraction remediation method could become a lengthy campaign. Since all chemicals evaporate faster when they are heated, if the contaminated soil could be heated, the chemicals would be easier to remove from the soil. By using heating techniques developed by the Oil and Gas Industry to enhance the removal of oil and gas

resources from the soil, the problem of removing contamination from the soils could be solved. The Thermal Enhanced Vapor Extraction System (TEVES) demonstration will combine vacuum vapor extraction technology with powerline frequency soil heating and radiofrequency soil heating to accelerate the soil decontamination process. The premise that soil heating technology can actually reduce the costs of soil decontamination is complicated by the high capital costs of the soil heating equipment and the cost of electrode installation. By performing this field demonstration, Sandia will be able to collect the information needed to see if this new technology will improve the decontamination of soils.

407 (SAND-93-1244C) Field demonstration of technologies for delineating uranium contaminated soils. Tidwell, V.C. (Sandia National Labs., Albuquerque, NM (United States)); Cunnane, J.C.; Schwing, J.; Lee, S.Y.; Perry, D.L.; Morris, D.E. Sandia National Labs., Albuquerque, NM (United States). [1993]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-931095-31: Department of Energy environmental remediation conference, Augusta, GA (United States), 24-28 Oct 1993). Order Number DE94001829. Source: OSTI; NTIS; INIS; GPO Dep.

An Integrated Demonstration Program, hosted by the Fernald Environmental Restoration Management Corporation (FERMCO), has been established for investigating technologies applicable to the characterization and remediation of soils contaminated with uranium. An important part of this effort is the evaluation of field screening tools capable of acquiring high resolution information on the distribution of uranium contamination in surface soils in a cost-and-time efficient manner. Consistent with this need, four field screening technologies have been demonstrated at two hazardous waste sites at the FERMCO. The four technologies tested are wide-area gamma spectroscopy, beta scintillation counting, laser ablation-inductively coupled plasma-atomic emission spectroscopy (LA-ICP-AES), and long-range alpha detection (LRAD). One of the important findings of this demonstration was just how difficult it is to compare data collected by means of multiple independent measurement techniques. Difficulties are attributed to differences in measurement scale, differences in the basic physics upon which the various measurement schemes are predicated, and differences in the general performance of detector instrumentation. It follows that optimal deployment of these techniques requires the development of an approach for accounting for the intrinsic differences noted above. As such, emphasis is given in this paper to the development of a methodology for integrating these techniques for use in site characterization programs as well as the development of a framework for interpreting the collected data. The methodology described here also has general application to other field-based screening technologies and soil sampling programs.

408 (SAND-93-2765) The in situ permeable flow sensor: A device for measuring groundwater flow velocity. Ballard, S. (Sandia National Labs., Albuquerque, NM (United States)); Barker, G.T.; Nichols, R.L. Sandia National Labs., Albuquerque, NM (United States). Mar 1994. 37p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE94011245. Source: OSTI; NTIS; INIS; GPO Dep.

A new technology called the In Situ Permeable Flow Sensor has been developed at Sandia National Laboratories.

These sensors use a thermal perturbation technique to directly measure the direction and magnitude of the full three dimensional groundwater flow velocity vector in unconsolidated, saturated, porous media. The velocity measured is an average value characteristic of an approximately 1 cubic meter volume of the subsurface. During a test at the Savannah River Site in South Carolina, two flow sensors were deployed in a confined aquifer in close proximity to a well which was screened over the entire vertical extent of the aquifer and the well was pumped at four different pumping rates. In this situation horizontal flow which is radially directed toward the pumping well is expected. The flow sensors measured horizontal flow which was directed toward the pumping well, within the uncertainty in the measurements. The observed magnitude of the horizontal component of the flow velocity increased linearly with pumping rate, as predicted by theoretical considerations. The measured horizontal component of the flow velocity differed from the predicted flow velocity, which was calculated with the assumptions that the hydraulic properties of the aquifer were radially homogeneous and isotropic, by less than a factor of two. Drawdown data obtained from other wells near the pumping well during the pump test indicate that the hydraulic properties of the aquifer are probably not radially homogeneous but the effect of the inhomogeneity on the flow velocity field around the pumping well was not modeled because the degree and distribution of the inhomogeneity are unknown. Grain size analysis of core samples from wells in the area were used to estimate the vertical distribution of hydraulic conductivity.

409 (SAND-93-3846C) Long term plutonium solubility and speciation studies in a synthetic brine. Nitsche, Heino (Lawrence Berkeley Lab., CA (United States)); Roberts, K.; Xi, Ruihua. Sandia National Labs., Albuquerque, NM (United States). [1993]. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-931201-9: 4. international conference on chemistry and migration behavior of actinides and fission products in the geosphere, Charleston, SC (United States), 12-17 Dec 1993). Order Number DE94005097. Source: OSTI; NTIS; INIS; GPO Dep.

The rate at which elements can be transported in groundwater systems is governed in part by the solubility of the element in the groundwater. This report documents plutonium solubility experiments in a brine simulant relevant to the Waste Isolation Pilot Plant. Approximately 1 to 2.5 mL of five stock solutions containing single oxidation states of plutonium (Pu(IV)-polymer, Pu^{3+} , Pu^{4+} , PuO_2^+ , and PuO_2^{2+}) were added to ~75 mL of synthetic H-17 Brine in five reaction vessels. Initial plutonium concentrations ranged from 1.3×10^{-4} to 5.1×10^{-4} M (moles per liter) total plutonium. Because these initial concentrations were far above the plutonium solubility limit in H-17 Brine, plutonium-containing solids precipitated. Aqueous plutonium concentrations were measured over time until steady-state was reached, requiring over 300 days in H-17 Brine.

410 (SAND-93-7077C) Electrokinetic extraction of chromate from unsaturated soils. Mattson, E.D. (SAT-UNSAT, Inc., Albuquerque, NM (United States)); Lindgren, E.R. Sandia National Labs., Albuquerque, NM (United States). [1993]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9309146-6: 5. annual American Chemical Society (ACS) Industrial and Engineering Chemistry (I&EC) Division special symposium on emerging technologies for hazardous

waste management, Atlanta, GA (United States), 27-29 Sep 1993). Order Number DE94002042. Source: OSTI; NTIS; INIS; GPO Dep.

Heavy-metal contamination of soil and groundwater is a widespread problem in industrial nations. Remediation by excavation of such sites may not be cost effective or politically acceptable. Electrokinetic remediation is one possible remediation technique for in situ removal of such contaminants from unsaturated soils. Previous papers discussing the work performed by researchers at Sandia National Laboratories (SNL) and Sat-Unsat, Inc. (SUI) (Lindgren et al., 1991, 1992, 1993) focused on the transport of contaminants and dyes by electrokinetics in unsaturated soils. These experiments were conducted with graphite electrodes with no extraction system. As the contaminants migrated through the soil, they increased in concentration at the electrode creating a diffusion flux in the opposite direction. This paper discusses a technique to remove the contaminants from unsaturated soils once they have reached an electrode.

411 (SAND-93-7112C) Variation of stability constants of thorium and uranium oxalate complexes with ionic strength. Erten, H.N. (Florida State Univ., Tallahassee, FL (United States). Dept. of Chemistry); Mohammed, A.K.; Choppin, G.R. Sandia National Labs., Albuquerque, NM (United States). [1993]. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-931201-7: 4. international conference on chemistry and migration behavior of actinides and fission products in the geosphere, Charleston, SC (United States), 12-17 Dec 1993). Order Number DE94005100. Source: OSTI; NTIS; GPO Dep.

Extraction of Th(IV) and UO_2^{2+} by a solution of TTA and HDEHP, respectively, in toluene was used to obtain stability constants of their oxalate complexes in 1, 3, 5, 7 and 9 M ionic strength (NaClO_2) solutions. The complexes formed were the MOx , MHOx , MOx_2 and $\text{M}(\text{HOx})_2$ ($\text{M} = \text{Th}$, UO_2) species. The values were analyzed by the Specific Interaction Theory and agreed to $I \leq 3$ M but required an additional term for fitting at $I > 3$ M.

412 (SAND-93-7113C) Solubility of Nd in brine. Khalili, F. (Florida State Univ., Tallahassee, FL (United States). Dept. of Chemistry); Symeopoulos, V.; Chen, J.F.; Choppin, G.R. Sandia National Labs., Albuquerque, NM (United States). [1993]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-931201-10: 4. international conference on chemistry and migration behavior of actinides and fission products in the geosphere, Charleston, SC (United States), 12-17 Dec 1993). Order Number DE94005099. Source: OSTI; NTIS; GPO Dep.

The solubility of Nd(III) has been measured in a synthetic brine at pH 6.4, 8.4, 10.4 and 12.4. The brine consisted predominantly of $(\text{Na}+\text{K})\text{Cl}$ and MgCl_2 , with an ionic strength of 7.8M (9.4m). The experimental solubility is much less than that estimated from modeling of the species in solution in equilibrium with the Nd solid using S.I.T. The predominant solid compound of Nd (III) at each pH was determined from X-ray diffraction patterns.

413 (SAND-93-8558C) A laser-based technique to continuously monitor metal aerosol emissions. Flower, W.L. (Sandia National Labs., Livermore, CA (United States)); Peng, L.W.; French, N.B.; Johnsen, H.A.; Ottesen, D.K.; Renzi, R.F.; Westbrook, L.V.; Bonin, M.P. Sandia National Labs., Livermore, CA (United States). [1993]. 19p.

Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DR00789. (CONF-9305183-1: EPRI workshop, Scottsdale, AZ (United States), 19-22 May 1993). Order Number DE93012836. Source: OSTI; NTIS; INIS; GPO Dep.

Sandia National Laboratories is developing an instrument to continuously monitor metal aerosol emissions. Applications for this monitor range from industrial process vents (e.g., exhaust stacks from electroplating baths) to waste treatment processes (incinerators), to boilers and industrial furnaces (coal-fired power plants). The monitoring technique is based on Laser Spark Spectroscopy (LASS; also known as Laser-Induced Breakdown Spectroscopy - LIBS), in which a pulsed laser is used to rapidly heat a particle and produce a plasma (or laser "spark"). The light emission from the spark is spectrally resolved and analyzed to identify the elemental constituents of the particle and quantify the abundance of the measured species. One feature of LASS is that it can measure atomic species embedded in either solid particles or fine liquid droplets, which account for a large percentage of metal emissions from applications of interest. Presented here are a description of the technique and initial results from laboratory simulations to determine sensitivity and to establish calibration procedures. Our project is currently focused on measuring chromium emissions from electroplating baths. This work forms the basis for future applications to incineration and fossil power plants since chromium is one of the more toxic metals under regulation by the Clean Air Act.

414 (SAND-94-0214) Evaluation of an air drilling cuttings containment system. Westmoreland, J. Sandia National Labs., Albuquerque, NM (United States). Apr 1994. 59p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE94011003. Source: OSTI; NTIS; GPO Dep.

Drilling at hazardous waste sites for environmental remediation or monitoring requires containment of all drilling fluids and cuttings to protect personnel and the environment. At many sites, air drilling techniques have advantages over other drilling methods, requiring effective filtering and containment of the return air/cuttings stream. A study of current containment methods indicated improvements could be made in the filtering of radionuclides and volatile organic compounds, and in equipment like alarms, instrumentation or pressure safety features. Sandia National Laboratories, Dept. 61 11 Environmental Drilling Projects Group, initiated this work to address these concerns. A look at the industry showed that asbestos abatement equipment could be adapted for containment and filtration of air drilling returns. An industry manufacturer was selected to build a prototype machine. The machine was leased and put through a six-month testing and evaluation period at Sandia National Laboratories. Various materials were vacuumed and filtered with the machine during this time. In addition, it was used in an actual air drive drilling operation. Results of these tests indicate that the vacuum/filter unit will meet or exceed our drilling requirements. This vacuum/filter unit could be employed at a hazardous waste site or any site where drilling operations require cuttings and air containment.

415 (SAND-94-0537C) Development of dry barriers for containment and remediation at waste sites. Thomson, B.M. (New Mexico Univ., Albuquerque, NM (United States). Dept. of Civil Engineering); Morris, C.E.; Stormont, J.; Ankeny, M.D. Sandia National Labs., Albuquerque, NM (United States). [1994]. 12p. Sponsored by USDOE,

Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-940225-30: Waste management '94, Tucson, AZ (United States), 27 Feb - 3 Mar 1994). Order Number DE94007062. Source: OSTI; NTIS; INIS; GPO Dep.

This paper describes a concept in which dry air is injected into an unsaturated formation to reduce the soil moisture content, referred to here as a dry (or sometimes tensiometric) barrier. The objective is to reduce the hydraulic conductivity of the unsaturated media to the point where liquid phase transport becomes negligible, thereby achieving containment. The concept could be applied in subsurface formations to provide containment from a leaking facility, or it could be incorporated into a cover design to provide redundancy for a capillary barrier. The air injection process could in principle be coupled with a vacuum extraction system to recover soil vapors, which would then provide a remediation process that would be appropriate if volatile organic compounds were present. Work to date has consisted of a combined theoretical, laboratory, and field research investigation. The objective of this research was to demonstrate the technical feasibility of the dry barrier concept by identifying the parameters which determine its effectiveness. Based on the results obtained for the experimental and theoretical studies, feasibility analyses were prepared for as a modification for a landfill cover design to prevent infiltration from atmospheric precipitation and for potential application of dry barriers to achieve subsurface containment and removal of volatile constituents. These analyses considered the technical as well as the economic aspects of the dry barrier concept.

416 (SAND-94-0797C) Hydrogeological influences on radionuclide migration from the major radioactive waste burial sites at Chernobyl (A review). Dgepo, S.P. (Inst. of Geological Sciences, Kiev (Ukraine)); Skalsky, A.S.; Bugai, D.A.; Marchuk, V.V.; Waters, R.D. Sandia National Labs., Albuquerque, NM (United States). [1994]. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-940385-1: Shelter '94, Kiev (Russian Federation), 21 Mar 1994). Order Number DE94008618. Source: OSTI; NTIS; INIS; GPO Dep.

This paper summarizes the recent hydrogeological investigations of several research organizations on waste confinement at the major radioactive waste (RW) burial sites immediately adjacent to the Chernobyl Nuclear Power Plant (Ch. NPP). Hydrogeological conditions and radiologic ground-water contamination levels are described. Ongoing ground-water monitoring practices are evaluated. The chemical and physical characteristics of the radionuclides within the burial sites are considered. Ground water and radionuclide transport modeling studies related to problems of the RW disposal sites are also reviewed. Current concerns on future impacts of the RW burial sites on the hydrological environment and water resources of the Ch.NPP area are discussed.

417 (UCRL-ID-111623) Analysis and evaluation of VOC removal technologies demonstrated at Savannah River. Chesnut, D.A. (Lawrence Livermore National Lab., CA (United States)); Wagoner, J.; Nitao, J.J.; Boyd, S.; Shaffer, R.J.; Kansa, E.J.; Buscheck, T.A.; Pruess, K.; Falta, R.W. Lawrence Livermore National Lab., CA (United States). Sep 1993. 245p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE94009974. Source: OSTI; NTIS; INIS; GPO Dep.

Volatile Organic Compounds, or VOCs, are ubiquitous subsurface contaminants at industrial as well as DOE sites.

At the Savannah River Plant, the principles VOCs contaminating the subsurface below A-Area and M-Area are Trichloroethylene (C_2HCl_3 , or TCE) and Tetrachloroethylene (C_2Cl_4 , or PCE). These compounds were used extensively as degreasing solvents from 1952 until 1979, and the waste solvent which did not evaporate (on the order of 2×10^6 pounds) was discharged to a process sewer line leading to the M-Area Seepage Basin (Figure 1.2). These compounds infiltrated into the soil and underlying sediments from leaks in the sewer line and elsewhere thereby contaminating the vadose zone between the surface and the water table as well as the aquifer.

418 (UCRL-ID-113852) The DEFUZE code for modeling gaseous diffusion of volatile contaminants in the vadose zone. Nitao, J.J. Lawrence Livermore National Lab., CA (United States). Feb 1994. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE94010000. Source: OSTI; NTIS; INIS; GPO Dep.

The DEFUZE computer model is a convenient and simple tool for calculating the subsurface gaseous diffusion of volatile contaminants in the vadose zone for the purposes of guiding vadose zone characterization and data collection efforts and for determining the need for site remediation. The reader is referred to Nitao (1990) for further details on the conceptual model for contaminant transport in the vadose zone and an application of DEFUZE to a site at the Lawrence Livermore National Laboratory.

419 (UCRL-JC-109902) Dynamic Underground Stripping Project. Aines, R. (Lawrence Livermore National Lab., CA (United States)); Newmark, R.; McConachie, W.; Udell, K.; Rice, D.; Ramirez, A.; Siegel, W.; Buettner, M.; Daily, W.; Krauter, P.; Folsom, E.; Boegel, A.J.; Bishop, D.; Udell, K. Lawrence Livermore National Lab., CA (United States). Jan 1992. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-920307-94: Waste management '92, Tucson, AZ (United States), 1-5 Mar 1992). Order Number DE93013133. Source: OSTI; NTIS; INIS; GPO Dep.

LLNL is collaborating with the UC Berkeley College of Engineering to develop and demonstrate a system of thermal remediation and underground imaging techniques for use in rapid cleanup of localized underground spills. Called "Dynamic Stripping" to reflect the rapid and controllable nature of the process, it will combine steam injection, direct electrical heating, and tomographic geophysical imaging in a cleanup of the LLNL gasoline spill. In the first 8 months of the project, a Clean Site engineering test was conducted to prove the field application of the techniques before moving the contaminated site in FY 92.

420 (UCRL-JC-110055) Monitoring remediation of trichloroethylene using a chemical fiber optic sensor: Field studies. Colston, B. Jr.; Brown, S.B.; Langry, K.; Daley, P.; Milanovich, F.P. Lawrence Livermore National Lab., CA (United States). May 1992. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-920851-90: Spectrum '92: nuclear and hazardous waste management international topical meeting, Boise, ID (United States), 23-27 Aug 1992). Order Number DE93009284. Source: OSTI; NTIS; INIS; GPO Dep.

Field tests of a remote fiber optic chemical sensor have recently been completed. The sensor has measured trace quantities of organohalides in the vadose zone and groundwater. Due to its toxicological importance and accessibility, a

specific contaminant monitored was trichloroethylene (TCE). Two elements considered in these field measurements included temperature and carbon dioxide (CO_2) fluctuations. The effects of these properties on the sensor have been modeled in the lab. These results were used in the final determination of TCE concentration. Department of Energy (DOE) sites where remediation work is in progress provided opportunities for testing the sensor. One test was conducted in the vadose zone over sampling wells at the Savannah River Plant DOE integrated test site. Measurements were made before and several months after remediation procedures were in progress. A series of wells was selected with discretely screened depth intervals. Data were collected over a range of depths. A second set of experiments took place at Lawrence Livermore Site 300, in collaboration with a private company (Purus). Purus is remediating groundwater contaminated with halogenated volatile organic compounds. The sensor was set up to continuously monitor the processed gas stream. Supporting data were provided in this case with side by side gas chromatograph measurements.

421 (UCRL-JC-110327) Electrical resistance tomography used to monitor subsurface steam injection. Ramirez, A. (Lawrence Livermore National Lab., CA (United States)); Daily, W.; Owen, E.; Chesnut, D.; LaBrecque, D. Lawrence Livermore National Lab., CA (United States). Apr 1992. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-921006-2: 62. annual meeting of the Society of Exploration Geophysicists, New Orleans, LA (United States), 25-29 Oct 1992). Order Number DE94000304. Source: OSTI; NTIS; GPO Dep.

We used electrical resistance tomography (ERT) to map the subsurface distribution of a steam flood as function of time as part of a prototype environmental restoration process performed by the Dynamic Underground Stripping Project. We evaluated the capability of ERT to monitor changes in the soil resistivity during the steam injection process using a dipole-dipole measurement technique to measure the bulk electrical resistivity distribution in the soil mass. The injected steam caused changes in the soil's resistivity because the steam displaced some of the native pore water, increased the pore water and soil temperatures and changed the ionic content of the pore water. We could detect the effects of steam invasion by mapping changes in the soil resistivity as a function of space and time. The ERT tomographs are compared with induction well logs, formation temperature logs and lithologic logs. These comparisons suggest that the ERT tomographs mapped the formation regions invaded by the steam flood. The data also suggest that steam invasion was limited in vertical extent to a gravel horizon at depth of approximately 43 m. The tomographs show that with time, the steam invasion zone extended laterally to all areas monitored by the ERT technique.

422 (UCRL-JC-110348) Dynamic Underground Stripping Engineering Demonstration Project: Construction, operation and engineering results. Siegel, W.H. (Lawrence Livermore National Lab., CA (US)); Buettner, M.; Udell, K. Lawrence Livermore National Lab., CA (United States). May 1992. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-920851-97: Spectrum '92: nuclear and hazardous waste management international topical meeting, Boise, ID (United States), 23-27 Aug 1992). Order Number DE93017180. Source: OSTI; NTIS; INIS; GPO Dep.

The Dynamic Underground Stripping Project demonstrates cost-effective, rapid cleanup of localized underground plumes, often the result of leaking underground storage tanks. The technique combines the complementary technologies of subsurface steam injection and electrical resistance heating. The engineering demonstration phase of this project was completed on a clean, uncontaminated site with well-characterized geology. The Clean Site is located in Livermore, California at the US Department of Energy's Sandia National Laboratory (SNL). The experience gained at the Clean Site will be applied to clean up an 8,000 to 12,000 gallon gasoline spill, approximately 500 yards to the northwest, at the Lawrence Livermore National Laboratory (LLNL).

423 (UCRL-JC-110353) Overview of the Dynamic Underground Stripping demonstration project. Aines, R. (Lawrence Livermore National Lab., CA (United States)); Newmark, R.; McConachie, W.; Rice, D.; Ramirez, A.; Siegel, W.; Buettner, M.; Daily, W.; Krauter, P.; Folsom, E.; Boegel, A.J.; Bishop, D.; Udell, K. Lawrence Livermore National Lab., CA (United States). Aug 1992. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-920851-94: Spectrum '92: nuclear and hazardous waste management international topical meeting, Boise, ID (United States), 23-27 Aug 1992). Order Number DE93012477. Source: OSTI; NTIS; GPO Dep.

Dynamic Underground Stripping is a limited-scope demonstration of a system of thermal remediation and underground imaging techniques for use in rapid cleanup of localized underground spills. Called "Dynamic Stripping" to reflect the rapid and controllable nature of the process, it combines steam injection, direct electrical heating, and tomographic geophysical imaging in a cleanup of the LLNL gasoline spill. The system is targeted toward the removal of free-phase organics of all kinds. The LLNL gasoline spill is a convenient test site because much of the gasoline has been trapped below the water table, mimicking the behavior of dense organic liquids.

424 (UCRL-JC-110356) Electrical resistance tomography used in environmental restoration. Ramirez, A.L. (Lawrence Livermore National Lab., CA (United States)); Daily, W.; LaBrecque, D. Lawrence Livermore National Lab., CA (United States). Apr 1992. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9206184-2: U.S. Department of Energy information exchange meeting on characterization, monitoring, and sensor technologies, Dallas, TX (United States), 3-4 Jun 1992). Order Number DE92018003. Source: OSTI; NTIS; INIS; GPO Dep.

We are developing a new imaging technique, Electrical Resistance Tomography (ERT), to map subsurface liquids as flow occurs during natural or clean-up processes; ERT can also be used to map geologic structure. Natural processes (such as surface water infiltrating the vadose zone) and clean-up processes (such as air injection in the saturated zone, steam injection, emplacement of subsurface barriers) can create changes in a soil's electrical properties that are readily measured. We use these measurements to calculate tomographs that show the spatial distribution of the subsurface resistivities. The information derived from ERT can be used by remediation projects to: monitor the effectiveness of clean-up processes, characterize hydrologic processes affecting contaminant transport, select appropriate clean-up alternatives, demonstrate regulatory compliance, and to verify the installation and performance of subsurface barriers.

425 (UCRL-JC-112037) Heterogeneity and contaminant transport modeling for the Savannah River integrated demonstration site. Chesnut, D.A. Lawrence Livermore National Lab., CA (United States). Nov 1992. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-930589-2: 4. international conference on contaminated soil, Berlin (Germany), 3-7 May 1993). Order Number DE93013843. Source: OSTI; NTIS; INIS; GPO Dep.

The effectiveness of remediating aquifers and vadose zone sediments is frequently controlled by spatial heterogeneities. A continuing and long-recognized problem in selecting, planning, implementing, and operating remediation projects is the development of methods for quantitatively describing heterogeneity and predicting its effects on process performance. The similarity to and differences from modeling oil recovery processes in the petroleum industry are illustrated by the extension to contaminant extraction processes of an analytic model originally developed for waterflooding petroleum reservoirs. The resulting equations incorporate the effects of heterogeneity through a single parameter, σ . Fitting this model to the Savannah River in situ Air Stripping test data suggests that the injection of air into a horizontal well below the water table may have improved performance by changing the flow pattern in the vadose zone. This change increased the capture volume, and consequently the contaminant mass inventory, of the horizontal injection well completed in the vadose zone. The apparent increases (compared to extraction only from the horizontal well) are from 10,200 to 21,000 pounds for TCE and from 3,600 pounds to 59,800 pounds for PCE. The predominance of PCE in this calculated increase suggests that redistribution of flow paths in the vadose zone, rather than in-situ stripping, may provide most of the improvement. Although this preliminary conclusion remains to be reinforced by more sophisticated modeling currently in progress, there appears to be a definite improvement, which is attributable to air injection, over conventional remediation methods.

426 (UCRL-JC-113854) Aerosol filtration with steel fiber filters. Bergman, W.; Wilson, K.; Larsen, G.; Lopez, R. Lawrence Livermore National Lab., CA (United States). Apr 1993. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9305166-3: American Filtration Society seminar and expo annual meeting, Chicago, IL (United States), 3-6 May 1993). Order Number DE93016990. Source: OSTI; NTIS; GPO Dep.

We have conducted an experimental study of aerosol penetration through a new high efficiency steel fiber filter and filter media that we developed in cooperation with Pall Corporation. Our previous studies have shown that sintered steel fiber media have significant improvements in higher filter efficiency and lower pressure drop than the previous steel filter technology based on sintered powder metal media. In the present study, we have measured the penetration of dioctyl sebacate (DOS) aerosols through flat sheet samples, pleated cartridge filters and a 1000 cfm filter having 64 cartridges housed in a 2 x 2 x 1 ft. frame. The steel fiber media used in our study consists of 2 μ m diameter stainless steel (316L) fibers sintered together into sheets.

427 (UCRL-JC-114126) Electrical resistance tomography during gas injection at the Savannah River Site. Ramirez, A.L.; Daily, W.D. Lawrence Livermore National Lab., CA (United States). May 1993. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9309146-4: 5. annual American

Chemical Society (ACS) Industrial and Engineering Chemistry (I&EC) Division special symposium on emerging technologies for hazardous waste management, Atlanta, GA (United States), 27-29 Sep 1993). Order Number DE94000394. Source: OSTI; NTIS; INIS; GPO Dep.

Electrical resistance tomography (ERT) is used to monitor some of the in situ remediation processes being evaluated for removal of volatile organic compounds from subsurface water and soil at the Integrated Demonstration for VOC's in Soils and Groundwater at Non Arid Sites, the Savannah River Site, near Aiken, South Carolina. Air was injected in the saturated zone and the intrained air was tomographically imaged by its effects on the formation electrical resistivity. The authors found that the flow paths are confined to a complex three dimensional network of channels, some of which extend as far as 30 m from the injection well. They conclude, based on these results, that the shape and extent of the air plume are controlled by spatial variations in the local gas permeability. These channels are somewhat unstable over a period of months and new channels appear to form with time.

428 (UCRL-JC-115005) **Thermoelectric cooled, purge-and-trap device for enhancing the utility of fiber optic VOC sensors.** Mizusawa, E.A.; Daley, P.F.; Kyle, K.R.; Langry, K.C.; Angel, S.M. Lawrence Livermore National Lab., CA (United States). Aug 1993. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9309199-10: Society of Photo-Optical Instrumentation Engineer's (SPIE) international symposium on optical tools for manufacturing and advanced automation, Boston, MA (United States), 7-10 Sep 1993). Order Number DE94001772. Source: OSTI; NTIS; GPO Dep.

A thermoelectric cooled, purge-and trap device (TEC) has been developed to enhance the utility of fiber optic VOC sensors. This simple device consists of a thin copper radiator which is sandwiched between two thermoelectric coolers. Two water-cooled, copper heat sinks are used to maintain the hog side surfaces of the thermoelectric coolers at 5 degrees C, allowing internal surface temperatures of the radiator to be controlled between 5 degrees C to -43 degrees C. This paper describes the use of the TEC with a reversible, fiber optic, carbon tetrachloride sensor. The sensor by itself has a detection limit of around 1,000 ppmv carbon tetrachloride in nitrogen. When the sensor is used with the TEC, vapor phase concentrations down to 100 ppmv can be measured.

429 (UCRL-JC-115362) **Using geophysical techniques to control in situ thermal remediation.** Boyd, S. (Lawrence Livermore National Lab., CA (United States)); Daily, W.; Ramirez, A.; Wilt, M.; Goldman, R.; Kayes, D.; Kenneally, K.; Udell, K.; Hunter, R. Lawrence Livermore National Lab., CA (United States). 22 Jan 1994. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-940353-2: Symposium on the application of geophysics to environmental and engineering problems, Boston, MA (United States), 27-31 Mar 1994). Order Number DE94006722. Source: OSTI; NTIS; INIS; GPO Dep.

Monitoring the thermal and hydrologic processes that occur during thermal environmental remediation programs in near real-time provides essential information for controlling the process. Geophysical techniques played a crucial role in process control as well as for characterization during the recent Dynamic Underground Stripping Project demonstration

in which several thousand gallons of gasoline were removed from heterogeneous soils both above and below the water table. Dynamic Underground Stripping combines steam injection and electrical heating for thermal enhancement with ground water pumping and vacuum extraction for contaminant removal. These processes produce rapid changes in the subsurface properties including changes in temperature fluid saturation, pressure and chemistry. Subsurface imaging methods are used to map the heated zones and control the thermal process. Temperature measurements made in wells throughout the field reveal details of the complex heating phenomena. Electrical resistance tomography (ERT) provides near real-time detailed images of the heated zones between boreholes both during electrical heating and steam injection. Borehole induction logs show close correlation with lithostratigraphy and, by identifying the more permeable gravel zones, can be used to predict steam movement. They are also useful in understanding the physical changes in the field and in interpreting the ERT images. Tiltmeters provide additional information regarding the shape of the steamed zones in plan view. They were used to track the growth of the steam front from individual injectors.

430 (UCRL-LR-113891) **Pilot study risk assessment for selected problems at the Nevada Test Site (NTS).** Daniels, J.I. (ed.) (Lawrence Livermore National Lab., CA (United States)); Anspaugh, L.R.; Bogen, K.T.; Daniels, J.I.; Layton, D.W.; Straume, T.; Andricevic, R.; Jacobson, R.L. Lawrence Livermore National Lab., CA (United States). Jun 1993. 104p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93016333. Source: OSTI; NTIS; INIS; GPO Dep.

The Nevada Test Site (NTS) is located in southwestern Nevada, about 105 km (65 mi) northwest of the city of Las Vegas. A series of tests was conducted in the late 1950s and early 1960s at or near the NTS to study issues involving plutonium-bearing devices. These tests resulted in the dispersal of about 5 TBq of $^{239,240}\text{Pu}$ on the surficial soils at the test locations. Additionally, underground tests of nuclear weapons devices have been conducted at the NTS since late 1962; ground water beneath the NTS has been contaminated with radionuclides produced by these tests. These two important problems have been selected for assessment. Regarding the plutonium contamination, because the residual ^{239}Pu decays slowly (half-life of 24,110 y), these sites could represent a long-term hazard if they are not remediated and if institutional controls are lost. To investigate the magnitude of the potential health risks for this no-remediation case, three basic exposure scenarios were defined that could bring individuals in contact with $^{239,240}\text{Pu}$ at the sites: (1) a resident living in a subdivision, (2) a resident farmer, and (3) a worker at a commercial facility - all located at a test site. The predicted cancer risks for the resident farmer were more than a factor of three times higher than the suburban resident at the median risk level, and about a factor of ten greater than the reference worker at a commercial facility. At 100 y from the present, the 5, 50, and 95th percentile risks for the resident farmer at the most contaminated site were 4×10^{-6} , 6×10^{-5} , and 5×10^{-4} , respectively. For the assessment of Pu in surface soil, the principal sources of uncertainty in the estimated risks were population mobility, the relationship between indoor and outdoor contaminant levels, and the dose and risk factors for bone, liver, and lung.

431 (WHC-EP-0142-4) **Ground water maps of Hanford Site Separations Areas, December 1989.** Kasza, G.L. Westinghouse Hanford Co., Richland, WA (United States).

Jun 1990. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91001351. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Separations Areas consist of the 200 East and 200 West areas and the surrounding vicinity on the Hanford Site. Chemical processing operations are carried out in the Separations Areas by Westinghouse Hanford Company for the US Department of Energy-Richland Operations Office. This set of ground water maps consists of: (1) Separations Areas depth-to-water map, (2) Separations Areas water table map, and (3) a map comparing the potentiometric surface of the Rattlesnake Ridge confined aquifer with the water table of the unconfined aquifer. The field measurements for these maps were collected during December 1989. 3 figs., 1 tab.

432 (WHC-EP-0332) Simulations of infiltration of meteoric water and contaminant plume movement in the vadose zone at single-shell tank 241-T-106 at the Hanford Site. Smoot, J.L. (Pacific Northwest Lab., Richland, WA (USA)); Szecsody, J.E.; Sagar, B.; Gee, G.W.; Kincaid, C.T. Westinghouse Hanford Co., Richland, WA (United States). Nov 1989. 121p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE90015819. Source: NTIS, PC A06/MF A01 - OSTI; GPO Dep.

Contaminant plume migration in the vadose zone from a leak at Tank 241-T-106 on the Hanford Site was modeled to determine the effect of coarse backfill covers on the infiltration of meteoric water and the subsequent transport of contaminants. Infiltration through the upper 2 m of soil cover was simulated for the period of 1947 to 2020 using hydraulic properties estimated for the backfill sediments. The Tank 241-T-106 leak was simulated for the period 1960 to 1990 using an infiltration average of 77 percent of precipitation. The results of the simulations indicate that increased meteoric water infiltration because of the presence of coarse surface sediments increases the rate of movement of ^{106}Ru . The simulations show the ^{106}Ru plume approaching the water table in the early 1980's, but subsequent radioactive decay appears to preclude the plume from moving into the saturated zone. The simulated ^{137}Cs plume migrates considerably less distance than the ^{106}Ru plume because of greater sorption. The increased plume mobility compared to previous simulations at lower infiltration rates implies that remedial action, in the form of an infiltration barrier, could be an effective means to inhibit the movement of the plume. 22 refs., 19 figs., 7 tabs.

433 (WHC-EP-0348) Hanford Site waste management and environmental restoration integration plan. Merrick, D.L. Westinghouse Hanford Co., Richland, WA (United States). 30 Apr 1990. 97p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91001284. Source: NTIS, PC A05/MF A01; OSTI; INIS; GPO Dep.

The "Hanford Site Waste Management and Environmental Restoration Integration Plan" describes major actions leading to waste disposal and site remediation. The primary purpose of this document is to provide a management tool for use by executives who need to quickly comprehend the waste management and environmental restoration programs. The Waste Management and Environmental Restoration Programs have been divided into missions. Waste Management consists of five missions: double-shell tank (DST) wastes; single-shell tank (SST) wastes (surveillance and interim storage, stabilization, and isolation);

encapsulated cesium and strontium; solid wastes; and liquid effluents. Environmental Restoration consists of two missions: past practice units (PPU) (including characterization and assessment of SST wastes) and surplus facilities. For convenience, both aspects of SST wastes are discussed in one place. A general category of supporting activities is also included. 20 refs., 14 figs., 7 tabs.

434 (WHC-EP-0348-Suppl.1) Hanford Site waste management and environmental restoration integration plan: Supplement 1, Level 2 activity networks. Merrick, D.L. Westinghouse Hanford Co., Richland, WA (United States). Jun 1990. 42p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91001301. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The Hanford Site Waste Management and Environmental Restoration Integration Plan, Supplement 1: Level 2 Activity Networks is being issued to provide detailed activity networks for three missions: the double-shell tank waste mission, the single-shell tank waste mission, and the solid waste mission. Supporting information can be found in the principal document, the Hanford Site Waste Management and Environmental Restoration Integration Plan, WHC-EP-0348. 2 refs., 3 figs.

435 (WHC-EP-0368) Emergency Doses (ED) - Revision 3: A calculator code for environmental dose computations. Rittmann, P.D. Westinghouse Hanford Co., Richland, WA (United States). Dec 1990. 128p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91007158. Source: OSTI; NTIS; INIS; GPO Dep.

The calculator program ED (Emergency Doses) was developed from several HP-41CV calculator programs documented in the report Seven Health Physics Calculator Programs for the HP-41CV, RHO-HS-ST-5P (Rittman 1984). The program was developed to enable estimates of offsite impacts more rapidly and reliably than was possible with the software available for emergency response at that time. The ED - Revision 3, documented in this report, revises the inhalation dose model to match that of ICRP 30, and adds the simple estimates for air concentration downwind from a chemical release. In addition, the method for calculating the Pasquill dispersion parameters was revised to match the GENII code within the limitations of a hand-held calculator (e.g., plume rise and building wake effects are not included). The summary report generator for printed output, which had been present in the code from the original version, was eliminated in Revision 3 to make room for the dispersion model, the chemical release portion, and the methods of looping back to an input menu until there is no further no change. This program runs on the Hewlett-Packard programmable calculators known as the HP-41CV and the HP-41CX. The documentation for ED - Revision 3 includes a guide for users, sample problems, detailed verification tests and results, model descriptions, code description (with program listing), and independent peer review. This software is intended to be used by individuals with some training in the use of air transport models. There are some user inputs that require intelligent application of the model to the actual conditions of the accident. The results calculated using ED - Revision 3 are only correct to the extent allowed by the mathematical models. 9 refs., 36 tabs.

436 (WHC-EP-0369) Simulations of strontium-90 transport from the 100-N Area to the Columbia River

using VAM2DH. Lu, A.H. Westinghouse Hanford Co., Richland, WA (United States). Apr 1991. 47p. Sponsored by USDOE, Washington, DC (USA). DOE Contract AC06-87RL10930. Order Number DE91014685. Source: OSTI; NTIS; INIS; GPO Dep.

The VAM2DH computer software was used to simulate the migration of ^{90}Sr from liquid waste disposal facilities in the 100-N Area to the Columbia River. A baseline calibration analysis was made using published concentrations of ^{90}Sr at N Springs on the south bank of the Columbia River adjacent to the 100-N Area. Because of the limitations of the two-dimensional model, data from groundwater monitoring wells were not used for the calibration. Excellent agreement was achieved between the published and simulated concentrations for the years 1973 through 1990. Concentrations of ^{90}Sr at N Springs were predicted for up to 20 yr based on a 350 gal/min rate of effluent discharge to the 1325-N Liquid Waste Disposal Facility. 20 refs., 30 figs., 3 tabs.

437 (WHC-EP-0372-Vol.1-Rev.1) Hanford Environmental Information System (HEIS) user's manual: Volume 1, Revision 1. Edwards, P.A. (ed.) (Pacific Northwest Lab., Richland, WA (United States)); Gordon, E.A. (ed.); Cowley, P.J.; Brown, J.C.; Corrigan, A.L.; Kemp, H.H.; Kissinger, B.A.; Littlefield, J. Westinghouse Hanford Co., Richland, WA (United States). [1992]. 911p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93007465. Source: OSTI; NTIS; GPO Dep.

The Hanford Environmental Information System (HEIS) is a consolidated set of automated resources that effectively manage the data gathered during environmental monitoring and restoration of the Hanford Site. The HEIS includes an integrated database that provides consistent and current data to all users and promotes sharing of data by the entire user community. This manual, the HEIS User's Manual, describes the facilities available to the scientist, engineer, or manager who uses the system for environmental monitoring, assessment, and restoration planning; and to the regulator who is responsible for reviewing Hanford Site operations against regulatory requirements and guidelines.

438 (WHC-EP-0381) Status report for the Small-Tube Lysimeter Facility, fiscal year 1990. Sackschewsky, M.R. (Westinghouse Hanford Co., Richland, WA (USA)); Kemp, C.J.; Cadwell, L.L.; Thiede, M.E.; Waugh, W.J. Westinghouse Hanford Co., Richland, WA (United States). Jan 1991. 62p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91007919. Source: OSTI; NTIS; INIS; GPO Dep.

Westinghouse Hanford Company and Pacific Northwest Laboratory are jointly developing earthen protective barriers for the near surface disposal of radioactive and hazardous waste. The proposed barrier design consists of soil overlying a sequence of layers. The experiments were designed to measure the influence of erosion control practices and alternative barrier layering configurations on water movement within the barrier. This report describes the results of nearly 2 full years of data collection. Four concurrent experiments are being performed; each experiment is designed to test different components of the barrier. The results of this study are summarized: (1) Surface Treatment Effects – All three main factors (surface treatment, precipitation, and vegetation) had significant effects on both water storage change and cumulative evapotranspiration. (2) Layering Sequence Effects – There were no significant storage or evapotranspiration differences between the bimodal and graded

subsurface layering treatments. (3) Surface Sand and Gravel Effects – A sand deposition layer was found to have a similar effect on soil column water balance as a gravel mulch layer. Drainage was detected from both. (4) Alternative Barrier Effects – There were no significant storage or evapotranspiration differences between the clay and grout treatments. All barrier configurations except those with a surface layer of sand or gravel prevented drainage. This result indicates that the barrier will prevent water infiltration. If a gravel admix surface erodes to form a gravel mulch or if sands are deposited on the barrier surface, then infiltration may be possible. 15 refs., 31 figs., 3 tabs.

439 (WHC-EP-0412) Fate and transport of constituents leaked from Tank 241-A-105. Caggiano, J.A. Westinghouse Hanford Co., Richland, WA (United States). Oct 1991. 102p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92002914. Source: OSTI; NTIS; INIS; GPO Dep.

Following a January 28, 1965 sudden steam release in Tank 241-A-105, the carbon steel liner of the tank was noted to have bulged to a maximum height of about 8.5 feet (2.6 meters). Most of this bulging likely resulted from the January 28, 1965 incident. But available data indicate that some bulging during an earlier leak in 1963 when waste was being added to the tank may have contributed. By March 8, 1965, increases in radiation in the 14-05-03 leak detection lateral indicated that fluids had escaped the tank and that the liner was ruptured. Waste was subsequently transferred from Tank 241-A-105 to other tanks, and liquid levels in Tank 241-A-105 were maintained at about 18 inches to control temperature to prevent deterioration of the concrete. Spray cooling water was added weekly to the tank from February 1971 to December 1978 to maintain liquid levels and temperatures, and some of this fluid is assumed to have leaked from the tank. This study examined available data to determine, to the extent possible, the distribution of the leaked constituents in surrounding soils and whether they migrated to groundwater. In this assessment, available data from gross gamma logging of dry wells and leak detection laterals as well as data from analyses of groundwater samples were examined throughout the period of interest. Logs of wells and photographs taken during construction of the 241-A-105 Tank Farm were also examined.

440 (WHC-EP-0418) CDFTBL: A statistical program for generating cumulative distribution functions from data: User's manual, Version 1.0. Eslinger, P.W. (Pacific Northwest Lab., Richland, WA (United States)). Westinghouse Hanford Co., Richland, WA (United States). Jun 1991. 117p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930 ; AC06-76RL01830. Order Number DE92002106. Source: OSTI; NTIS; INIS; GPO Dep.

This document describes the theory underlying the CDFTBL code and gives details for using the code. The CDFTBL code provides an automated tool for generating a statistical cumulative distribution function that describes a set of field data. The cumulative distribution function is written in the form of a table of probabilities, which can be used in a Monte Carlo computer code. As a specific application, CDFTBL can be used to analyze field data collected for parameters required by the PORMC computer code. Section 2.0 discusses the mathematical basis of the code. Section 3.0 discusses the code structure. Section 4.0 describes the free-format input command language, while Section 5.0 describes in detail the commands to run the program. Section

6.0 provides example program runs, and Section 7.0 provides references. The Appendix provides a program source listing. 11 refs., 2 figs., 19 tabs.

441 (WHC-EP-0423) PORPST: A statistical post-processor for the PORMC computer code: User's manual, Version 1.0. Eslinger, P.W. (Pacific Northwest Lab., Richland, WA (United States)); Didier, B.T. Westinghouse Hanford Co., Richland, WA (United States). Jun 1991. 54p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930 ; AC06-76RL01830. Order Number DE92002105. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes the theory underlying the PORPST code and gives details for using the code. The PORPST code is designed to do statistical postprocessing on files written by the PORMC computer code. The data written by PORMC are summarized in terms of means, variances, standard deviations, or statistical distributions. In addition, the PORPST code provides for plotting of the results, either internal to the code or through use of the CONTOUR3 post-processor. Section 2.0 discusses the mathematical basis of the code, and Section 3.0 discusses the code structure. Section 4.0 describes the free-format point command language. Section 5.0 describes in detail the commands to run the program. Section 6.0 provides an example program run, and Section 7.0 provides the references. 11 refs., 1 fig., 17 tabs.

442 (WHC-EP-0430) Environmental Restoration Remedial Action Program records management plan. Michael, L.E. Westinghouse Hanford Co., Richland, WA (United States). Jul 1991. 36p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91016625. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy-Richland Operations Office (DOE-RL) Environmental Restoration Field Office Management Plan [(FOMP) DOE-RL 1989] describes the plans, organization, and control systems to be used for management of the Hanford Site environmental restoration remedial action program. The FOMP, in conjunction with the Environmental Restoration Remedial Action Quality Assurance Requirements document [(QARD) DOE-RL 1991], provides all the environmental restoration remedial action program requirements governing environmental restoration work on the Hanford Site. The FOMP requires a records management plan be written. The Westinghouse Hanford Company (Westinghouse Hanford) Environmental Restoration Remedial Action (ERRA) Program Office has developed this ERRA Records Management Plan to fulfill the requirements of the FOMP. This records management plan will enable the program office to identify, control, and maintain the quality assurance, decisional, or regulatory prescribed records generated and used in support of the ERRA Program. 8 refs., 1 fig.

443 (WHC-EP-0430-Rev.1) Environmental Restoration Program Records Management Plan: Revision 1. Montgomery, L.M. Westinghouse Hanford Co., Richland, WA (United States). Dec 1992. 59p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93006525. Source: OSTI; NTIS; GPO Dep.

This document describes the plans, organization, and control systems to be used for management of the Hanford Site Environmental Restoration (ER) Program. The Field Office

Management Plan (FOMP), in conjunction with the Environmental Restoration Program Quality Assurance System Requirements for the Hanford Site (QASR [DOE-RL 1992a]), provides requirements governing ER Program work activities on the Hanford Site. The FOMP requires a records management plan be written. The Westinghouse Hanford Company (WHC) ER Program Office has developed this ER Program Records Management Plan to fulfill the requirements of the FOMP (DOE-RL 1989). This records management plan will enable the ER Program Office and other ER Program participants to identify, control, and maintain the records generated and used in support of the ER Program.

444 (WHC-EP-0433) Environmental Restoration Program Document Control Plan. Montgomery, L.M. Westinghouse Hanford Co., Richland, WA (United States). Sep 1993. 46p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94001692. Source: OSTI; NTIS; INIS; GPO Dep.

This Environmental Restoration (ER) Program Document Control Plan has been developed to comply with the document control system requirements of the US Department of Energy, Richland Operations Office (RL), the Hanford Federal Facility and the ER Program. One of the five components, or summary subprojects, of the Environmental Restoration (ER) Program is program management and support, which includes both management systems development and information and data management. Efforts within the management systems development area include the creation of a document control plan. Westinghouse Hanford Company (WHC) has developed and established an overall document control system that governs the methods by which all WHC documents are generated, maintained, and disposed of. The ER Program performing organizations within WHC utilize the established WHC document control systems to the maximum extent possible. These systems are discussed in Chapters 3.0 and 4.0 of this plan. In addition, this plan describes the documents that require control within the ER Program and how they will be controlled.

445 (WHC-EP-0458) Hanford groundwater cleanup and restoration conceptual study. Roock, F.V. Westinghouse Hanford Co., Richland, WA (United States). Jul 1992. 281p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92019885. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of the sitewide groundwater restoration study is to (1) develop groundwater use scenarios, (2) identify potential groundwater restoration technologies that may be appropriate at the Hanford Site, (3) recommend sitewide engineering systems that satisfy the restoration objectives for each groundwater-use scenario, and (4) identify emerging technologies or research and development (R&D) needs that have potential at the Hanford Site. Three groundwater restoration-use scenarios have been developed to meet specific objectives and land uses at the Hanford Site. These scenarios are described in detail within the next section. This report presents three recommended sitewide systems, one for each scenario, that are engineered to a preconception level of detail. Within each scenario, the engineered system is intended to restore groundwater on a sitewide basis, rather than to collect individual systems for each operable unit. Although aggregate areas (100, 200, 300, and 600) may have distinct restoration systems, these systems must be compatible and integrated for successful implementation and operation within each scenario. This report also

identifies technologies that were considered during the formulation of the sitewide engineered systems. New and emerging technologies or R&D needs are discussed along with their application and potential to each groundwater-use scenario.

446 (WHC-EP-0459) 300 Area Hanford past-practice site cleanup and restoration conceptual study. Westinghouse Hanford Co., Richland, WA (United States). Jul 1992. 306p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92019882. Source: OSTI; NTIS; INIS; GPO Dep.

The Hanford Site has been divided into operational (aggregate) areas since operations began in the 1940's. Each operational area currently contains a number of operable units, each currently undergoing an independent RI/FS process. Throughout the history of the Hanford Site, each operational area had specific missions, but similar contaminants can be found throughout each area. Cleanup of the Hanford Site by operational area (as opposed to the operable unit approach) may prove to be more cost effective and faster to implement, particularly if large-scale equipment is used. The 200 and 300 areas are the two Hanford Site operational areas of interest for this study. The 300 Area was involved in the handling and processing of uranium during the 1940's and 1950's. Since the 1950's, the primary activities in the 300 Area have been related to process development and research activities. This study addresses the remediation of the 300 Area. The 200 Areas make up the process operations area. Since the 1960's, most of the waste management activities have been conducted in the 200 Areas. The 200 Areas are the projected disposal sites for radioactive and mixed waste from the remediation of the 300 Area. The primary objective of this report is to provide a conceptual engineering baseline, including an estimate of the cost and schedule for cleanup, disposal, and restoration of the entire Hanford Site 300 Area using a large-scale or macroengineering approach. The systems proposed in this study are conceptual in nature and are not to be considered final. This study is a planning tool and not equivalent to a definitive design.

447 (WHC-EP-0489) Hanford Site surface soil radioactive contamination control plan for fiscal year 1992. Winship, R.A.; Hughes, M.C. Westinghouse Hanford Co., Richland, WA (United States). Nov 1991. 113p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92004542. Source: OSTI; NTIS; INIS; GPO Dep.

The Surplus Facilities and Resource Conservation and Recovery Act of 1976 (RCRA) closures program is responsible to the US Department of Energy Field Office, Richland, for the safe and cost-effective surveillance, maintenance, and decommissioning of surplus facilities and RCRA closures at the Hanford Site. This program is also responsible for the Radiation Area Remedial Action (RARA) work that includes the surveillance, maintenance, decontamination, and/or interim stabilization of inactive burial grounds, cribs, ponds, trenches, and unplanned release sites. This plan addresses only the RARA activity requirements for managing and controlling the contaminated surface soil areas associated with these inactive sites until they are remediated as part of the Hanford Site environmental restoration process. All known RARA and non-RARA contaminated surface soil areas are listed in this document so that a complete list of the sites requiring remediation is in one document. Specific

organizational responsibility for management and control of these sites is shown in Appendix A.

448 (WHC-EP-0489-1) Hanford Site surface soil radioactive contamination control plan for fiscal year 1993. Winship, R.A.; Hughes, M.C. Westinghouse Hanford Co., Richland, WA (United States). Sep 1992. 102p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93003984. Source: OSTI; NTIS; INIS; GPO Dep.

The Decommissioning and Resource Conservation and Recovery Act Closure Program ensures safe and cost-effective surveillance, maintenance, and decommissioning of surplus facilities and Resource Conservation and Recovery Act closures at the Hanford Site and reports to the US Department of Energy, Richland Field Office. This program also manages the Radiation Area Remedial Action, which includes the surveillance, maintenance, decontamination, and/or interim stabilization of inactive burial grounds, cribs, ponds, trenches, and unplanned release sites. This report addresses only the Radiation Area Remedial Action activity requirements for managing and controlling the contaminated surface soil areas associated with these inactive sites until they are remediated as part of the Hanford Site environmental restoration process.

449 (WHC-EP-0489-2) Hanford Site surface soil radioactive contamination control plan, March 1993. Mix, P.D.; Winship, R.A. Westinghouse Hanford Co., Richland, WA (United States). Apr 1993. 97p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93016354. Source: OSTI; NTIS; INIS; GPO Dep.

The Decommissioning and Resource Conservation and Recovery Act Closure Program is responsible to the US Department of Energy Richland Field Office, for the safe and cost-effective surveillance, maintenance, and decommissioning of surplus facilities and Resource Conservation and Recovery Act of 1976 closures at the Hanford Site. This program also manages the Radiation Area Remedial Action that includes the surveillance, maintenance, decontamination, and/or interim stabilization of inactive burial grounds, cribs, ponds, trenches, and unplanned release sites. This plan addresses only the Radiation Area Remedial Action activity requirements for managing and controlling the contaminated surface soil areas associated with these inactive sites until they are remediated as part of the Hanford Site environmental restoration process. All officially numbered Radiation Area Remedial Action and non-Radiation Area Remedial Action contaminated surface soil areas are listed in this document so that a complete list of the sites requiring remediation is contained in one document.

450 (WHC-EP-0548) Conducting Five-Year Plan and Tri-Party Agreement community outreach activities at the US Department of Energy Richland Field Office. Peterson, J.M. (USDOE Richland Field Office, WA (United States)); Brown, M.C. Westinghouse Hanford Co., Richland, WA (United States). Mar 1992. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-920307-90: Waste management '92, Tucson, AZ (United States), 1-5 Mar 1992). Order Number DE93001464. Source: OSTI; NTIS; GPO Dep.

For cleanup to succeed, the public must be informed and involved. Both the Tri-Party Agreement and the Five-Year Plan require significant public interactions. The Tri-Party

Agreement has a community relations plan, and the Five-Year Plan has a rigorous community outreach agenda. Both recognize that the public must get every reasonable opportunity to learn about and to voice opinions about DOE's cleanup activities. Beginning this year, our Five-Year Plan public participation action plan will fold in all DOE Environmental Restoration and Waste Management outreach activities at Hanford. This supports the need we recognize to coordinate public involvement activities sitewide.

451 (WHC-EP-0587) Groundwater impact assessment report for the 400 Area ponds. Westinghouse Hanford Co., Richland, WA (United States). Oct 1992. 142p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93005843. Source: OSTI; NTIS; INIS; GPO Dep.

The 400 Area Secondary Cooling Water stream (informally designated the process sewer effluent) discharges to the 4608B and 4608C percolation ponds (informally designated the 400 Area ponds) located north of the 400 Area perimeter fence. This report satisfies one of the requirements of the Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement) Milestone M-17-00B as agreed by the US Department of Energy, Washington State Department of Ecology, and the US Environmental Protection Agency. Tri-Party Agreement Milestone M-17-00B includes a requirement to assess impacts to groundwater from disposal of the process effluent to the 400 Area ponds.

452 (WHC-EP-0595) Westinghouse Hanford Company Operational Groundwater status report, 1990-1992. Johnson, V.G. Westinghouse Hanford Co., Richland, WA (United States). Mar 1993. 509p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93017594. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents information related to the water quality of ground water at the Hanford Reservation. Included are plume maps, geology, hydrology, and information on various effluent sources.

453 (WHC-EP-0597) Status report for the Small-Tube Lysimeter Facility; Fiscal year 1992. Sackschewsky, M.R. (Westinghouse Hanford Co., Richland, WA (United States)); Kemp, C.J.; Cadwell, L.L. Westinghouse Hanford Co., Richland, WA (United States); Pacific Northwest Lab., Richland, WA (United States). Jul 1993. 79p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93040391. Source: OSTI; NTIS; INIS; GPO Dep.

Westinghouse Hanford Company and Pacific Northwest Laboratory are jointly developing earthen protective barriers for the near-surface disposal of radioactive and hazardous waste at the Hanford Site. The proposed barrier design consists of a blanket of fine-textured soil overlying a sequence of layers, varying from sand to basalt riprap. The experiments conducted at the Small-Tube Lysimeter Facility (STLF) were designed to measure the influence of erosion-control practices and alternate barrier layer configurations on water movement within the barrier, and extraction of water from the barrier. This report describes the results of data collected during the period from September 1988 through May 1992 at the STLF. Four concurrent experiments are being performed at this facility, each of these experiments are designed to test different components of the proposed barrier. The experiments are as follows.

454 (WHC-EP-0609) Riverbank seepage of groundwater along the 100 Areas shoreline, Hanford Site. Peterson, R.E.; Johnson, V.G. Westinghouse Hanford Co., Richland, WA (United States). Dec 1992. 70p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93008840. Source: OSTI; NTIS; INIS; GPO Dep.

Chemical and radiological data are described for samples of riverbank seepage, nearshore river water, and sediment associated with seepage. Sampling locations are along the right bank (generally southern shoreline) of the Columbia River on the Hanford Site. Locations extend from the 100-B Area approximately 26 miles downstream to the northern edge of the Hanford Townsite. The data were obtained during (1) environmental surveillance activities and (2) remedial investigations to characterize the influence of contaminated groundwater on the Columbia River.

455 (WHC-EP-0610) Westinghouse Hanford Company Native American Employment Program: 1992 program overview and year-end summary. Azure, G.P. Westinghouse Hanford Co., Richland, WA (United States). Nov 1992. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93008176. Source: OSTI; NTIS; GPO Dep.

The Native American Employment Program (NAEP) is an aggressive, innovative approach to employment outreach and training. It is designed to address the diverse needs of Native American communities through recognition of their unique culture. Through training and employment, Native Americans have first-hand involvement in the important task of environmental restoration at the Hanford Site. Participants have the opportunity to embark on careers that offer tremendous pathing potential while fulfilling vital Hanford staffing needs.

456 (WHC-EP-0620) 100 Areas CERCLA ecological investigations. Landeen, D.S.; Sackschewsky, M.R.; Weiss, S. Westinghouse Hanford Co., Richland, WA (United States). Sep 1993. 203p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94000737. Source: OSTI; NTIS; INIS; GPO Dep.

This document reports the results of the field terrestrial ecological investigations conducted by Westinghouse Hanford Company during fiscal years 1991 and 1992 at operable units 100-FR-3, 100-HR-3, 100-NR-2, 100-KR-4, and 100-BC-5. The tasks reported here are part of the Remedial Investigations conducted in support of the Comprehensive Environmental Response, compensation, and Liability Act of 1980 studies for the 100 Areas. These ecological investigations provide (1) a description of the flora and fauna associated with the 100 Areas operable units, emphasizing potential pathways for contaminants and species that have been given special status under existing state and/or federal laws, and (2) an evaluation of existing concentrations of heavy metals and radionuclides in biota associated with the 100 Areas operable units.

457 (WHC-EP-0661) Summary report on parametric pressure propagation test T0127-1. Fauske, H.K. (Fauske and Associates, Inc., Burr Ridge, IL (US)). Westinghouse Hanford Co., Richland, WA (United States). Jun 1993. 101p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93018059. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents the results of two ferrocyanide propagating reaction generated aerosol tests, conducted as a part of a series of tests directed by Westinghouse Hanford Company (WHC). The tests discussed in this document are designated as T0208-1 and T0209-1. The tests were carried out in a 49 L containment volume equipped with an aerosol filter housing. The test setup is described in Section 2.0. Each test used an ≈ 50 gm. sample of InFarm-1 bottom flow sheet material which was vacuum dried, screened through a 140 mesh sieve, and rehydrated to 1 wgt. % water content prior to testing. The test sample and reaction ignition method are described in Section 3.0. A special test protocol was defined and followed for the tests as described in Section 4.0 and Appendix B. Test results are discussed in Section 5.0. Both tests yielded a significant aerosol sample on the filter element. These filter elements and aerosol deposits have been sent to WHC for analysis, and any information as to the content or chemical composition of the trapped particulate material awaits the results of WHC efforts in this regard. The reaction propagation tests were conducted at 60°C and 120°C respectively. The average propagation velocities are consistent with other related observations.

458 (WHC-EP-0662) Summary report on 49 L ferrocyanide aerosol tests T0208-1 and T0209-1. Fauske, H.K. (Fauske and Associates, Inc., Burr Ridge, IL (United States)). Westinghouse Hanford Co., Richland, WA (United States); Fauske and Associates, Inc., Burr Ridge, IL (United States). Jun 1993. 50p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93040339. Source: OSTI; NTIS; GPO Dep.

This report presents the results of the first test conducted in a series of tests directed by Westinghouse Hanford Company (WHC). For the record, Ref.[1] is included as Appendix A. The test discussed in this document, designated as T0127-1, is a ferrocyanide reaction propagation rate determination test conducted under an inert argon atmosphere of 10 atm. abs. (130 psig). The test was conducted in a new 49 L containment volume described in Section 2.0. The test sample was dry In-Farm 1 bottom flow sheet material. The test protocol was similar to that described in Refs.[2 and 3]. However, as requested in Ref.[1] supplemental gas sample taking procedures were prepared and followed as described in Section 4.0 and Appendix B. Test results showed an inverse reaction propagation velocity of ≈ 4 sec/cm. This is about 50% faster than a prior similar test conducted under 1 atm. abs. pressure. For further comparison, this burn velocity of the ferrocyanide test is also about an order-of-magnitude slower than a slow burn gun powder at 1 atm. Pre- and post-test gas samples were taken and have been forwarded to WHC for further analyses. Details of these results are presented in Section 5.0 and comparisons with other similar reaction propagation rate tests are discussed in Section 6.0.

459 (WHC-EP-0664) Groundwater impact assessment for the 216-U-17 Crib, 200 West Area. Reidel, S.P.; Johnson, V.G.; Kline, N.W. Westinghouse Hanford Co., Richland, WA (United States). Jun 1993. 204p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93040392. Source: OSTI; NTIS; INIS; GPO Dep.

As required by the Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement milestone M-17-00A), this report assesses the impact to groundwater from discharge of process condensate to the ground at the 216-U-17 Crib. The assessment considers impacts associated

with moisture movement through soil beneath the crib and the potential transport of contaminants to the groundwater.

460 (WHC-EP-0666) Groundwater impact assessment report for the 100-D Ponds. Alexander, D.J. Westinghouse Hanford Co., Richland, WA (United States). Jul 1993. 119p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93040404. Source: OSTI; NTIS; INIS; GPO Dep.

The 183-D Water Treatment Facility (WTF) discharges effluent to the 120-0-1 Ponds (100-D Ponds) located north of the 100-D Area perimeter fence. This report satisfies one of the requirements of the Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement) Milestone M-17-00B as agreed by the US Department of Energy, Washington State Department of Ecology, and the US Environmental Protection Agency. Tri-Party Agreement Milestone M-17-00B includes a requirement to assess impacts to groundwater from disposal of the 183-D WTF effluent to the 100-D Ponds. In addition, the 100-D Ponds are a Resource Conservation and Recovery Act of 1976 treatment, storage, and disposal facility covered by the 100-D Ponds Closure Plan (DOE-RL 1993a). There is evidence of groundwater contamination, primarily nitrate, tritium, and chromium, in the unconfined aquifer beneath the 100-D Area and 100 Areas in general. The contaminant plumes are area wide and are a result of past-practice reactor and disposal operations in the 100-D Area currently being investigated as part of the 100-DR-1 and 100-HR-3 Operable Units (DOE-RL 1992b, 1992a). Based on current effluent conditions, continued operation of the 100-D Ponds will not adversely affect the groundwater quality in the 100-D Area. Monitoring wells near the pond have slightly higher alkaline pH values than wells in the rest of the area. Concentrations of known contaminants in these wells are lower than ambient 100-D Area groundwater conditions and exhibit a localized dilution effect associated with discharges to the pond. Hydraulic impact to the local groundwater system from these discharges is minor. The groundwater monitoring well network for the 100-D Ponds is adequate.

461 (WHC-EP-0673) Permanent isolation surface barrier development plan. Wing, N.R. Westinghouse Hanford Co., Richland, WA (United States). Jan 1994. 176p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94008656. Source: OSTI; NTIS; INIS; GPO Dep.

The exhumation and treatment of wastes may not always be the preferred alternative in the remediation of a waste site. In-place disposal alternatives, under certain circumstances, may be the most desirable alternatives to use in the protection of human health and the environment. The implementation of an in-place disposal alternative will likely require some type of protective covering that will provide long-term isolation of the wastes from the accessible environment. Even if the wastes are exhumed and treated, a long-term barrier may still be needed to adequately dispose of the treated wastes or any remaining waste residuals. Currently, no "proven" long-term barrier is available. The Hanford Site Permanent Isolation Surface Barrier Development Program (BDP) was organized to develop the technology needed to provide a long-term surface barrier capability for the Hanford Site. The permanent isolation barrier technology also could be used at other sites. Permanent isolation barriers use engineered layers of natural materials to create an integrated structure with redundant protective features. Drawings of conceptual permanent isolation surface

barriers are shown. The natural construction materials (e.g., fine soil, sand, gravel, riprap, asphalt) have been selected to optimize barrier performance and longevity. The objective of current designs is to use natural materials to develop a maintenance-free permanent isolation surface barrier that isolates wastes for a minimum of 1,000 years by limiting water drainage to near-zero amounts; reducing the likelihood of plant, animal, and human intrusion; controlling the exhalation of noxious gases; and minimizing erosion-related problems.

462 (WHC-EP-0674) Groundwater impact assessment report for the 216-Z-20 Crib, 200 West Area. Johnson, V.G. Westinghouse Hanford Co., Richland, WA (United States). Oct 1993. 288p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94002481. Source: OSTI; NTIS; INIS; GPO Dep.

As required by the Hanford Federal Facility Agreement and Consent Order ([Tri-Party Agreement] Milestone M-17-00A), this report assesses the impact of wastewater discharges to the 216-Z-20 Crib on groundwater quality. The assessment reported herein extends the initial analysis conducted from 1989 through 1990 for the Liquid Effluent Study Final Project Report. Three primary issues are addressed in response to regulator concerns with the initial analysis: The magnitude and status of the soil column transuranic inventory. Potential interactions of wastewater with carbon tetrachloride from adjacent facilities. Preferential pathways created by unsealed monitoring wells.

463 (WHC-EP-0675) Groundwater impact assessment report for the 1325-N Liquid Waste Disposal Facility. Alexander, D.J.; Johnson, V.G. Westinghouse Hanford Co., Richland, WA (United States). Sep 1993. 126p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94001226. Source: OSTI; NTIS; INIS; GPO Dep.

In 1943 the Hanford Site was chosen as a location for the Manhattan Project to produce plutonium for use in nuclear weapons. The 100-N Area at Hanford was used from 1963 to 1987 for a dual-purpose, plutonium production and steam generation reactor and related operational support facilities (Diediker and Hall 1987). In November 1989, the reactor was put into dry layup status. During operations, chemical and radioactive wastes were released into the area soil, air, and groundwater. The 1325-N LWDF was constructed in 1983 to replace the 1301-N Liquid Waste Disposal Facility (1301-N LWDF). The two facilities operated simultaneously from 1983 to 1985. The 1301-N LWDF was retired from use in 1985 and the 1325-N LWDF continued operation until April 1991, when active discharges to the facility ceased. Effluent discharge to the piping system has been controlled by administrative means. This report discusses ground water contamination resulting from the 1325-N Liquid Waste Disposal facility.

464 (WHC-EP-0678) The Westinghouse Hanford Company Operational Environmental Monitoring Program CY-93. Schmidt, J.W. Westinghouse Hanford Co., Richland, WA (United States). Oct 1993. 38p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94004895. Source: OSTI; NTIS; INIS; GPO Dep.

The Operational Environmental Monitoring Program (OEMP) provides facility-specific environmental monitoring to protect the environment adjacent to facilities under the responsibility of Westinghouse Hanford Company (WHC) and

assure compliance with WHC requirements and local, state, and federal environmental regulations. The objectives of the OEMP are to evaluate: compliance with federal (DOE, EPA), state, and internal WHC environmental radiation protection requirements and guides; performance of radioactive waste confinement systems; and trends of radioactive materials in the environment at and adjacent to nuclear facilities and waste disposal sites. This paper identifies the monitoring responsibilities and current program status for each area of responsibility.

465 (WHC-EP-0679) Groundwater impact assessment report for the 284-WB Powerplant Ponds. Alexander, D.J.; Johnson, V.G.; Lindsey, K.A. Westinghouse Hanford Co., Richland, WA (United States). Sep 1993. 78p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94001228. Source: OSTI; NTIS; INIS; GPO Dep.

As required by the Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement Milestone M-17-00A), this report assesses the impact of wastewater discharged to the 284-WB Powerplant Ponds on groundwater quality. The assessment reported herein expands upon the initial analysis conducted between 1989 and 1990 for the Liquid Effluent Study Final Project Plan.

466 (WHC-EP-0680) Final report on fiscal year 1992 activities for the environmental monitors line-loss study. Kenoyer, J.L. (Science Applications International Corp., Richland, WA (United States)). Westinghouse Hanford Co., Richland, WA (United States); Science Applications International Corp., Richland, WA (United States). 9 Dec 1993. 170p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94005513. Source: OSTI; NTIS; INIS; GPO Dep.

The work performed on this Environmental Monitors Line-Loss Study has been performed under Contract Numbers MLW-SVV-073750 and MFH-SVV-207554. Work on the task was initiated mid-December 1991, and this report documents and summarizes the work performed through January 18, 1993. The sections included in this report summarize the work performed on the Environmental Monitors Line-Loss Study. The sections included in this report are arranged to reflect individual sub-tasks and include: descriptions of measurement systems and procedures used to obtain cascade impactor samples and laser spectrometer measurements from multiple stacks and locations; information on data acquisition, analyses, assessment, and software; discussion of the analyses and measurement results from the cascade impactor and laser spectrometer systems and software used; discussion on the development of general test methods and procedures for line-loss determinations; an overall summary and specific conclusions that can be made with regard to efforts performed on this task during FY 1992 and FY 1993. Supporting information for these sections is included in this report as appendices.

467 (WHC-EP-0684) Surface stabilization and revegetation test plots: Fiscal year 1993 status report. Sackschewsky, M.R.; Kemp, C.J.; Hayward, W.M. Westinghouse Hanford Co., Richland, WA (United States). Sep 1993. 37p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94001238. Source: OSTI; NTIS; INIS; GPO Dep.

Westinghouse Hanford Company Decommissioning and Decontamination Engineering Group and Environmental Technology and Assessment Groups are developing new

technologies to improve revegetation techniques for interim stabilization control over underground waste sites within the Radiation Area Remedial Action Program. Successful revegetation is an integral aspect of waste isolation strategy. Unfortunately, revegetation can be very difficult to achieve on the Hanford Site due to several factors: low annual precipitation, unpredictable timing of precipitation, low fertility of available soils, and coarse physical texture of soils covering waste sites. The tests in this report were performed during fiscal years 1992 and 1993 and include the use of two soil sealants in combination with bare soil and a soil/compost mixture and a comparison of a wheatgrass mixture and a native seed mixture. Hydroprobe access ports were placed in one-half of the test plots and moisture data was collected. Soil fertility and plant community characteristics were monitored during the two years of the test. During the first year all sites with compost provided additional fertility and retained greater amounts of soil moisture than noncomposted sites. The use of Enduraseal soil fixative provided greater soil moisture than the use of Aerospray-77 soil fixative. During the second year the use of compost and soil fixative's had a lesser effect on soil moisture. During late summer periods all treatments had very similar soil moisture profiles. The use of compost greatly increased vegetative cover and soil fertility in comparison to sites that had no compost added. Testing of the seed mixtures found that Siberian wheatgrass and Sandberg's bluegrass were the most dominant of the seeded species observed. All plots exhibited a dominant plant cover of volunteer cheatgrass. Biomass production was significantly greater on plots with compost than on the noncomposted plots.

468 (WHC-EP-0688) Fixation of soil surface contamination using natural polysaccharides. Sackschewsky, M.R. Westinghouse Hanford Co., Richland, WA (United States). Sep 1993. 107p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94001225. Source: OSTI; NTIS; INIS; GPO Dep.

Natural polysaccharides were evaluated as alternatives to commercially available dust-control agents for application in buried-waste and contaminated-soil remediation situations. Materials were identified and evaluated with specific criteria in mind: the materials must be environmentally benign and must not introduce any additional hazardous materials; they must be effective for at least 2 or 3 days, but they do not necessarily have to be effective for more than 2 to 3 weeks; they should be relatively resistant to light traffic; they must not interfere with subsequent soil treatment techniques, especially soil washing; and they must be relatively inexpensive. Two products, a pregelled potato starch and a mixture of carbohydrates derived from sugar beets, were selected for evaluation. Testing included small- and large-scale field demonstrations, laboratory physical property analyses, and wind-tunnel evaluations.

469 (WHC-EP-0690) Groundwater Impact assessment report for the 216-S-26 Crib, 200 West Area. Lindberg, J.W.; Evelo, S.D.; Alexander, D.J. Westinghouse Hanford Co., Richland, WA (United States). Nov 1993. 273p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94005515. Source: OSTI; NTIS; INIS; GPO Dep.

This report assesses the impact of wastewater discharged to the 216-S-26 Crib on groundwater quality. The 216-S-26 Crib, located in the southern 200 West Area, has been in use since 1984 to dispose of liquid effluents from the 222-S

Laboratory Complex. The 222-S Laboratory Complex effluent stream includes wastewater from four sources: the 222-S Laboratory, the 219-S Waste Storage Facility, the 222-SA Chemical Standards Laboratory, and the 291-S Exhaust Fan Control House and Stack. Based on assessment of groundwater chemistry and flow data, contaminant transport predictions, and groundwater chemistry data, the 216-S-26 Crib has minimal influence on groundwater contamination in the southern 200 West Area.

470 (WHC-EP-0698) Groundwater Impact assessment report for the 216-U-14 Ditch. Singleton, K.M.; Lindsey, K.A. Westinghouse Hanford Co., Richland, WA (United States). Jan 1994. 636p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94007425. Source: OSTI; NTIS; GPO Dep.

Groundwater impact assessments are conducted at liquid effluent receiving sites on the Hanford Site to determine hydrologic and contaminant impacts caused by discharging wastewater to the soil column. The assessments conducted are pursuant to the Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement) Milestone M-17-00A and M-17-00B, as agreed by the US Department of Energy (DOE), Washington State Department of Ecology (Ecology), and the US Environmental Protection Agency (EPA) (Ecology et al. 1992). This report assesses impacts on the groundwater and vadose zone from wastewater discharged to the 216-U-14 Ditch. Contemporary effluent waste streams of interest are 242-S Evaporator Steam Condensate and UO₃/U Plant wastewater.

471 (WHC-EP-0749) Westinghouse radiological containment guide. Aitken, S.B. (Idaho National Engineering Lab., Idaho Falls, ID (United States)); Brown, R.L.; Cantrell, J.R.; Wilcox, D.P. Westinghouse Hanford Co., Richland, WA (United States). Mar 1994. 156p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94010889. Source: OSTI; NTIS; INIS; GPO Dep.

This document provides uniform guidance for Westinghouse contractors on the implementation of radiological containments. This document reflects standard industry practices and is provided as a guide. The guidance presented herein is consistent with the requirements of the DOE Radiological Control Manual (DOE N 5480.6). This guidance should further serve to enable and encourage the use of containments for contamination control and to accomplish the following: Minimize personnel contamination; Prevent the spread of contamination; Minimize the required use of protective clothing and personal protective equipment; Minimize the generation of waste.

472 (WHC-MR-0227) Tank wastes discharged directly to the soil at the Hanford Site. Waite, J.L. Westinghouse Hanford Co., Richland, WA (United States). Apr 1991. 35p. Sponsored by USDOE, Washington, DC (USA). DOE Contract AC06-87RL10930. Order Number DE91013239. Source: OSTI; NTIS; GPO Dep.

This report summarizes the type, quantity, and characteristics of wastes associated with the single-shell storage tanks discharged intentionally or inadvertently to the ground at the Hanford Site. This includes: waste, discharged from the single-shell tanks (SST) directly to the ground via pumping or cascade overflow; leaks from SSTs; leaks from transfer lines and other unplanned releases and spills. The report does not address process condensate wastestreams

resulting from the evaporator concentration or other processing of tank wastes. These condensate streams were of much larger volume, but contained significantly less radionuclide content. These streams are documented in other reports. This report does not address the many other liquid disposal sites that received other (non-SST) wastes as part of the soil column disposal practices at the Hanford Site. Also included are discussions of the process steps and tank streams discharged, chemical composition of discharged waste and the environmental impact and clean up of waste discharges at the Hanford Site. 18 refs., 3 figs., 4 tabs.

473 (WHC-MR-0229) **Status of ground water in the 1100 Area.** Law, A.G. Westinghouse Hanford Co., Richland, WA (United States). Dec 1990. 100p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91007159. Source: OSTI; NTIS; INIS; GPO Dep.

This document contains the results of monthly sampling of 1100 Area Wells and ground water monitoring. Included is a table that presents all of the results of monthly sampling and analyses between April 1989 and May 1990, for four constituents selected to be most indicative of the potential for contamination from US Department of Energy facilities. The samples were collected from the three wells near the city of Richland well field. Also included is a table that presents a listing of the analytical results from sampling and analyses of five wells between April 1989, and May 1990 in the 1100 Area. The detection limit and drinking water standards or maximum contaminant level are also listed in the tables for each constituent.

474 (WHC-MR-0270) **200-BP-5 operable unit Technical Baseline report.** Jacques, I.D.; Kent, S.K. Westinghouse Hanford Co., Richland, WA (United States). Oct 1991. 45p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94002477. Source: OSTI; NTIS; INIS; GPO Dep.

This report supports development of a remedial investigation/feasibility study work plan for the 200-BP-5 operable unit. The report summarizes baseline information for waste sites and unplanned release sites located in the 200-BP-5 operable unit. The sites were investigated by the Technical Baseline Section of the Environmental Engineering Group, Westinghouse Hanford Company (Westinghouse Hanford). The investigation consisted of review and evaluation of current and historical Hanford Site reports, drawings, and photographs, and was supplemented with recent inspections of the Hanford Site and employee interviews. No field investigations or sampling were conducted.

475 (WHC-MR-0293) **Legacy and legend: Fifty years of defense production at the Hanford Site.** Gerber, M.S. Westinghouse Hanford Co., Richland, WA (United States). Jan 1992. 61p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92007917. Source: OSTI; NTIS; INIS; GPO Dep.

This document compiles eleven articles written on the history of Hanford site. Beginning in 1855 with a discussion of the settlement of the basin, the author moves to the wartime production of plutonium, and later Hanford's role in radioactive waste storage and eventual remediation.

476 (WHC-MR-0293-Rev.1) **Legend and legacy: Fifty years of defense production at the Hanford Site: Revision 1.** Gerber, M.S. Westinghouse Hanford Co., Richland, WA (United States). Mar 1992. 64p. Sponsored by USDOE, Washington, DC (United States). DOE Contract

AC06-87RL10930. Order Number DE92011191. Source: OSTI; NTIS; INIS; GPO Dep.

This document compiles eleven articles written on the history of Hanford site. Beginning in 1855 with a discussion of the settlement of the basin, the author moves to the wartime production of plutonium, and later Hanford's role in radioactive waste storage and eventual remediation.

477 (WHC-MR-0293-Rev.2) **Legend and legacy: Fifty years of defense production at the Hanford Site.** Gerber, M.S. Westinghouse Hanford Co., Richland, WA (United States). Sep 1992. 55p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94010377. Source: OSTI; NTIS; INIS; GPO Dep.

Today, the Hanford Site is engaged in the largest waste cleanup effort ever undertaken in human history. That in itself makes the endeavor historic and unique. The Hanford Site has been designated the "flagship" of Department of Energy (DOE) waste remediation endeavors. And, just as the wartime Hanford Project remains unmatched in history, no counterpart exists for the current waste cleanup enterprise. This report provides a summary of the extensive historical record, however, which does give a partial road map. The science of environmental monitoring pioneered at the Hanford Site, and records of this type are the most complete of any in the world, from private companies or public agencies, for the early years of Site operations. The Hanford Site was unique for establishing a detailed, scientific, and multi-faceted environmental monitoring program.

478 (WHC-MR-0382) **T-Plant engineering study secondary containment and leak detection upgrades.** La Barge, M.J. (Science Applications International Corp., Richland, WA (United States)). Westinghouse Hanford Co., Richland, WA (United States); Science Applications International Corp., Richland, WA (United States). Dec 1992. 126p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Contract MLW-SVV-073750. Order Number DE93006532. Source: OSTI; NTIS; INIS; GPO Dep.

T-Plant at the Hanford Site was constructed in the mid-1940s to extract plutonium from production reactor fuel. The plant continued to perform this function until it was deactivated in 1956. Most of the original process equipment was subsequently removed. In 1957, T-Plant was placed in service as a beta-gamma decontamination facility and as a support complex for experiments or other operations requiring containment or isolation. At present it functions primarily as decontamination facility (Hinckley 1985). The Integrity Assessment Plan (IAP) being prepared for T-Plant has identified portions of the current liquid waste handling system that are not in compliance with the regulations. In addition, the IAP has identified engineering studies designed to investigate a range of alternatives for upgrades and modifications to bring the T-Plant Facility into compliance with the WAC requirements. This document is the first of these studies and focuses on the identification and evaluation of viable secondary containment and leak detection options for T-Plant. A review of the specific systems within T-Plant that may be required to function as a secondary containment is performed. The specific criteria to be used in the evaluation of viable secondary containment and leak detection options are presented. The specific alternatives for each major T-Plant system are described, and these alternatives are evaluated. Finally, the preferred secondary containment and leak detection methods are recommended.

479 (WHC-MR-0391) Field trip guide to the Hanford Site. Reidel, S.P.; Lindsey, K.A.; Fecht, K.R. Westinghouse Hanford Co., Richland, WA (United States). Nov 1992. 56p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93012612. Source: OSTI; NTIS; INIS; GPO Dep.

This report is designed to provide a guide to the key geologic and hydrologic features of the US Department of Energy's Hanford Site located in south-central Washington. The guide is divided into two parts. The first part is a general introduction to the geology of the Hanford Site and its relation to the regional framework of south-central Washington. The second part is a road log that provides directions to important geologic features on the Hanford Site and descriptions of the locality. The exposures described were chosen for their accessibility and importance to the geologic history of the Hanford Site and to understanding the geohydrology of the Site.

480 (WHC-MR-0392) A peer review of the Hanford Site Permanent Isolation Surface Barrier Development Program. Wing, N.R. Westinghouse Hanford Co., Richland, WA (United States). Sep 1992. 69p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93002240. Source: OSTI; NTIS; INIS; GPO Dep.

A panel of technical experts was organized to peer review the Hanford Site Permanent Isolation Surface Barrier Development Program (BDP) and to provide a specific review of a preconceptual prototype barrier design initiated during fiscal year (FY) 1990. The technical peer review of the BDP and the prototype is being conducted in three phases, two of which have been completed. This document presents the peer review panel's findings on the first two phases of the peer review process. Biointrusion and water intrusion control are discussed, along with design life, vegetation, and climate impact.

481 (WHC-SA-0980) Environmental recordkeeping: The administrative record. Sprouse, B.S. Westinghouse Hanford Co., Richland, WA (United States). Aug 1991. 50p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-9108113-2: 1991 Nuclear Information and Records Management Association (NIRMA) symposium, Charlotte, NC (United States), 25-28 Aug 1991). Order Number DE92002112. Source: OSTI; NTIS; INIS; GPO Dep.

This document provides information on an environmental records management system. It includes information on environmental recordkeeping; environmental regulations with emphasis on the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA); and the administrative record including a case study of the Hanford Site's administrative record system. This paper will focus on the following objectives: (1) identify resources that can be used as reference tools; (2) understand the reasons for developing and maintaining an administrative record; and, (3) evaluate an existing system and identify means of complying with the regulations. 15 refs., 2 figs.

482 (WHC-SA-0990) Development of Hanford Site lysimeter facilities. Phillips, S.J. (Westinghouse Hanford Co., Richland, WA (USA)); Relyea, J.F.; Kemp, C.J.; Wing, N.R.; Campbell, M.D.; Gee, G.W.; Graham, M.J.; Kirkham, R.R.; Ruben, M.S. Westinghouse Hanford Co., Richland, WA (United States). Jan 1991. 10p. Sponsored by USDOE, Washington, DC (USA). DOE Contract AC06-87RL10930.

(CONF-910270-62: Waste management '91; International symposium on lysimetry, Tucson, AZ (United States); Honolulu, HI (United States), 24 Feb - 1 Mar 1991; 23-25 Jul 1991; CONF-910794-2). Order Number DE91014681. Source: OSTI; NTIS; INIS; GPO Dep.

Lysimeters have been constructed at the Hanford Site near Richland, Washington, to quantify mechanisms that affect migration of radioactive and hazardous waste in geologic media. The history of design and construction of specific lysimeter facilities is summarized. Design criteria and construction specifications are also provided for comparison of facilities. 8 refs., 2 figs.

483 (WHC-SA-0993) Reverse osmosis applications to low-level radioactive waste. Garrett, L. Westinghouse Hanford Co., Richland, WA (United States). Sep 1990. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-9010202-1: 8. 1990 annual membrane technology/planning conference and 1. high-tech separations symposium, Newton, MA (United States), 15-17 Oct 1990). Order Number DE91000551. Source: NTIS; PC A03/MF A01 - OSTI; GPO Dep.

The Hanford Site at Richland, Washington, is operated for the US Department of Energy (DOE) by Westinghouse Hanford Company. Since the Hanford Site was established in the 1940's, the operation of the various facilities has resulted in the contamination of liquid effluents and some groundwater with radioactive constituents. Westinghouse Hanford Company has been testing various technologies to determine their effectiveness in decontaminating these two types of liquids. Reverse osmosis (RO) has been applied to two process effluents and two groundwaters. Rejection data have been collected for uranium, technetium, tritium, strontium, cesium, and total alpha and beta. 4 refs., 1 fig., 8 tabs.

484 (WHC-SA-1006) Use of personal computers in performing a linear modal analysis of a large finite-element model. Wagenblast, G.R.; Northey, M.D. Westinghouse Hanford Co., Richland, WA (United States). Mar 1991. 8p. Sponsored by USDOE, Washington, DC (USA). DOE Contract AC06-87RL10930. (CONF-910602-23: 1991 American Society of Mechanical Engineers (ASME) pressure vessels and piping conference, San Diego, CA (United States), 23-28 Jun 1991). Order Number DE91010112. Source: OSTI; NTIS; GPO Dep.

This paper presents the use of personal computers in performing a dynamic frequency analysis of a large (2801 degrees of freedom) finite-element model. Large model linear time history dynamic evaluations of safety related structures were previously restricted to mainframe computers using direct integration analysis methods. This restriction was a result of the limited memory and speed of personal computers. With the advances in memory capacity and speed of the personal computers, large finite-element problems now can be solved in the office in a timely and cost effective manner. Presented in three sections, this paper describes the procedure used to perform the dynamic frequency analysis of the large (2801 degrees of freedom) finite-element model on a personal computer. Section 2.0 describes the structure and the finite-element model that was developed to represent the structure for use in the dynamic evaluation. Section 3.0 addresses the hardware and software used to perform the evaluation and the optimization of the hardware and software operating configuration to minimize the time required to perform the analysis. Section 4.0 explains the analysis techniques used to reduce the

problem to a size compatible with the hardware and software memory capacity and configuration.

485 (WHC-SA-1010) Comparison of reinforced-concrete models for use in the analysis of extreme loads. Dyrness, A.D.; Julyk, J.L. Westinghouse Hanford Co., Richland, WA (United States). Mar 1991. 8p. Sponsored by USDOE, Washington, DC (USA). DOE Contract AC06-87RL10930. (CONF-910602-19: 1991 American Society of Mechanical Engineers (ASME) pressure vessels and piping conference, San Diego, CA (United States), 23-28 Jun 1991). Order Number DE91010108. Source: OSTI; NTIS; INIS; GPO Dep.

Reinforced concrete in combination with a steel liner has had a wide application to confinement structures containing hazardous material. The double-shell waste storage tanks at the US Department of Energy's Hanford Site use this type of construction. The performance goals defined for these tanks typically require these structures to be analyzed for low probability, beyond-design-basis loads. The response of reinforced-concrete structures subjected to extreme loads is often characterized by gross exceedance of the material elastic limit without loss of integrity. In such extreme load scenarios, failure may be defined by structural instabilities at loads well beyond those associated with material strength-based allowables defined by conventional codes and standards. The use of finite-element methods in predicting such failures requires a reinforced-concrete constitutive model that accounts for nonlinear post-cracking behavior. Most of the existing literature on modeling the nonlinear behavior of reinforced concrete focuses on improving the accuracy or numerical stability of the constitutive model itself. The comparisons presented herein address both the numerical stability associated with post-cracking tensile strains and solution accuracy of two existing constitutive models. 12 refs., 7 figs., 1 tab.

486 (WHC-SA-1035) Airborne source-term modeling of past and future interim storage practices of Hanford Site waste treatment facilities using AIR-SOURCE model. Roblyer, S.P. Westinghouse Hanford Co., Richland, WA (United States). Mar 1991. 9p. Sponsored by USDOE, Washington, DC (USA). DOE Contract AC06-87RL10930. (CONF-9104215-1: HAZMACON '91, Santa Clara, CA (United States), 16-18 Apr 1991). Order Number DE91010836. Source: OSTI; NTIS; INIS; GPO Dep.

Westinghouse Hanford Company functions as the operations and engineering contractor at the Hanford Site US Department of Energy (DOE) facilities. A major mission of this responsibility is to process the chemical and radioactive wastes from former weapons material production and other activities into a form suitable for permanent storage or disposal. These processing activities involve waste reduction which separates solid wastes from effluents that have trace concentrations of chemical and radioactive materials. This water had been previously disposed of in soil column cribs which sometimes resulted in a local below-surface contamination. As a result of timing commitments and processing schedules, a facility that will remove and permanently store the trace contamination materials from the contaminated effluent water will not be available for several years. It is necessary to provide interim storage of the effluent water in order to keep the waste processing functions operating until these effluent treatment facilities are made available. In order to operate this interim storage facility, the State of Washington required a demonstration that atmospheric releases from the future practices interim storage would be

less than those of the past practices operations involving the soil column disposal of effluents. To achieve this objective, a description of equipment items and processes in the past practices and proposed future practices interim storage was made. This description involved concentrations, flow rates, temperatures, and parameters such as surface areas, ventilation rates, and filtration efficiencies which affect the atmospheric source-term releases. Several design variables were considered and evaluated before a design was finalized. At the beginning of this project, 72 inorganic, organic, and radioactive materials were considered in the effluent stream. Provision was required for possible addition to this list. 2 figs., 2 tabs.

487 (WHC-SA-1039) Development, testing, and demonstration of geotechnical and cement-based encapsulant materials for the stabilization of radioactive and hazardous waste disposal structures. Phillips, S.J. (Westinghouse Hanford Co., Richland, WA (United States)); Cammann, J.W.; Benny, H.L.; Serne, R.J.; Martin, P.F.; Ames, L.L. Westinghouse Hanford Co., Richland, WA (United States). Sep 1991. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-920559-1: 4. international conference on the use of fly ash, silica fume, slag, and natural pozzolans in concrete, Istanbul (Turkey), 3-8 May 1992). Order Number DE92002917. Source: OSTI; NTIS; INIS; GPO Dep.

A zeolite fluidized-bed treatment system is being developed and tested for the treatment of radioactive and hazardous waste-contaminated subsurface disposal structures. Formulations of cement, fly ash, and slag slurries and sequestering agents also are being tested and evaluated. Leach resistance of radionuclides, heavy metals, and hazardous inorganic compounds in the solidified cement-based encapsulant has been determined. These results simulate the resistance to water leaching of the solidified product after it has been injected an open and interstitial void volume in and proximal to liquid waste disposal structures. Micro- and macro-encapsulation of contaminants within and geologic media surrounding subsurface disposal structures is being demonstrated as an alternative technology for waste site remediation. 5 refs., 1 fig., 1 tab.

488 (WHC-SA-1182) Development of an administrative record system and information repository system to support environmental cleanup at the Hanford Site in Richland, Washington. Sprouse, B.S. Westinghouse Hanford Co., Richland, WA (United States). Sep 1991. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-910981-32: Environmental remediation '91 conference, Pasco, WA (United States), 8-11 Sep 1991). Order Number DE92002049. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this paper is to describe the development of an administrative record (AR) file system for the Hanford Site in Richland, Washington. This paper will focus on the background of the AR system and its implementation at the Hanford Site; the types of documents to be included in an AR file; the management system used to develop and implement the AR system; the unique characteristics of the AR system and the role of the information repositories. The objective of this session is to present the methodology used in developing an AR and information repository system so that common hurdles from various sites can be addressed and resolved similarly. Therefore unnecessary effort does not have to be put forth to resolve the same issues over and over again. The concepts described can be applied to all

federal facility sites with a minimum amount of modification and revision. 9 refs.

489 (WHC-SA-1202) Accelerated cleanup of the 316-5 Process Trenches at the Hanford Site. Henckel, G.C.; Johnson, W.L. Westinghouse Hanford Co., Richland, WA (United States). Sep 1991. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-910981-56: Environmental remediation '91 conference, Pasco, WA (United States), 8-11 Sep 1991). Order Number DE92008380. Source: OSTI; NTIS; INIS; GPO Dep.

In October, 1990, the US Department of Energy, the US Environmental Protection Agency, and the Washington State Department of Ecology signed an Agreement in Principle to accelerate remedial actions on the Hanford Site. Removal of contaminated sediments from the 300 Area (316-5) Process Trenches was one of the three initial candidate locations identified for the accelerated remediation. The trenches have received small quantities of radioactive and hazardous wastes in large volumes of process water (up to 11,360,000 L/day). The trenches are approximately 300 m west of the Columbia River and 7 m above the water table. The trenches are an active interim permitted disposal facility that may remain active for the next few years. In order to reduce the potential for migration of contaminants from the trench sediments into the groundwater, an expedited response action to remove approximately 2,500 m² of soil from the active portion of the trenches is being performed. Field activities were initiated in July 1991 with site preparation. The first trench to be excavated was completed by August 15, 1991. Approximately 2 weeks were needed to begin removal activities in the second trench. The second trench should be completed by October 1, 1991, with the subsequent construction of an interim cover over the consolidated materials completed by December 1991.

490 (WHC-SA-1203) Accelerated cleanup of past practice waste sites on the Hanford Site, Richland, Washington. Gustafson, F.W.; Johnson, W.L. Westinghouse Hanford Co., Richland, WA (United States). [1991]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-911286-1: Pacific Northwest International Air and Waste Management Association conference, Kalispell, MT (United States), 4-6 Dec 1991). Order Number DE92006521. Source: OSTI; NTIS; INIS; GPO Dep.

This report provides a basic description of the Expedited Response Action program currently being implemented at the Hanford Site located in Richland, Washington, including reference to the applicable regulations regarding the program's implementation.

491 (WHC-SA-1204) Accelerated cleanup of carbon tetrachloride in a radiologically contaminated site on the Hanford Site. Hagood, M.C. (Westinghouse Hanford Co., Richland, WA (United States)); Rohay, V.J.; Johnson, W.L.; Valcich, P.J.; Cameron, R.J. Westinghouse Hanford Co., Richland, WA (United States). Sep 1991. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-910981-55: Environmental remediation '91 conference, Pasco, WA (United States), 8-11 Sep 1991). Order Number DE92008389. Source: OSTI; NTIS; INIS; GPO Dep.

Radioactively-contaminated acidic aqueous wastes and organic liquids were discharged to the soil column at three

disposal sites within the Hanford Nuclear Reservation, resulting in the carbon tetrachloride contamination of the ground water and unsaturated soils. A CERCLA Expedited Response Action (ERA) has been initiated for the removal of carbon tetrachloride from the unsaturated soils to mitigate further contamination of the ground water. Based on the contaminant nature and distribution, site physical characteristics, and technology pilot tests, soil vapor extraction with above-ground treatment of the soil vapor was chosen as the preferred remedial technology for the ERA.

492 (WHC-SA-1205) Soil vapor extraction test in a radiologically contaminated site, Hanford, Washington. Swanson, L.C.; Moak, D.J.; Coffman, R.T.; Gale, S.J.; Wilder, J. Westinghouse Hanford Co., Richland, WA (United States). Sep 1991. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-910981-68: Environmental remediation '91 conference, Pasco, WA (United States), 8-11 Sep 1991). Order Number DE93002241. Source: OSTI; NTIS; INIS; GPO Dep.

A pilot test was conducted at the Hanford site in Washington State using soil vapor extraction technology, to test the vapor extraction technology under Hanford Site conditions, and to provide data for designing a large-scale vapor extraction system that will be used to stabilize an existing vadose zone CCl₄ vapor plume. Testing was performed at the 216-Z-1A tile field where over 5 million liters of water, 245 metric tons of CCl₄ and 58 kilograms of plutonium and americium were disposed in the 1960s. The test objectives were to determine the distribution of CCl₄ beneath the tile field, estimate soil permeabilities, observe trends in CCl₄ concentrations during soil vapor extraction, and determine the behavior of radionuclides during the extraction process. The presence of the radionuclides required the use of a high efficiency particulate filter mounded in-line with the conventional vapor extraction equipment. Gas and filter samples were collected for laboratory analysis using a gas chromatograph/mass spectrometer. Real-time monitoring was performed using on-line flame-ionization and photo-ionization detectors for CCl₄ and continuous alpha-radiation and beta-radiation air monitors for radionuclides.

493 (WHC-SA-1206) Initial site characterization approach and preliminary results, 200 West Area carbon tetrachloride Expedited Response Action, Hanford Site, Richland, Washington. Rohay, V.J.; Hagood, M.C. Westinghouse Hanford Co., Richland, WA (United States). Sep 1991. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-910981-67: Environmental remediation '91 conference, Pasco, WA (United States), 8-11 Sep 1991). Order Number DE92018155. Source: OSTI; NTIS; INIS; GPO Dep.

An Expedited Response Action (ERA) is being proposed to remediate the carbon tetrachloride contamination in the unsaturated soils beneath the 200 West Area of the Hanford Site in Washington. The ERA is based on the preliminary conceptual model that carbon tetrachloride vapors remaining in the unsaturated zone continue to provide a source of carbon tetrachloride contamination to the groundwater. The goal of the initial phase of site characterization was to refine this conceptual model, and to collect data in support of the selection and design of an initial remedial action, while meeting the accelerated schedule of the ERA. Using this approach, site characterization activities were designed to make optimum use of field screening-level data and existing boreholes. Field tasks included analysis of soil gas samples collected from the bottoms of boreholes or detected at the

wellhead; a soil gas survey; a pilot test of a vapor extraction system; and groundwater sampling and analysis. Results of this initial phase of site characterization suggest that carbon tetrachloride vapors are still contained within the unsaturated zone in concentrations sufficient to support an effective early removal action.

494 (WHC-SA-1207) Accelerated cleanup at the 618-9 Burial Ground. Frain, J.M. Westinghouse Hanford Co., Richland, WA (United States). Sep 1991. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-910981-57: Environmental remediation '91 conference, Pasco, WA (United States), 8-11 Sep 1991). Order Number DE92008379. Source: OSTI; NTIS; INIS; GPO Dep.

This paper describes the time-critical expedited response action taken at a potentially uranium-contaminated solvent waste disposal trench on the Hanford Site, in southeastern Washington state. An expedited response was initiated to remove solvents, still contained in their original containers, to prevent them from leaching into the groundwater. Actions at the site were initiated in February and completed in May of 1991.

495 (WHC-SA-1209) Destruction of complexants used in groundwater decontamination. Hodgson, K.M.; Moberg, T.P. Westinghouse Hanford Co., Richland, WA (United States). Aug 1991. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-910981-2: Environmental remediation '91 conference, Pasco, WA (United States), 8-11 Sep 1991). Order Number DE91018139. Source: OSTI; NTIS; INIS; GPO Dep.

A supported liquid membrane process is being developed to remove uranium from aqueous solutions. The uranium would be concentrated into a strip solution containing either vinylidene-1,1-diphosphonic acid (VDPA) or 1-hydroxyethane-1,1-diphosphonic acid (HEDPA). This study compares the degradation of HEDPA and VDPA under similar conditions. For the time of the tests in this study (3 h) the maximum amount of HEDPA that was destroyed was 83.5% using hydrogen peroxide and the maximum amount of VDPA destroyed was 64.6% using nitric acid. 3 refs., 5 figs.

496 (WHC-SA-1224) Historical genesis of Hanford Site wastes. Gerber, M.S. Westinghouse Hanford Co., Richland, WA (United States). Sep 1991. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-910981-58: Environmental remediation '91 conference, Pasco, WA (United States), 8-11 Sep 1991). Order Number DE92008368. Source: OSTI; NTIS; GPO Dep.

This paper acquaints the audience with historical waste practices and policies as they changed over the years at the Hanford Site, and with the generation of the major waste streams of concern in Hanford Site clean-up today. The paper also describes the founding and basic operating history of the Hanford Site, including World War II construction and operations, three major postwar expansions (1947-55), the peak years of production (1956-63), production phase downs (1964-the present), and some past suggestions and efforts to chemically treat, "fractionate," and/or immobilize Hanford's wastes. Recent events, including the designation of the Hanford Site as the "flagship" of Department of Energy (DOE) waste remediation efforts and the signing of the landmark Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement), have generated new interest in

Hanford's history. Clean-up milestones dictated in this agreement demand information about how, when, in what quantities and mixtures, and under what conditions, Hanford Site waste were generated and released. This paper presents original, primary-source research into the waste history of the Hanford Site. The earliest, 1940s knowledge base, assumptions and calculations about radioactive and chemical discharges, as discussed in the memos, correspondence and reports of the original Hanford Site (then Hanford Engineer Works) builders and operators, are reviewed. The growth of knowledge, research efforts, and subsequent changes in Site waste disposal policies and practices are traced. Finally, the paper places the current Hanford Site waste remediation endeavors in the broad context of American and world history.

497 (WHC-SA-1228) Environmental Restoration Remedial Action Quality Assurance Requirements Document. Cote, R.F. Westinghouse Hanford Co., Richland, WA (United States). Sep 1991. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-910981-30: Environmental remediation '91 conference, Pasco, WA (United States), 8-11 Sep 1991). Order Number DE92002108. Source: OSTI; NTIS; GPO Dep.

The Environmental Restoration Remedial Action Quality Assurance Requirements Document defines the quality assurance program requirements for the US Department of Energy-Richland Field Office Environmental Restoration Remedial Action Program at the Hanford Site. This paper describes the objectives outlined in DOE/RL 90-28. The Environmental Restoration Remedial Action Program implements significant commitments made by the US Department of Energy in the Hanford Federal Facility Agreement and Consent Order entered into with the Washington State Department of Ecology and the US Environmental Protection Agency. 18 refs.

498 (WHC-SA-1300) Soil density and mass attenuation coefficients for use in shielding calculations at the Hanford Waste Vitrification Plant. Brown, R.C. Westinghouse Hanford Co., Richland, WA (United States). Jan 1992. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-920431-5: Meeting on new horizons in radiation protection and shielding, Pasco, WA (United States), 26 Apr - 1 May 1992). Order Number DE92004570. Source: OSTI; NTIS; INIS; GPO Dep.

Compacted, backfilled soil excavated during construction may be used to provide shielding from gamma radiation at the Hanford Waste Vitrification Plant (HWVP). To provide a reasonable estimate of the shielding offered by this back-filled soil, the bulk density and the composition of the emplaced soil must be specified. This study provides an estimate of the bulk density and the mass attenuation coefficients of soil used for calculating gamma-ray shielding attenuation at the HWVP. These estimates are based on measurements taken from soil samples and underlying rock samples at the Hanford Site.

499 (WHC-SA-1345) Physical modeling of contaminant diffusion from a cementitious waste form. Crane, P.J.; Benny, H.L.; Wood, M.I. Westinghouse Hanford Co., Richland, WA (United States). Feb 1992. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-921020-2: Cement industry solutions to waste management, Calgary (Canada), 7-9 Oct

1992). Order Number DE92008369. Source: OSTI; NTIS; INIS; GPO Dep.

Cementitious materials can be used to immobilize waste materials for disposal. The Westinghouse Hanford Company is pursuing approval of disposal technologies by which hazardous and radioactive wastes are blended or packaged with cementitious materials for disposal. Of significant concern is the mobility of the waste contaminants both from the waste form and in the arid soils of the Hanford Site. A physical model has been developed to study the diffusion of waste contaminants from simulated cementitious waste forms in unsaturated Hanford Site soils. The model can be used to predict cementitious waste form performance in a representative environment, support design of waste management facilities and technologies, and provide data for environmental permitting of proposed treatment and disposal facilities.

500 (WHC-SA-1368) Contaminated soil stabilization demonstration. Kemp, C.J.; Sackschewsky, M.R.; Sampson, A.E.; Phillips, S.J. Westinghouse Hanford Co., Richland, WA (United States). Oct 1991. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-921020-1: Cement industry solutions to waste management, Calgary (Canada), 7-9 Oct 1992). Order Number DE92002913. Source: OSTI; NTIS; INIS; GPO Dep.

Long-term herbicide control along with a shotcrete cover was constructed at the Hanford Site in May 1991. The cover system allows for maintenance-free containment of contaminants by preventing wind and water transport of contaminants from the soil surface, preventing plant uptake of contaminants, and minimizing water infiltration through the soil column. The cover is composed of two parts: a commercial nonwoven geotextile material impregnated with trifluralin, and a >5-centimeter top cover of shotcrete containing polyethylene fibers. The herbicide-impregnated geotextile functions to prevent plant root growth into contaminated soil if any holes or cracks develop in the shotcrete layer. The herbicide component, trifluralin, is mixed into polymer nodules that degrade slowly over many years, thus releasing trifluralin slowly over time. The shotcrete topcover was sprayed using a sludge pump and air compressor to form a hard, impenetrable surface that prevents wind erosion and reduces water infiltration through the contaminated materials underneath. The benefits of the cover system are expected to last 20 to 30 years. 2 refs., 4 figs.

501 (WHC-SA-1450-Rev.1) Application of service examinations to transuranic waste container integrity at the Hanford Site: Revision 1. Duncan, D.R.; Burbank, D.A. Jr.; Anderson, B.C.; Demiter, J.A. Westinghouse Hanford Co., Richland, WA (United States). Sep 1993. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-921119-2-Rev.1: American Society for Testing and Materials (ASTM) symposium on application of accelerated corrosion tests to life prediction of materials, Miami, FL (United States), 16-17 Nov 1992). Order Number DE94002183. Source: OSTI; NTIS; INIS; GPO Dep.

Transuranic waste containers in retrievable storage trenches at the Hanford Site and their storage environment are described. The containers are of various types, predominantly steel 0.21-m³ (55-gal) drums and boxes of many different sizes and materials. The storage environment is direct soil burial and aboveground storage under plastic tarps with earth on top of the tarps. Available data from several

transuranic waste storage sites are summarized and degradation rates are projected for containers in storage at the Hanford Site.

502 (WHC-SA-1489) Implementation of a Hanford past-practice investigation strategy for the 100 areas. Day, R.E.; Krug, A.D.; Lauterbach, M.J. Westinghouse Hanford Co., Richland, WA (United States). May 1992. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-920851-38: Spectrum '92: nuclear and hazardous waste management international topical meeting, Boise, ID (United States), 23-27 Aug 1992). Order Number DE92015910. Source: OSTI; NTIS; GPO Dep.

The initial work plans for the cleanup of the 100 Areas at the Hanford Site followed the traditional US Environmental Protection Agency (EPA) path with a somewhat linear and phased process of investigation and decision making. Because of this process, the proposed investigation schedules were typically 7 to 9 years in duration. Additionally, a large amount of resources and funding were committed this investigative phase without achieving any remediation or reduction in risk. To correct these deficiencies, a new strategy has been developed for use at the Hanford Site based on past practice. In late 1991, work plans were revised to reflect this strategy. has provided for (1) accelerated decision-making by maximizing the use of existing data consistent with the data quality objectives, and, (2) undertaking expedited response actions (ERAs) and/or interim remedial measures (IRMs), as appropriate.

503 (WHC-SA-1511) Application of innovative technologies at the Hanford Site. Powell, R.W.; DiSibio, R.R. Westinghouse Hanford Co., Richland, WA (United States). Mar 1992. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-9204121-1: Innovative technologies for cleaning the environment: air, water, and soil, Erice (Italy), 22-29 Apr 1992). Order Number DE92012198. Source: OSTI; NTIS; GPO Dep.

The US Department of Energy is actively seeking innovative technologies from around the world to apply to the waste management and environmental cleanup efforts at all of its sites. Cleanup of these sites will be very expensive. Existing technologies and methods currently available are not sufficient because they are simply unaffordable. New technologies must be found derived from methods that are cheaper, faster, better, and safer. Technologies from other industries that can be adapted to Hanford Site challenges are being evaluated and new technologies are being designed and developed.

504 (WHC-SA-1516) Adsorption of plutonium on shallow sediments at the Hanford Site. Barney, G.S. Westinghouse Hanford Co., Richland, WA (United States). May 1992. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-9205154-5: 16. actinide separations conference, Golden, CO (United States), 11-14 May 1992). Order Number DE92015834. Source: OSTI; NTIS; INIS; GPO Dep.

Models of plutonium transport in groundwater require the evaluation of parameters that describe adsorption of plutonium on shallow sediments under the Hanford Site. Adsorption of plutonium species having different initial oxidation states [(IV), (V), and (VI)] was measured as a function of time and plutonium concentration in a typical groundwater. The results indicate that plutonium (VI) is not

adsorbed significantly because of carbonate complexing. Both plutonium (VI) and (V) are reduced slowly to plutonium (IV) by reducing components in the sediments, and the plutonium (IV) subsequently is strongly absorbed. The adsorption reaction is mostly reversible. Distribution coefficients range from 5000 to 30,000 mL/g.

505 (WHC-SA-1529) Combining expedited cleanup with innovative technology demonstrations. Hagood, M.C. (Westinghouse Hanford Co., Richland, WA (United States)); Rohay, V.J.; Valcich, P.J.; Brouns, T.M.; Cameron, R.J. Westinghouse Hanford Co., Richland, WA (United States). Apr 1993. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930906-20: '93 international conference on nuclear waste management and environmental remediation; Innovative technologies for cleaning the environment: air, water, and soil, Prague (Czech Republic); Erice (Italy), 5-11 Sep 1993; 22-29 apr 1992; C Order Number DE94005485. Source: OSTI; NTIS; INIS; GPO Dep.

A Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) expedited response action (ERA) has been initiated at the Hanford Site, Washington, for the removal of carbon tetrachloride from contaminated soils to mitigate further contamination of the groundwater. Soil vapor extraction with aboveground collection and treatment was chosen as the preferred remedial technology for the first phase of the ERA. At the same time, innovative technology demonstrations are being conducted in coordination with the ERA to determine the viability of emerging technologies that can be used to characterize, remediate, and monitor carbon tetrachloride and cocontaminants. The overall goal is to improve the performance and decrease the costs of carbon tetrachloride remediation while maintaining a safe working environment.

506 (WHC-SA-1581) Characterization of mobile radiation detection systems at the Hanford Site. Antonio, E.J. (Pacific Northwest Lab., Richland, WA (United States)); Schmidt, J.W.; Gunnink, D.S.; Neisen, L.A. Westinghouse Hanford Co., Richland, WA (United States). Jan 1993. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930130-11: 26. Health Physics Society midyear topical meeting on environmental health physics, Coeur d'Alene, ID (United States), 24-28 Jan 1993). Order Number DE93008147. Source: OSTI; NTIS; INIS; GPO Dep.

The use of vehicle-mounted radiation detection systems for characterizing large areas contaminated with radioactive materials at the Hanford Reservation were examined. Detection capabilities as a function of vehicle speed, detector-source geometry, and source characteristics were evaluated for each of the three systems currently used at the Hanford Site. Large-area radioactive sources (1 ft²) with varying source strengths containing gamma- and beta-emitting radionuclides were used to measure detection-system performance. Detection capability was found to be most influenced by vehicle speed and detector-source geometry. As the vehicle's speed was increased, the probability of detecting a given source decreased dramatically. The probability of detecting a given source was significantly lower under "poor" geometry conditions. Each vehicle's monitoring performance was found to compare favorably with portable survey instrument capabilities. The use of vehicle-mounted detectors proves to be far more economical for surveying large surface areas.

507 (WHC-SA-1613) Packaging development needs to support environmental restoration. Hummer, J.H.; Kuklinski, J.L. Westinghouse Hanford Co., Richland, WA (United States). Sep 1992. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-920905-37: PATRAM '92: 10th international symposium on the packaging and transportation of radioactive materials, Yokohama (Japan), 13-18 Sep 1992). Order Number DE93001477. Source: OSTI; NTIS; INIS; GPO Dep.

Westinghouse Hanford is the DOE's Management and Operations contractor at the Hanford Site responsible for this cleanup effort. Westinghouse Hanford's Transportation and Packaging Function has overall responsibility for implementation of, and compliance with, onsite and offsite radioactive and hazardous waste shipping requirements. Packaging needs are described.

508 (WHC-SA-1623) Vadose zone characterization of highly radioactive contaminated soil at the Hanford Site. Buckmaster, M.A. Westinghouse Hanford Co., Richland, WA (United States). May 1993. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930906-10: '93 international conference on nuclear waste management and environmental remediation, Prague (Czech Republic), 5-11 Sep 1993). Order Number DE93014916. Source: OSTI; NTIS; INIS; GPO Dep.

The Hanford Site in south-central Washington State contains over 1500 identified waste sites and numerous groundwater plumes that will be characterized and remediated over the next 30 years. As a result of the Hanford Federal Facility Agreement and Consent Order, the US Department of Energy has initiated a remedial investigation/feasibility study at the 200-BP-1 operable unit. The 200-BP-1 remedial investigation is the first Comprehensive Environmental Response, Compensation, and Liability Act of 1980 investigation on the Hanford Site that involves drilling into highly radioactive and chemically contaminated soils. The initial phase of site characterization was designed to assess the nature and extent of contamination associated with the source waste site within the 200-BP-1 operable unit. Characterization activities consisted of drilling and sampling the waste site, chemical and physical analysis of samples, and development of a conceptual vadose zone model. Predicted modeling concentrations compared favorably to analytical data collected during the initial characterization activities.

509 (WHC-SA-1799) The development of permanent isolation surface barriers: Hanford Site, Richland, Washington, U.S.A. Wing, N.R. (Westinghouse Hanford Co., Richland, WA (United States)); Gee, G.W. Westinghouse Hanford Co., Richland, WA (United States). Jan 1993. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-9306137-1: Geo confine 93: international symposium on geology and confinement of toxic wastes, Montpellier (France), 8-11 Jun 1993). Order Number DE93040408. Source: OSTI; NTIS; INIS; GPO Dep.

Permanent isolation surface barriers are being developed to isolate wastes disposed of in situ (in place) at the US Department of Energy's Hanford Site in Washington State (USA). The current focus of development efforts is to design barriers that will function in a semiarid to subhumid climate, limit infiltration and percolation of water through the waste zone to near-zero amounts, be maintenance free, and last

up to 1000 years or more. A series of field tests, experiments, and lysimeter studies have been conducted for several years. The results of tests to date confirm that the Hanford barrier concepts are valid for both present and wetter climatic conditions. The data collected also have provided the foundation for the design of a large prototype barrier to be constructed later in 1993. This paper presents the results of some of the field tests, experiments, and lysimeter studies.

510 (WHC-SA-1805) Volatile organic carbon/air separation test using gas membranes. King, C.V.; Kaschemekat, J. Westinghouse Hanford Co., Richland, WA (United States). Aug 1993. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-9308137-6: 1993 summer national American Institute of Chemical Engineers (AIChE) conference, Seattle, WA (United States), 15-18 Aug 1993). Order Number DE93040336. Source: OSTI; NTIS; INIS; GPO Dep.

An estimated 900 metric tons of carbon tetrachloride were discharged to soil columns during the Plutonium Finishing Plant Operations at the Hanford Site. The largest percentage of this volatile organic compound was found in the vadose region of the 200 West Area. Using a Vacuum Extraction System, the volatile organic compound was drawn from the soil in an air mixture at a concentration of about 1,000 parts per million. The volatile organic compounds were absorbed from the air stream using granulated activated carbon canisters. A gas membrane separation system, developed by Membrane Technology and Research, Inc., was tested at the Vacuum Extraction System site to determine if the volatile organic compound load on the granulated activated carbon could be reduced. The Vacuum Extraction System condensed most of the volatile organic compound into liquid carbon tetrachloride and vented the residual gas stream into the granulated activated carbon. This system reduced the cost of operation about \$5/kilogram of volatile organic compound removed.

511 (WHC-SA-1846) Master Safety Analysis Report (SAR) approach for solid waste treatment, storage, and disposal facilities. Bonner, A.L.; Estrellado, J.P. Jr. Westinghouse Hanford Co., Richland, WA (United States). Jun 1993. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-9306143-14: Energy Facility Contractors Group safety analysis meeting, Denver, CO (United States), 16-18 Jun 1993). Order Number DE93016476. Source: OSTI; NTIS; INIS; GPO Dep.

In 1989, the Hanford Site took on a new mission of waste remediation and environmental cleanup. The Hanford Site vision is to become the leader in environmental cleanup technology while bringing the site back to its environmental pristine condition. This technology drive to launch the Hanford site as the flagship of environmental restoration has been divided into several mission areas. This paper focuses on the solid waste management (SWM) mission.

512 (WHC-SA-1880) Continuum soil modeling in the static analysis of buried structures. Julyk, L.J. (Westinghouse Hanford Co., Richland, WA (United States)); Marlow, R.S.; Moore, C.J.; Day, J.P.; Dyrness, A.D. Westinghouse Hanford Co., Richland, WA (United States). Oct 1993. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-9310102-10: 4. energy natural phenomena hazards mitigation conference, Atlanta, GA (United States), 19-22 Oct 1993).

Order Number DE93040406. Source: OSTI; NTIS; INIS; GPO Dep.

Soil loading traditionally has been modeled as a hydrostatic pressure, a practice acceptable for many design applications. In the analyses of buried structure with predictive goals, soil compliance and load redistribution in the presence of soil plasticity are important factors to consider in determining the appropriate response of the structure. In the analysis of existing buried waste-storage tanks at the US Department of Energy's Hanford Site, three soil-tank interaction modeling considerations are addressed. First, the soil interacts with the tank as the tank expands and contracts during thermal cycles associated with changes in the heat generated by the waste material as a result of additions and subtractions of the waste. Second, the soil transfers loads from the surface to the tank and provides support by resisting radial displacement of the tank haunch. Third, conventional finite-element mesh development causes artificial stress concentrations in the soil associated with differential settlement.

513 (WHC-SA-1896) Environmental remediation of the 200 Areas, Hanford Site, Washington. Johnson, W.L.; Wittreich, C.D. Westinghouse Hanford Co., Richland, WA (United States). Apr 1993. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-9304117-2: International waste management conference, San Juan (Puerto Rico), 28 Apr - 1 May 1993). Order Number DE93012615. Source: OSTI; NTIS; INIS; GPO Dep.

The Hanford Site, established in 1943, was originally designed, built, and operated to produce plutonium for nuclear weapons using production reactors and chemical reprocessing plants. Operations in the 200 Areas were mainly related to separation of special nuclear materials from spent nuclear fuel and contain related chemical and fuel processing and waste management facilities. Large quantities of chemical and radioactive waste associated with these processes were often disposed to the environment. This has resulted in extensive contamination in several types of environmental media including air, vadose zone, groundwater, surface water, ground surface, and biota. Efforts are currently underway to remediate chemical and nuclear processing areas of the Hanford Site. Because of the complexity and extent of environmental contamination that has resulted from decades of hazardous and radioactive waste disposal practices, an innovative approach to remediating the site was required. A comprehensive study, referred to as the 200 Aggregate Area Management Study (AAMS) Program, of waste disposal and environmental monitoring data with field investigations was conducted in 1992 to assess the scope of the remediation effort and to develop a plan to expedite the cleanup process.

514 (WHC-SA-1917) Safety analysis factors for environmental restoration and decontamination and decommissioning. Ellingson, D.R. Westinghouse Hanford Co., Richland, WA (United States). Apr 1993. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94008659. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental restoration (ER) and facility decontamination/decommissioning (D&D) operations can be grouped into two general categories. "Nonstationary cleanup" or simply "cleanup" activities are where the operation must relocate to the site of new contaminated material at the completion of each task (i.e., the operation moves to the contaminated

material). "Stationary production" or simply "production" activities are where the contaminated material is moved to a centralized location (i.e., the contaminated material is moved to the operation) for analysis, sorting, treatment, storage, and disposal. This paper addresses the issue of nonstationary cleanup design. The following are the specific assigned action items: Collect and compile a list of special safety-related ER/D&D design factors, especially ones that don't follow DOE Order 6430.1A requirements. Develop proposal of what makes sense to recommend to designers; especially consider recommendations for short-term projects. Present proposal at the January meeting. To achieve the action items, applicable US Department of Energy (DOE) design requirements, and cleanup operations and differences from production activities are reviewed and summarized; basic safety requirements influencing design are summarized; and finally, approaches, considerations, and methods for safe, cost-effective design of cleanup activities are discussed.

515 (WHC-SA-1921) Summary of FY 1992 operations of the vapor extraction system at the Hanford Site, Washington. Green, J.W.; Hand, R.L.; Johnson, W.L.; Millikin, E.J.; Rohay, V.J. Westinghouse Hanford Co., Richland, WA (United States). May 1993. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-9304117-3: International waste management conference, San Juan (Puerto Rico), 28 Apr - 1 May 1993). Order Number DE93013050. Source: OSTI; NTIS; INIS; GPO Dep.

The 200 West Area Carbon Tetrachloride Expedited Response Action is being conducted on the Hanford Site by the US Department of Energy at the direction of the US Environmental Protection Agency and the Washington State Department of Ecology. The Expedited Response Action was initiated based on concerns that carbon tetrachloride residing in soils beneath the 200 West Area from past disposal practices may be continuing to serve as a source for contamination of the groundwater. The method for removing the carbon tetrachloride includes utilization of soil vapor extraction from existing wells with above-ground collection of the carbon tetrachloride on granular activated carbon. The activated carbon is sent off-site for regeneration. This paper summarizes the operations and lessons learned for Fiscal Year 1992 and presents operational plans for FY 1993.

516 (WHC-SA-1929) Hanford Environmental Restoration data validation process for chemical and radiochemical analyses. Adams, M.R. (Westinghouse Hanford Co., Richland, WA (United States)); Bechtold, R.A.; Clark, D.E.; Angelos, K.M.; Winter, S.M. Westinghouse Hanford Co., Richland, WA (United States). Oct 1993. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-931095-29: Department of Energy environmental remediation conference, Augusta, GA (United States), 24-28 Oct 1993). Order Number DE94001694. Source: OSTI; NTIS; INIS; GPO Dep.

Detailed procedures for validation of chemical and radiochemical data are used to assure consistent application of validation principles and support a uniform database of quality environmental data. During application of these procedures, it was determined that laboratory data packages were frequently missing certain types of documentation causing subsequent delays in meeting critical milestones in the completion of validation activities. A quality improvement team was assembled to address the problems caused by missing documentation and streamline the entire process. The result was the development of a separate data package

verification procedure and revisions to the data validation procedures. This has resulted in a system whereby deficient data packages are immediately identified and corrected prior to validation and revised validation procedures which more closely match the common analytical reporting practices of laboratory service vendors.

517 (WHC-SA-1939) Method for evaluating cumulative impacts of projects which involve uncertainty in the baseline environmental conditions. Eccleston, C.H. Westinghouse Hanford Co., Richland, WA (United States). Sep 1993. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-931095-16: Department of Energy environmental remediation conference, Augusta, GA (United States), 24-28 Oct 1993). Order Number DE94001227. Source: OSTI; NTIS; INIS; GPO Dep.

Analysis of cumulative impacts is typically an inexact science. Evaluating cumulative impacts when there is uncertainty in project design data can further complicate the analysis of cumulative impacts. Additionally, a lengthy and expensive effort is often required to obtain baseline data necessary to conduct a quantitatively rigorous analysis of cumulative impacts. Such an extensive effort, would in many cases, only amount to quantifying what is intuitively obvious, adding little substantive value to the decision-making process. Analysts should therefore, carefully weigh the additional value that would be derived before a decision is made to initiate such a study. In many situations, less rigorous approaches may provide decision makers with reliable information that will support the decision-making process. The following discussion outlines such an approach. The approach involves determining the degree to which cumulative impacts would be changed as a result of pursuing an action. This approach combines a quantitative impact analysis of the proposed action with a qualitative analysis of the existing baseline environment. Such an approach is applicable to many different situations where there is uncertainty or incomplete information concerning baseline environmental conditions. The methodology can be applied to the analysis of cumulative impacts for a wide variety of activities that directly or indirectly support environmental remediation projects.

518 (WHC-SA-1943) Benefits of integrating decontamination and decommissioning RCRA/CERCLA site cleanup actions at Hanford. Hughes, M.C.; Wintczak, T.M.; Jordan, K.N. Westinghouse Hanford Co., Richland, WA (United States). Sep 1993. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-931095-41: Department of Energy environmental remediation conference, Augusta, GA (United States), 24-28 Oct 1993). Order Number DE94002353. Source: OSTI; NTIS; INIS; GPO Dep.

There are currently over 100 surplus facilities awaiting decontamination and decommissioning (D&D) at the Hanford Site. These include eight production reactors, two fuels processing facilities, and miscellaneous support structures. All of these facilities are located within what are known as Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and/or the Resource Conservation and Recovery Act of 1976 (RCRA) operable units which contain inactive waste sites scheduled for remediation. However, unlike the waste sites, the surplus facilities are not specifically included in the Hanford Federal Facility Agreement and Consent Order, better known as the Tri-Party Agreement.

519 (WHC-SA-1946) Projecting the range of potential future climate change as an aid in the assessment of the effectiveness of the Hanford Site Permanent Isolation Barrier. Petersen, K.L. Westinghouse Hanford Co., Richland, WA (United States). Oct 1993. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-9310135-2: 32. Hanford symposium on health and the environment, Richland, WA (United States), 18-21 Oct 1993). Order Number DE94003093. Source: OSTI; NTIS; INIS; GPO Dep.

The Hanford Site Permanent Isolation Barrier Development Program was organized to develop an in-place disposal capability for low-level nuclear waste for the US Department of Energy at the Hanford Site in south-eastern Washington. Layered earthen and engineered barriers are being developed by Westinghouse Hanford Company and the Pacific Northwest Laboratory that will function in what is presently a semiarid environment (annual precipitation 150 mm) for at least 1,000 yr by limiting the infiltration of water through the waste. The Long-Term Climate Change Task is one of several key barrier tasks. Based on the recommendation of a panel of internationally recognized climate and modeling experts, climatic data for this task is being acquired in a step-wise and multi-disciplinary manner. The specific research strategy includes literature review and specialized studies to obtain pollen-derived climatic reconstruction, documented historic weather patterns, and Global Circulation Model output of potential future climate changes related to both the greenhouse effect and the cycling into the next ice age. The specific goals of the task are to: (1) obtain defensible probabilistic projections of the long-term climate variability in the Hanford Site region at many different time scales into the future, (2) develop several test case climate scenarios that bracket the range of potential future climate, and (3) use the climate scenarios both to test and to model protective barrier performance.

520 (WHC-SA-1963) Management of liquid effluents at the Hanford Site. Flyckt, D.L. Westinghouse Hanford Co., Richland, WA (United States). May 1993. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-9308125-1: Pollution prevention topical meeting, Seattle, WA (United States), 15-18 Aug 1993). Order Number DE93016224. Source: OSTI; NTIS; INIS; GPO Dep.

The Hanford Site, located in south-central Washington State, covers approximately 1450 km² (560 mi²) of semiarid land that is owned by the US Government and managed by the US Department of Energy. In 1943, the Hanford Site was selected for nuclear reactors, chemical separations, and other activities related to the production and purification of special nuclear materials. Today, the mission of the Hanford Site is environmental remediation and restoration. This paper will review activities to bring liquid effluent discharges (waste water) on the Hanford Site into compliance with both the Resource Conservation and Recovery Act of 1976 (1), and the Clean Water Act of 1977 (2). A summary is presented of ongoing liquid effluent activities, including the determination and implementation of Best Available Technology.

521 (WHC-SA-2018) Interpretation of Ground Penetrating Radar data at the Hanford Site, Richland, Washington. Bergstrom, K.A.; Mitchell, T.H.; Kunk, J.R. Westinghouse Hanford Co., Richland, WA (United States). Jul 1993. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930.

(CONF-9310160-1: Advanced ground penetrating radar: technologies and applications, Columbus, OH (United States), 26-28 Oct 1993). Order Number DE93040409. Source: OSTI; NTIS; INIS; GPO Dep.

Ground Penetrating Radar (GPR) is being used extensively during characterization and remediation of chemical and radioactive waste sites at the Hanford Site in Washington State. Time and money for GPR investigations are often not included during the planning and budgeting phase. Therefore GPR investigations must be inexpensive and quick to minimize impact on already established budgets and schedules. An approach to survey design, data collection, and interpretation has been developed which emphasizes speed and budget with minimal impact on the integrity of the interpretation or quality of the data. The following simple rules of thumb can be applied: (1) Assemble as much pre-survey information as possible, (2) Clearly define survey objectives prior to designing the survey and determine which combination of geophysical methods will best meet the objectives, (3) Continuously communicate with the client, before, during and after the investigation, (4) Only experienced GPR interpreters should acquire the field data, (5) Use real-time monitoring of the data to determine where and how much data to collect and assist in the interpretation, (6) Always "error" in favor of collecting too much data, (7) Surveys should have closely spaced (preferably 5 feet, no more than 10 feet), orthogonal profiles, (8) When possible, pull the antenna by hand.

522 (WHC-SA-2056) Status of remedial investigation activities in the Hanford Site 300 Area groundwater operable unit. Hulstrom, L.C.; Innis, B.E.; Frank, M.A. Westinghouse Hanford Co., Richland, WA (United States). Sep 1993. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-931095-33: Department of Energy environmental remediation conference, Augusta, GA (United States), 24-28 Oct 1993). Order Number DE94001690. Source: OSTI; NTIS; INIS; GPO Dep.

The Phase 1 remedial investigation (RI) and Phase 1 and 2 feasibility studies (FS) for the 300-FF-5 groundwater operable unit underlying the 300 Area on the Hanford Site have been completed. Analysis and evaluation of soil, sediment, and surface water, and biotic sampling data, groundwater chemistry, and radiological data gathered over the past 3 years has been completed. Risk assessment calculations have been performed. Use of the data gathered, coupled with information from an automated water level data collection system, has enabled engineers to track three plumes that represent the most significant contamination of the groundwater.

523 (WHC-SA-2057) Cost benefit analysis of remediation alternatives for controlling the flux of strontium-90 into the Columbia River. Gustafson, F.W. (Westinghouse Hanford Co., Richland, WA (United States)); Todd, M.E. Westinghouse Hanford Co., Richland, WA (United States). Sep 1993. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-931095-30: Department of Energy environmental remediation conference, Augusta, GA (United States), 24-28 Oct 1993). Order Number DE94001696. Source: OSTI; NTIS; INIS; GPO Dep.

The release of large volumes of water to waste disposal cribs at the Hanford Site's 100-N Area caused contaminants, principally strontium-90, to be carried toward the Columbia River through the groundwater. Since shutdown of

the N Reactor, these releases have been discontinued, although small water flows continue to be discharged to the 1325-N crib. Most of the contamination which is now transported to the river is occurring as a result of the natural groundwater movement. The contaminated groundwater at N Springs flows into the river through seeps and springs along the river's edge. An expedited response action (ERA) has been proposed to eliminate or restrict the flux of strontium-90 into the river. A cost benefit analysis of potential remedial alternatives was completed that recommends the alternative which best meets given selection criteria prescribed by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The methodology used for evaluation, cost analysis, and alternative recommendation is the engineering evaluation/cost analysis (EE/CA). Complete remediation of the contaminated groundwater beneath 100-N Area was not a principal objective of the analysis. The objective of the cost benefit analysis was to identify a remedial alternative that optimizes the degree of benefit produced for the costs incurred.

524 (WHC-SA-2059) 100 Area Hanford soil washing treatability tests. Field, J.G. (Westinghouse Hanford Co., Richland, WA (United States)); Belden, R.D.; Serne, R.J.; Mattigod, S.V.; Freeman, H.D.; Scheck, R.W.; Goller, E.D. Westinghouse Hanford Co., Richland, WA (United States). Sep 1993. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-931095-27: Department of Energy environmental remediation conference, Augusta, GA (United States), 24-28 Oct 1993). Order Number DE94001688. Source: OSTI; NTIS; INIS; GPO Dep.

Soil washing laboratory tests performed at Hanford in support of 100 Area Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) feasibility studies included characterization of soils, physical separation, chemical extraction, and water treatment. Results to date show that < 20 % of the soil is finer than 0.25 mm (-40 mesh). The highest concentration of ^{60}Co , ^{152}Eu , and ^{137}Cs contaminants is generally associated with fine soil particles. However, measurable concentrations of contaminants were found in all sizes of soil particles. In initial testing, attrition scrubbing was generally sufficient to treat soils to meet selected performance levels for ^{60}Co and ^{152}Eu . However, more intense attrition scrubbing, autogenous grinding, or chemical extraction was required to enhance removal of ^{137}Cs . Additional tests and assessment of the feasibility of using soil washing techniques are in progress.

525 (WHC-SA-2064) Well venting and application of passive soil vapor extraction at Hanford and Savannah River. Rohay, V.J. (Westinghouse Hanford Co., Richland, WA (United States)); Rossabi, J.; Looney, B.; Cameron, R.; Peters, B. Westinghouse Hanford Co., Richland, WA (United States). Sep 1993. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-931095-34: Department of Energy environmental remediation conference, Augusta, GA (United States), 24-28 Oct 1993). Order Number DE94001693. Source: OSTI; NTIS; INIS; GPO Dep.

At the Hanford and Savannah River Sites, wells with open intervals in the unsaturated zone have been observed to "breathe", i.e., to inhale ambient air from the surface and to exhale soil gas to the atmosphere. This breathing results primarily from the difference in pressure that develops between the soil pressure near the open interval of a well and the barometric pressure. Volatile organic compounds (VOC)

have been identified at both Hanford (carbon tetrachloride) and Savannah River (trichloroethylene and tetrachloroethylene). Passive vapor extraction (PVE) refers to the enhancement and application of this natural breathing phenomenon as a remediation method for increased VOC removal rates from the unsaturated zone. Passive vapor extraction is proposed as a complementary technology to be used with active vapor extraction (AVE). The AVE system would be used to extract soil gas from the high VOC concentration, highly permeable zones. The enhanced PVE would be used to address those zones of lower VOC concentration and those zones where extraction is limited by mass transfer and diffusion. The primary advantages of PVE application are low capital costs and minimal operating costs. This combination allows for many small PVE systems to be placed on individual wells and for the systems to operate for the extended periods of time associated with remediation of sites in which soil-gas transport is diffusion limited.

526 (WHC-SA-2101) Subsurface barrier design alternatives for confinement and controlled advection flow. Phillips, S.J. (Westinghouse Hanford Co., Richland, WA (United States)); Stewart, W.E.; Alexander, R.G.; Cantrell, K.J.; McLaughlin, T.J. Westinghouse Hanford Co., Richland, WA (United States). Feb 1994. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-940225-91: Waste management '94, Tucson, AZ (United States), 27 Feb - 3 mar 1994). Order Number DE94009608. Source: OSTI; NTIS; INIS; GPO Dep.

Various technologies and designs are being considered to serve as subsurface barriers to confine or control contaminant migration from underground waste storage or disposal structures containing radioactive and hazardous wastes. Alternatives including direct-coupled flood and controlled advection designs are described as preconceptual examples. Prototype geotechnical equipment for testing and demonstration of these alternative designs tested at the Hanford Geotechnical Development and Test Facility and the Hanford Small-Tube Lysimeter Facility include mobile high-pressure injectors and pumps, mobile transport and pumping units, vibratory and impact pile drivers, and mobile batching systems. Preliminary laboratory testing of barrier materials and additive sequestering agents have been completed and are described.

527 (WHC-SA-2110) Laboratory evaluation of the in situ chemical treatment approach to soil and groundwater remediation. Thorton, E.C. (Westinghouse Hanford Co., Richland, WA (United States)); Trader, D.E. Westinghouse Hanford Co., Richland, WA (United States). Oct 1993. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-931095-62: Department of Energy environmental remediation conference, Augusta, GA (United States), 24-28 Oct 1993). Order Number DE94003096. Source: OSTI; NTIS; INIS; GPO Dep.

Results of initial proof of principle laboratory testing activities successfully demonstrated the viability of the in situ chemical treatment approach for remediation of soil and groundwater contaminated by hexavalent chromium. Testing activities currently in progress further indicate that soils contaminated with hexavalent chromium and uranium at concentrations of several hundred parts per million can be successfully treated with 100 ppm hydrogen sulfide gas mixtures. Greater than 90% immobilization of hexavalent chromium and 50% immobilization of uranium have been achieved in these tests after a treatment period of one day.

Activities associated with further development and implementation of the in situ chemical treatment approach include conducting additional bench scale tests with contaminated geomedia, and undertaking scale-up laboratory tests and a field demonstration. This report discusses the testing and further development of this process.

528 (WHC-SA-2112) Selecting data quality objectives, analytical quality levels, and validation levels for CERCLA data. Schwab, M.R. (Westinghouse Hanford Co., Richland, WA (United States)); Henckel, R.P.; Fox, R.D.; Werdel, N.A. Westinghouse Hanford Co., Richland, WA (United States). Sep 1993. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-931095-83: Department of Energy environmental remediation conference, Augusta, GA (United States), 24-28 Oct 1993). Order Number DE94010374. Source: OSTI; NTIS; GPO Dep.

In the process of performing environmental restoration at the 560-square mile Hanford Site in southeastern Washington State, very large amounts of scientific and technical data are being generated from sampling taking place all over the Site. Topics discussed in this paper include the lessons learned during the implementation of a Past Practice strategy to accelerate waste site characterization through the application of the Data Quality Objectives process to select sample analytical data and data validation requirements; and the lessons learned during the implementation of computerized data management for maintaining "real-time" data availability to the end users including the regulators.

529 (WHC-SA-2113) Minimization of effluent discharge to the Soil Column. Dronen, V.R.; Hydzik, K.M. Westinghouse Hanford Co., Richland, WA (United States). Jan 1994. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-940225-85: Waste management '94, Tucson, AZ (United States), 27 Feb - 3 Mar 1994). Order Number DE94009436. Source: OSTI; NTIS; GPO Dep.

In 1987, the US Congress mandated that the US Department of Energy (DOE), cease discharge of contaminated effluents to the soil column at the Hanford Site by calendar year 1995. The plan and schedule for this activity can be found in The Plan and Schedule to Discontinue Disposal of Contaminated Liquid into the Soil Column at the Hanford Site, (WHC 1987). Coupled with this mandate and DOE's intent to cleanup Hanford (remediate and restore to the extent practicable), DOE entered into an agreement with the US Environmental Protection Agency (EPA) and the Washington State Department of Ecology (Ecology). The agreement is called the "Hanford Federal Facility Agreement and Consent Order" (Ecology et al. 1992) otherwise known as the Tri-Party Agreement. The Tri-Party Agreement established schedules and legally enforceable milestones for the Hanford cleanup mission. One such milestone was to cease discharge of effluent to Hanford's 300 Area process trenches located approximately 100 m from the Columbia River, north of Richland, Washington.

530 (WHC-SA-2186) REGAL model of gas and liquid migration from grout containing radioactive waste. Roblyer, S.P.; Finrock, S.H.; Ritter, G.A.; Schwinkendorf, K.N. Westinghouse Hanford Co., Richland, WA (United States). Jan 1994. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-940456-16: 1994 Society for Computer Simulation multiconference, San Diego, CA (United States), 11-15 Apr

1994). Order Number DE94009766. Source: OSTI; NTIS; INIS; GPO Dep.

A concern for hydrogen and flammable gas generation in the Hanford Site grout radioactive waste disposal facility led to the development of the REGAL model. This model predicts buildup of radiolytically formed gases in the grout region and their migration to air-filled regions surrounding the grout. The REGAL model is a three-dimensional finite difference code that couples models of gas diffusion, two-phase gas and liquid flow, liquid evaporation and condensation, and heat transfer. Final preliminary software quality assurance of the REGAL code has not been completed at this time; however, the current status of the model is adequate to demonstrate the liquid expulsion predictions described in this paper. A unique finding of this model was that an expulsion of liquid from the grout region could occur. This liquid is from the radioactive waste tanks and may contain soluble radioisotopes and chemicals, such as ¹³⁷Cs and nitrates. This liquid expulsion is driven by displacement of gas bubbles formed within the grout microstructure. Liquid expulsion is very sensitive to the level of gas production, geometry and design of the grout region, and material properties of the grout.

531 (WHC-SA-2263) A tool for designing pollution prevention into US Department of Energy facilities. Dorsey, J.A. (Kaiser Engineers Hanford Co., Richland, WA (United States)); Raney, E.A.; Whitehead, J.K. Westinghouse Hanford Co., Richland, WA (United States). Jan 1994. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-940632-3: Annual meeting and exhibition of the Air and Waste Management Association, Cincinnati, OH (United States), 19-24 Jun 1994). Order Number DE94006327. Source: OSTI; NTIS; GPO Dep.

Historically, pollution prevention activities within the Department of Energy (DOE) have focused on existing process waste streams. However, the DOE estimates that 70 percent of the opportunity to reduce or eliminate pollutants is gained or lost during design. Design is considered a critical component of the DOE's operations, products and services, as evidenced by the numerous new facilities planned to support the cleanup mission of the complex. Pollution prevention during design: (a) significantly reduces the potential generation of waste and environmental releases, (b) promotes the use of energy efficient materials, (c) minimizes resource consumption, and (d) lowers life-cycle costs. Life-cycle cost considerations during design can include construction, operation, and eventual decommissioning of the facility. This paper highlights: (1) the development of the guideline, including specific examples of the guideline's content and intended use, (2) a discussion on the philosophy and content of the training module, (3) a strategy for integrating the guideline's use into the existing DOE design process, and (4) future plans for enhancing the guideline and training class while continuing to integrate pollution prevention into the DOE design process.

532 (WHC-SA-2264) Use of an Open-path FTIR sensor to measure VOCs at the Hanford Site. Kagann, R.H. (MDA Scientific, Inc., Glenview, IL (United States)); Fancher, J.D.; Tomich, S.D. Westinghouse Hanford Co., Richland, WA (United States). Jan 1994. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-940632-9: Annual meeting and exhibition of the Air and Waste Management Association,

Cincinnati, OH (United States), 19-24 Jun 1994). Order Number DE94009662. Source: OSTI; NTIS; INIS; GPO Dep.

An Open-path Fourier Transform Infrared (OP-FTIR) instrument was used to measure carbo tetrachloride vapor emitted from contaminated soil and monitoring wells in the 200 West Area of the Hanford Site in southeastern Washington State (see Figure 1). Historical activities at US Department of Energy (DOE) facilities around the United States during World War II, including development of a nuclear deterrent, resulted in the discharge of chemical and radioactive materials to the environment. Beginning in 1955, carbon tetrachloride and other liquid wastes were released to the subsurface along with cocontaminants to three liquid waste disposal facilities. The DOE has now focused a major technical effort on the mitigation of the effects of those discharges through an environmental restoration program. The OP-FTIR was used over the soil surface near the 216-Z-9 Trench (one of the disposal facilities) in the 200 West Area. The Hanford demonstration of the OP-FTIR was conducted as part of the Volatile Organic Compound-Arid Integrated Demonstration (VOC-Arid ID), which is funded by the US Department of Energy, Office of Technology Development. The mission of the VOC-Arid ID is to identify, develop, and demonstrate new and innovative technologies to support environmental restoration.

533 (WHC-SA-2345) Establishing a predictive maintenance (PdM) program at the Hanford Site. Murray, W.A.; Winslow, R.G. Westinghouse Hanford Co., Richland, WA (United States). Feb 1994. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-940276-2: Energy Facility Contractors Group (EFCOG) conference, San Francisco, CA (United States), 15 Feb 1994). Order Number DE94011396. Source: OSTI; NTIS; INIS; GPO Dep.

The production reactors have been shut down for some time. But for the rest of the site, there is currently about 16,000 people engaged in a multi-billion dollar effort to safely process wastes which have been stored at the site since the 1940's. This effort also includes demolition of some older facilities and environmental restoration of much of the site. This is expected to take approximately 30 to 40 years. The concept of a site-wide predictive maintenance (PdM) program began to form in early 1993. Several informal studies showed that the stand alone predictive maintenance groups which had prevailed on site to date were less than 15% effective at trending equipment conditions and predicting failures. To improve the effectiveness of PdM within the company, an engineering analysis by Rick Winslow confirmed that utilization of software networking technology which was now available would significantly overcome many of these built in handicaps. A site-wide predictive maintenance network would make PdM technology accessible to all of the areas and facilities at the site regardless of geographical distances and company division lines. Site resident vibration experts can easily be located and provide consultations on the network. However, it was recognized that strong leadership and management skills would be required within each of the two organizations for effective implementation. To start this process, a letter of understanding and agreement between the facilities and Tank Farm divisions was drafted and endorsed by company management. The agreement assigned the primary responsibility of acquiring the network software and licensee to the Tank Farm divisions. The acquisition and installation of the network server would be the responsibility of the facilities

division. This paper describes the rest of the network development and implementation process.

534 (WHC-SA-2439) Pollution prevention opportunity assessment benchmarking: Recommendations for Hanford. Engel, J.A. Isuzu Motors Ltd., Southfield, MI (United States). May 1994. 52p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94013083. Source: OSTI; NTIS; INIS; GPO Dep.

Pollution Prevention Opportunity Assessments (P2OAs) are an important first step in any pollution prevention program. While P2OAs have been and are being conducted at Hanford, there exists no standard guidance, training, tracking, or systematic approach to identifying and addressing the most important waste streams. The purpose of this paper then is to serve as a guide to the Pollution Prevention group at Westinghouse Hanford in developing and implementing P2OAs at Hanford. By searching the literature and benchmarks other sites and agencies, the best elements from those programs can be incorporated and pitfalls more easily avoided. This search began with the 1988 document that introduces P2OAs (then called Process Waste Assessments, PWAS) by the Environmental Protection Agency. This important document presented the basic framework of P2OA features which appeared in almost all later programs. Major Department of Energy programs were also examined, with particular attention to the Defense Programs P2OA method of a graded approach, as presented at the Kansas City Plant. The graded approach is a system of conducting P2OAs of varying levels of detail depending on the size and importance of the waste stream. Finally, private industry programs were examined briefly. While all the benchmarked programs had excellent features, it was determined that the size and mission of Hanford precluded lifting any one program for use. Thus, a series of recommendations were made, based on the literature review, in order to begin an extensive program of P2OAs at Hanford. These recommendations are in the areas of: facility Pollution Prevention teams, P2OA scope and methodology, guidance documents, training for facilities (and management), technical and informational support, tracking and measuring success, and incentives.

535 (WHC-SD-EN-EV-026) Results of groundwater quality assessment program at Low-Level Waste Management Area 3 of the low-level burial grounds. Mercer, R.B. Westinghouse Hanford Co., Richland, WA (United States). 11 Jan 1994. 36p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94007156. Source: OSTI; NTIS; INIS; GPO Dep.

Low-Level Waste Management Area 3 (LLWMA-3) is located in the 200 West Area of the Hanford Site. It is regulated under the Resource Conservation and Recovery Act (RCRA) and is currently operating under an interim status groundwater quality assessment program described in Chamness, Jensen, and Last (1990). This assessment program was initiated when well 299-W7-4 exceeded the critical mean established for Total Organic Halogen (TOX) and wells 299-W7-5 and 299-W8-1 exceeded the critical mean for Total Organic Carbon (TOC). The purpose of this report is to present the results of the assessment program. Additional upgradient monitoring wells have been installed and critical mean values for indicator parameters at LLWMA-3 must be recalculated. This assessment concludes that

LLWMA-3 should return to a background evaluation program in January 1994.

536 (WHC-SD-EN-SD-001) Hanford Environmental Information System (HEIS) sample/data entry flow summary. Key, K.T. Westinghouse Hanford Co., Richland, WA (United States). [1993]. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94002494. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this summary is to present a unified overview of the processes that ultimately lead to the loading and storage of the Hanford environmental data on the Hanford Environmental Information System (HEIS) database and the Hanford Groundwater Database (HGWDB). The relationships among the various organizations involved in the process and the functions they perform with respect to these databases are delineated. As such, this summary can be used to support the activities of the overall Hanford environmental data management, either by the various WHC departments or by PNL, with the ultimate goal of integrating the totality of the Hanford environmental data onto the HEIS database.

537 (WHC-SD-EN-SPP-003) Soil washwater treatment system operating procedure. Green, J.W. Westinghouse Hanford Co., Richland, WA (United States). 2 Nov 1993. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94004410. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes the Met-Pro Physical Chemical Treatment System which incorporates numerous integrated processes either physical or chemical in nature. They include the following: coagulation with chemicals; rapid mixing to assure intimate contact of influent and coagulant; controlled flocculation for maximum flock growth via addition of polymer; extended time clarification for optimum settling of solids; solids collection and disposal, and recycle for seeding; filtration for additional suspended solids removal; and ion exchange removal of uranium and heavy metals.

538 (WHC-SD-EN-TI-110) QA/QC requirements for physical properties sampling and analysis. Innis, B.E. Westinghouse Hanford Co., Richland, WA (United States). 21 Jul 1993. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93018745. Source: OSTI; NTIS; GPO Dep.

This report presents results of an assessment of the available information concerning US Environmental Protection Agency (EPA) quality assurance/quality control (QA/QC) requirements and guidance applicable to sampling, handling, and analyzing physical parameter samples at Comprehensive Environmental Restoration, Compensation, and Liability Act (CERCLA) investigation sites. Geotechnical testing laboratories measure the following physical properties of soil and sediment samples collected during CERCLA remedial investigations (RI) at the Hanford Site: moisture content, grain size by sieve, grain size by hydrometer, specific gravity, bulk density/porosity, saturated hydraulic conductivity, moisture retention, unsaturated hydraulic conductivity, and permeability of rocks by flowing air. Geotechnical testing laboratories also measure the following chemical parameters of soil and sediment samples collected during Hanford Site CERCLA RI: calcium carbonate and saturated column leach testing. Physical parameter data are used for (1) characterization of vadose and saturated zone geology and hydrogeology, (2) selection of monitoring well screen sizes,

(3) to support modeling and analysis of the vadose and saturated zones, and (4) for engineering design. The objectives of this report are to determine the QA/QC levels accepted in the EPA Region 10 for the sampling, handling, and analysis of soil samples for physical parameters during CERCLA RI.

539 (WHC-SD-EN-TI-173) Data validation summary report: 300-FF-5 operable unit; Round 6 groundwater. Hulstrom, L.C. Westinghouse Hanford Co., Richland, WA (United States). 21 Mar 1994. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94010369. Source: OSTI; NTIS; INIS; GPO Dep.

Laboratory data for Sixth Round Groundwater samples collected during the 300-FF-5 Operable Unit Remedial Investigation have been reviewed and validated to ensure that they are of sufficient quality to support decisions regarding further actions to be taken at the 300-FF-5 Operable Unit. Table 1-1 is a summary of the validated samples. This report summarizes the results previously presented to Westinghouse Hanford in a series of Preliminary Quality Assurance Reports (PQAR) for the 300-FF-5 Sixth Round Groundwater samples. In some instances, the data qualifiers originally presented in the PQARs have been changed based upon further review of the data; these changes are highlighted in the text.

540 (WHC-SD-EN-TI-181) 100-D Area technical baseline report. Carpenter, R.W. Westinghouse Hanford Co., Richland, WA (United States). 20 Aug 1993. 210p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93041107. Source: OSTI; NTIS; INIS; GPO Dep.

This document is prepared in support of the 100 Area Environmental Restoration activity at the US Department of Energy's Hanford Site near Richland, Washington. It provides a technical baseline of waste sites located at the 100-D Area. The report is based on an environmental investigation undertaken by the Westinghouse Hanford Company (WHC) History Office in support of the Environmental Restoration Engineering Function and on review and evaluation of numerous Hanford Site current and historical reports, drawings, and photographs, supplemented by site inspections and employee interviews. No intrusive field investigation or sampling was conducted. All Hanford coordinate locations are approximate locations taken from several different maps and drawings of the 100-D Area. Every effort was made to derive coordinate locations for the center of each facility or waste site, except where noted, using standard measuring devices. Units of measure are shown as they appear in reference documents. The 100-D Area is made up of three operable units: 100-DR-1, 100-DR-2, and 100-DR-3. All three are addressed in this report. These operable units include liquid and solid waste disposal sites in the vicinity of, and related to, the 100-D and 100-DR Reactors. A fourth operable unit, 100-HR-3, is concerned with groundwater and is not addressed here. This report describes waste sites which include cribs, trenches, pits, french drains, retention basins, solid waste burial grounds, septic tanks, and drain fields. Each waste site is described separately and photographs are provided where available. A complete list of photographs can be found in Appendix A. A comprehensive environmental summary is not provided here but may be found in Hanford Site National Environmental Policy Act Characterization (Cushing 1988), which describes the geology and soils, meteorology, hydrology, land use, population, and air quality of the area.

541 (WHC-SD-EN-TI-188) Physical separations soil washing system cold test results. McGuire, J.P. Westinghouse Hanford Co., Richland, WA (United States). 28 Jul 1993. 32p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94002485. Source: OSTI; NTIS; GPO Dep.

This test summary describes the objectives, methodology, and results of a physical separations soil-washing system setup and shakedown test using uncontaminated soil. The test is being conducted in preparation for a treatability test to be conducted in the North Pond of the 300-FF-1 Operable Unit. It will be used to assess the feasibility of using a physical separations process to reduce the volume of contaminated soils in the 300-FF-1 Operable Unit. The test is described in DOE-RL (1993). The setup test was conducted at an uncontrolled area located approximately 3.2 km northwest of the 300-FF-1 Operable Unit. The material processed was free of contamination. The physical separation equipment to be used in the test was transferred to the US Department of Energy (DOE) by the US Environmental Protection Agency (EPA) Risk Reduction Engineering Laboratory. On May 13, 1993, soil-washing equipment was moved to the cold test location. Design assistance and recommendation for operation was provided by the EPA.

542 (WHC-SD-EN-TI-197) Data validation report for the 100-D Ponds Operable Unit: 100-D ponds sampling. Stankovich, M.T. Westinghouse Hanford Co., Richland, WA (United States). 4 Jan 1994. 98p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94006329. Source: OSTI; NTIS; INIS; GPO Dep.

Westinghouse-Hanford has requested that 100 percent of the Sample Delivery Groups be validated for the 100-D Ponds Operable Unit Sampling Investigation. Therefore the data from the chemical analysis of all 30 samples from this sampling event and their related quality assurance samples were reviewed and validated to verify that reported sample results were of sufficient quality to support decisions regarding remedial actions performed at this site.

543 (WHC-SD-EN-TI-198) 100 Area Columbia River sediment sampling. Weiss, S.G. (Westinghouse Hanford Co., Richland, WA (United States)). Westinghouse Hanford Co., Richland, WA (United States); International Technology Corp., Richland, WA (United States). 8 Sep 1993. 156p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94000738. Source: OSTI; NTIS; INIS; GPO Dep.

Forty-four sediment samples were collected from 28 locations in the Hanford Reach of the Columbia River to assess the presence of metals and man-made radionuclides in the near shore and shoreline settings of the Hanford Site. Three locations were sampled upriver of the Hanford Site plutonium production reactors. Twenty-two locations were sampled near the reactors. Three locations were sampled downstream of the reactors near the Hanford Townsite. Sediment was collected from depths of 0 to 6 in. and between 12 to 24 in. below the surface. Samples containing concentrations of metals exceeding the 95 % upper threshold limit values (DOE-RL 1993b) are considered contaminated. Contamination by arsenic, chromium, copper, lead, and zinc was found. Man-made radionuclides occur in all samples except four collected opposite the Hanford Townsite. Man-made radionuclide concentrations were generally less than 1 pCi/g.

544 (WHC-SD-EN-TI-214) Sediment and process water characterization in support of 300 Area North Process Pond physical soil washing test. Field, J.G. Westinghouse Hanford Co., Richland, WA (United States). 18 Feb 1994. 150p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94010371. Source: OSTI; NTIS; INIS; GPO Dep.

The sediments in the 300 Area North Process Pond are being considered for clean-up using soil washing processes. Prior to site clean-up several preliminary pilot-scale physical washing campaigns were performed by Westinghouse Hanford Company (WHC) staff in the summer of 1993. WHC used equipment that was obtained from the US Environmental Protection Agency. Specific details are found in the 300-FF-1 Physical Separations CERCLA Treatability Test Plan. Physical soil washing includes separation and proper containment of the contaminant-rich fines and residual liquid effluent and release of the coarse "clean" fraction, should it meet minimum performance levels for residual contaminant concentration to the site being cleaned. A goal of the demonstration is to concentrate the contaminants into $\leq 10\%$ of the soil volume excavated and, therefore, to release $\geq 90\%$ of the soil back to the site as clean soil. To support interpretation of the WHC soil washing treatability study, PNL performed some sediment and process water characterization on samples taken during three major and one small campaign. This report documents particle-size distributions in various field washed piles, and chemical and gamma emitting radionuclide contents as a function of particle-size distribution for the field washed sediments and contents in the spent process water. All of the particle fractions were separated by wet sieving, but two field samples were also subjected to dry sieving and attrition scrubbing followed by wet sieving.

545 (WHC-SD-EN-TI-216) Vegetation communities associated with the 100-Area and 200-Area facilities on the Hanford Site. Stegen, J.A. Westinghouse Hanford Co., Richland, WA (United States). 17 Jan 1994. 64p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94006993. Source: OSTI; NTIS; INIS; GPO Dep.

The Hanford Site, Benton County, Washington, lies within the broad semi-arid shrub-steppe vegetation zone of the Columbia Basin. Thirteen different habitat types on the Hanford Site have been mapped in Habitat Types on the Hanford Site: Wildlife and Plant Species of Concern (Downs et al. 1993). In a broad sense, this classification is correct. On a smaller scale, however, finer delineations are possible. This study was conducted to determine the plant communities and estimate vegetation cover in and directly adjacent to the 100 and 200 Areas, primarily in relation to waste sites, as part of a comprehensive ecological study for the Compensation Environmental Response, Compensation, and Liability Act (CERCLA) characterization of the 100 and 200 Areas. During the summer of 1993, field surveys were conducted and a map of vegetation communities in each area, including dominant species associations, was produced. The field surveys consisted of qualitative community delineations. The community delineations described were made by field reconnaissance and are qualitative in nature. The delineations were made by visually determining the dominant plant species or vegetation types and were based on the species most apparent at the time of inspection. Additionally, 38 transects were run in these plant communities to try to obtain a more accurate representation of the community. Because habitat disturbances from construction/

operations activities continue to occur in these areas, users of this information should be cautious in applying these maps without a current ground survey. This work will complement large-scale habitat maps of the Hanford Site.

546 (WHC-SD-EN-TI-219) Data validation report for the 100-HR-3 Operable Unit, fifth round groundwater samples. Vukelich, S.E. (Kearney (A.T.), Inc., Chicago, IL (United States)). Westinghouse Hanford Co., Richland, WA (United States); Kearney (A.T.), Inc., Chicago, IL (United States). 20 Jan 1994. 199p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94007148. Source: OSTI; NTIS; INIS; GPO Dep.

The data from the chemical analysis of 68 samples from the 100-HR-3 Operable Unit Third Quarter 1993 Groundwater Sampling Investigation and their related quality assurance samples were reviewed and validated to verify that reported sample results were of sufficient quality to support decisions regarding remedial actions performed at the site. Sample analysis included inorganics and general chemical parameters. Fifty three samples were validated for radiochemical parameters.

547 (WHC-SD-EN-TP-036) Soil washing physical separations test procedure - 300-FF-1 operable unit. Belden, R.D. Westinghouse Hanford Co., Richland, WA (United States). 8 Oct 1993. 117p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94013012. Source: OSTI; NTIS; INIS; GPO Dep.

This procedure provides the operations approach, a field sampling plan, and laboratory procedures for a soil washing test to be conducted by Alternative Remedial Technologies, Inc. (ART) in the 300-FF-1 area at the Hanford site. The "Quality Assurance Project Plan for the Soil Washing Physical Separations Test, 300-FF-1 Operable Unit," Hanford, Washington, Alternative Remedial Technologies, Inc., February 1994 (QAPP) is provided in a separate document that presents the procedural and organizational guidelines for this test. This document describes specifications, responsibilities, and general procedures to be followed to conduct physical separation soil treatability tests in the North Process Pond of the 300-FF-1 Operable Unit (OU) at the Hanford Site. These procedures are based on the "300-FF-1 Physical Separations CERCLA Treatability Test Plan, DOE/RL 92-21," (DOE-RL 1993).

548 (WHC-SD-ER-DTR-001) Treatment tests for ex situ removal of chromate, nitrate, and uranium (VI) from Hanford (100-HR-3) groundwater: Final report. Beck, M.A.; Duncan, J.B. Westinghouse Hanford Co., Richland, WA (United States). 15 Nov 1993. 138p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94008611. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes batch and anion exchange column laboratory-scale studies investigating ex situ methods to remove chromate (chromium [VI]), nitrate (NO_3), and uranium (present as uranyl (uranium [VI]) carbonate anionic species) from contaminated Hanford Site groundwaters. The technologies investigated include chemical precipitation or coprecipitation to remove chromate and uranium, and anion exchange to remove chromate, uranium, and nitrate. The technologies investigated were specified in the 100-HR-3 Groundwater Treatability Test Plan (DOE-RL 1993). The goal of these tests was to determine the best method to remove

selected contaminants to below the concentration of the project performance goals. The raw data and observations made during these tests can be found in the Westinghouse Hanford Company (WHC) laboratory notebooks (Beck 1992, Herting 1993). The method recommended for future study is anion exchange with Dowex 21K resin.

549 (WHC-SP-0098-5) Routine Operational Environmental Monitoring schedule, CY 1994. Schmidt, J.W. Westinghouse Hanford Co., Richland, WA (United States). Dec 1993. 97p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94005510. Source: OSTI; NTIS; INIS; GPO Dep.

This document provides Health Physics (HP) a schedule in accordance with the Environmental Compliance Manual, WHC-CM-7-5, of monitoring and sampling routines for the Operational Environmental Monitoring (OEM) Program during calendar year (CY) 1994. The survey frequencies for particular sites are determined by the technical judgment of EES and may depend on the site history, radiological status, use, and general conditions. Additional surveys may be requested at irregular frequencies if conditions warrant. All radioactive waste sites are scheduled to be surveyed annually at a minimum. Any newly discovered waste sites not documented by this schedule will be included in the revised schedule for CY 1995. This schedule does not discuss the manpower needs nor does it list the monitoring equipment to be used in completing specific routines.

550 (WHC-SP-0704) Laboratory evaluation of the in situ chemical treatment approach for remediation of Cr(VI)-contaminated soils and groundwater. Thorton, E.C.; Jurgensmeier, C.A.; Baechler, M.A. Westinghouse Hanford Co., Richland, WA (United States). Oct 1991. 61p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93006901. Source: OSTI; NTIS; INIS; GPO Dep.

Bench-scale solution and soil tests were conducted in a proof of principle demonstration of the in situ chemical treatment approach to the remediation of metal and radionuclide contaminated soil and groundwater. These tests were directed specifically towards treatment of Cr(VI) contaminated solutions and unsaturated soil as an application of the approach. Testing was planned and conducted to provide general information relating treatment agent concentrations to effect. This approach served to define the amount of a specific agent required to achieve acceptable results and provided information regarding treatment rates and pH effects associated with the treatment reactions.

551 (WINCO-1182) ICPP water inventory study leak test report. Richards, B.T. Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (United States). Dec 1993. 131p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-84ID12435. Order Number DE94008920. Source: OSTI; NTIS; GPO Dep.

Data from the Idaho Chemical Processing Plant (ICPP) indicate that there are three areas where perched water bodies (groundwater) are suspect to exist beneath the ICPP. Questions have been raised concerning the recharge sources for the northwest (NW) perched water body which is located below the northwest area of the ICPP. In response to these questions, a Water Inventory Study was initiated to determine the extent and the potential impacts of the ICPP water systems as a recharge source. A key part of the Water Inventory Study was the leak test investigation, performed to leak test the ICPP water piping distribution

system, or portions thereof, which could potentially contribute to the recharge of the NW perched water body. This report provides an overview and the results of the leak test investigation and will be incorporated into the overall Water Inventory Study Report.

552 (WINCO-11980) **Contaminant resorption during soil washing.** Gombert, D. Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (United States). [1993]. 33p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-84ID12435. (CONF-9308137-8: 1993 summer national American Institute of Chemical Engineers (AIChE) conference, Seattle, WA (United States), 15-18 Aug 1993). Order Number DE94000932. Source: OSTI; NTIS; INIS; GPO Dep.

To evaluate the applicability of soil washing to a specific site requires some basic research in how contaminants are bound. Much can be learned from sequential extraction methodology based on micronutrient bioavailability studies wherein the soil matrix is chemically dissected to selectively remove particular fixation mechanisms independently. This procedure uses a series of progressively more aggressive solvents to dissolve the principle phases that make up a soil, however, the published studies do not appear to consider the potential for a contaminant released from one type of site to resorb on another site during an extraction. This physical model assumes no ion exchange or adsorption at sites either previously occupied by other ions, or exposed by the dissolution. Therefore, to make engineering use of the sequential extraction data, the release of contamination must be evaluated relative to the effects of resorption. Time release studies were conducted to determine the optimum duration for extraction to maximize complete destruction of the target matrix fraction while minimizing contaminant resorption. Tests with and without a potassium brine present to inhibit cesium resorption indicated extraction efficiency could be enhanced by as much as a factor of ten using the brine.

553 (WSRC-MS-91-290-Draft) **The Savannah River Integrated demonstration program.** Westinghouse Savannah River Co., Aiken, SC (United States). [1991]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE92009587. Source: OSTI; NTIS; GPO Dep.

Leakage of solvents (trichloroethylene and tetrachloroethylene) from an underground process sewer line has contaminated soils and underlying groundwaters at the Savannah River facility of the Department of Energy (DOE). This site was chosen for an experimental project, conducted as part of DOE's integrated demonstrated program for environmental remediation. The project demonstrated a new in situ remediation technology that has the potential to reduce clean-up costs and time. Known as in-situ air stripping, the new technology involves injection of air through underground horizontal wells to strip groundwater and soils of volatile organics; the resulting diffused air is collected, and the hazardous chemicals are removed to the surface for further processing. This brochure briefly describes the use of the integrated demonstration approach, and in-situ air stripping with horizontal wells as a viable new remediation method.

554 (WSRC-MS-93-362) **In-situ bioremediation via horizontal wells.** Hazen, T.C. (Westinghouse Savannah River Co., Aiken, SC (United States)); Looney, B.B.; Enzien, M.; Franck, M.M.; Fliermans, C.B.; Eddy, C.A. Westinghouse Savannah River Co., Aiken, SC (United States). [1993]. 6p. Sponsored by USDOE, Washington, DC (United States).

DOE Contract AC09-89SR18035. (CONF-9309146-8: 5. annual American Chemical Society (ACS) Industrial and Engineering Chemistry (I&EC) Division special symposium on emerging technologies for hazardous waste management, Atlanta, GA (United States), 27-29 Sep 1993). Order Number DE94009055. Source: OSTI; NTIS; INIS; GPO Dep.

This project is designed to demonstrate in situ bioremediation of groundwater and sediment contaminated with chlorinated solvents. Indigenous microorganisms were stimulated to degrade TCE, PCE and their daughter products in situ by addition of nutrients to the contaminated zone. In situ biodegradation is a highly attractive technology for remediation because contaminants are destroyed, not simply moved to another location or immobilized, thus decreasing costs, risks, and time, while increasing efficiency and public and regulatory acceptability. Bioremediation has been found to be among the least costly technologies in applications where it will work (Radian 1989). Subsurface soils and water adjacent to an abandoned process sewer line at the SRS have been found to have elevated levels of TCE (Marine and Bledsoe 1984). This area of subsurface and groundwater contamination is the focus of a current integrated demonstration of new remediation technologies utilizing horizontal wells. Bioremediation has the potential to enhance the performance of in situ air stripping as well as offering stand-alone remediation of this and other contaminated sites (Looney et al. 1991). Horizontal wells could also be used to enhance the recovery of groundwater contaminants for bioreactor conversions from deep or inaccessible areas (e.g., under buildings) and to enhance the distribution of nutrient or microbe additions in an in situ bioremediation.

555 (WSRC-MS-93-362-Rev.1) **In situ bioremediation via horizontal wells: Revision 1.** Hazen, T.C.; Looney, B.B.; Enzien, M.; Dougherty, J.M.; Wear, J.; Fliermans, C.B.; Eddy, C.A. Westinghouse Savannah River Co., Aiken, SC (United States). [1993]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-9209427-1-Rev.1: Michigan Biotechnology Institute symposium, Grand Rapids, MI (United States), 10-15 Sep 1992). Order Number DE94004033. Source: OSTI; NTIS; INIS; GPO Dep.

The test consisted of methane mixed with air into the contaminated aquifer via a horizontal well and extraction from the vadose zone via a parallel horizontal well. This configuration has the advantage of simultaneously stimulating methanotrophic activity in both the groundwater and vadose zone, and inhibiting spread of the contaminant plume. Groundwater was monitored biweekly from 13 wells for a variety of chemical and microbiological parameters. Groundwater from wells in affected areas showed increases in methanotrophs of more than 1 order of magnitude every 2 weeks for several weeks after 1% methane-in-air injection was started. Some wells had increases as much as 7 orders of magnitude. Simultaneous with the increase in methanotrophs was a decrease in water and soil gas concentrations of trichloroethylene (TCE) and tetrachloroethane (PCE). Two wells declined in TCE/PCE concentration in the water by more than 90% to below 2 ppb. All of the wells in the affected zone showed significant decreases in contaminants in less than one month. Chloride concentrations in the water were inversely correlated with TCE/PCE concentration. Four of five vadose zone piezometers declined from concentration as high as 10,000 ppm to less than 5 ppm in less than 6 weeks. The fifth cluster also declined by more than 95%. After only three months on injection, a decline in TCE/PCE in the sediment of more than 30% was also

observed, with TCE/PCE being undetectable in most sediments at the end of the 14-month test. Gene probes and direct isolation from the water and sediment revealed that the right types of methanotrophs were being stimulated and that isolates could degrade TCE at a high rate.

556 (WSRC-MS-93-511) Groundwater cleanup and update of the Savannah River Site experience. Bergren, C.L.; Horvath, J.G. Westinghouse Savannah River Co., Aiken, SC (United States). [1993]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-931095-15: Department of Energy environmental remediation conference, Augusta, GA (United States), 24-28 Oct 1993). Order Number DE94001184. Source: OSTI; NTIS; GPO Dep.

A full scale pump and treat groundwater remediation program which addresses a large plume of volatile organic solvents has been ongoing at the Savannah River Site since 1985. The system has recovered over 135,000 kilograms of solvent and is containing the center of the plume. While overall protection is being achieved, reducing the concentration of contaminants to regulatory acceptable levels is problematic.

557 (WSRC-MS-94-0233) Application of optical and thermal imagery to detect oil contaminated soil. Pendergast, M.M. (Weirich and Associates (United States)); Nalezny, C.L. Westinghouse Savannah River Co., Aiken, SC (United States). [1994]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-940536-1: 10. conference on geologic remote sensing: exploration, environment and engineering, San Antonio, TX (United States), 9-12 May 1994). Order Number DE94011166. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy, Office of Environmental Restoration and Waste Management, Office of Technology Development, is evaluating the use of remote sensing to identify, characterize, and monitor waste sites at DOE facilities. This paper reports on the results of a study to determine under what conditions, and for how long, oil contaminated soil can be detected optically and thermally. The study site was the Oil Test Site at the Savannah River Site at Aiken, SC. The Oil Test Site was created in 1975 to investigate biodegradation of oil as an economical means of disposing of waste oil and solvents. In that investigation, about 18,000 liters of waste oil and solvents were applied in varying amounts to 27 rectangular plots. The goal of the research was to determine the effects of fertilizer on biodegradation of oil and solvents. The oil test site was monitored regularly for 5 years, during which time most of the oil and solvents degraded. The site remains intact today and provides an ideal means for testing remote sensing methods for detecting oil and solvent contaminated surface soil. Ground based solar reflectance spectra, ground-based laser induced fluorescence spectra, and surface temperature measurements were used to characterize the oil contaminated plots and control test plots for comparison with remote sensing data.

558 (WSRC-TR-93-565) Summary report of the drilling technologies tested at the Integrated Demonstration Project for cleanup of organic contaminants in soils and groundwater at non-arid sites. Westinghouse Savannah River Co., Aiken, SC (United States). Nov 1993. 116p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE94006668. Source: OSTI; NTIS; GPO Dep.

The Department of Energy's Office of Technology Development initiated an integrated demonstration of innovative technologies and systems for cleanup of volatile organic compounds in soil and groundwater at SRS. The overall goal of the program is the demonstration of multiple technologies and systems in the fields of drilling, characterization, monitoring, and remediation at a single test bed. Horizontal environmental well installation technology was one of the remediation technologies that was demonstrated at SRS. Four distinctly different systems of directional drilling and horizontal well installations were successfully demonstrated and evaluated. The four systems were developed in the petroleum industry, the river crossing industry, and the utility industry. The transfer of information concerning the horizontal environmental well installations has been facilitated by publishing a series of reports describing each individual demonstration. This is the final report in the series and provides a comprehensive evaluation of all four systems. The objectives of this report are to summarize the strengths and weaknesses of each drilling technology, describe and compare the problems encountered by each drilling technology, compare the compatibility of each technology with varying logistical and geological conditions, and discuss the expense of using each technology. This report is designed to be a horizontal environmental well reference document for the environmental remediation industry. An environmental problem holder may use this report to evaluate a directional drilling technology for use at his/her site.

559 (Y/ER-16) Work plan for the preliminary assessment and characterization of dense nonaqueous-phase liquids in the Bear Creek Burial Grounds Hazardous Waste Disposal Unit at the Oak Ridge Y-12 Plant. Haase, C.S.; King, H.L. Oak Ridge Y-12 Plant, TN (United States). Jul 1990. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OS21400. Order Number DE92019636. Source: OSTI; NTIS; INIS; GPO Dep.

On January 5, 1990, accumulations of dense, nonaqueous-phase liquids (DNAPLs) were discovered at depths of approximately 274 ft below ground surface along the southern border of Burial Ground A-South within the Bear Creek Burial Grounds Hazardous Waste Disposal Unit at the Y-12 plant. Subsequent to this discovery, a preliminary investigation was conducted to obtain information on the mode of occurrence and distribution of the DNAPLs and to obtain expert technical advice on DNAPL behavior in fractured rock, such as that underlying the Bear Creek Burial Grounds. The investigation included installation and sampling of two additional groundwater monitoring wells, re-sampling of existing wells in the vicinity of the discovery well, evaluation of existing groundwater quality data, and technical review of available information and site conditions by an independent consultant expert in the behavior of DNAPLs. Results of this investigation are summarized.

560 (Y/ER-20/V2) Response to comments and recommendations on RCRA Facility Investigation Plan for Group 4 at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee: Volume 2, Operable Unit 2: Environmental Restoration Program. Oak Ridge Y-12 Plant, TN (United States). Dec 1991. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OS21400. (ES/ER-10/V2-D2). Order Number DE92006666. Source: OSTI; NTIS; INIS; GPO Dep.

This document has been prepared to respond to comments and recommendations resulting from the Department

of Energy (DOE) Technical Working Group Meeting-Y12 that was attended by representatives from the DOE Oak Ridge Field Office; Martin Marietta Energy Systems, Inc.; Environmental Protection Agency Region IV; and the Tennessee Department of Environment and Conservation. Comments and recommendations were provided to improve the sampling efforts proposed for the Abandoned Nitric Acid Pipeline (ANAPL) in the RCRA Facility Investigation Plan for Group 4 at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee (ES/ER-10/V1&D1 and ES/ER-10/V2&D1). Thus, the sampling methodology discussed in this document replaces the sampling approach discussed in Sect. 8.5 of that plan. The Nitric Acid Pipeline transported wastes from operations in Buildings 9215, 9212, and 9206 and discharged these wastes into the S-3 Ponds surface impoundments. Materials known to be discharged through the stainless steel pipeline included free nitric acid and depleted and enriched uranium. The revised sampling and analytical methodology for the ANAPL includes: Decreasing the number of soil sampling locations for this phase of the investigation; taking deeper samples from the proposed shallow soil sample sites and archiving all samples except the one taken nearest the pipeline; analyzing the sample taken nearest the pipeline for inductively coupled plasma metals, leachable nitrate, total uranium, and percent of ^{235}U present; conducting field screening for volatile organic compounds; and proposing nitrate and uranium concentration action levels to trigger analysis of archived samples after analysis and evaluation of the samples taken nearest the pipeline.

561 (Y/ER-21) Response to comments on remedial investigation report for the Plating Shop Container Areas (S-334 and S-351) at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee: Environmental Restoration Program. Oak Ridge Y-12 Plant, TN (United States); Oak Ridge National Lab., TN (United States). Office of Risk Analysis. Dec 1991. 67p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OS21400. (ES/ER-36-D2). Order Number DE92006667. Source: OSTI; NTIS; INIS; GPO Dep.

The Plating Shop Container Storage Areas site is composed of two solid waste management units (SWMUs) designated S-334 and S-351. Both SWMUs were previously sampled during a remedial investigation (RI) in 1989. Samples were collected at the ground surface, 2 ft below the ground surface, and 4 ft below the ground surface. Beryllium, chromium, cyanide, lead, uranium, and nickel were detected at slightly elevated concentrations at both SWMU locations within the site. The samples were not analyzed for organics. The samples collected for the Resource Conservation and Recovery Act Facility Investigation (RFI) should have been analyzed for volatile organic contaminants. The site was resampled in August 1991. Samples were collected from between 1 ft to 3 ft from the boreholes drilled for the original RFI. In addition, samples were obtained from the same depth horizons that were sampled previously. These additional samples were analyzed for volatile organics. Tetrachloroethene was detected in some of the samples at concentrations up to 86 $\mu\text{g}/\text{kg}$. The baseline risk assessment was revised to incorporate the organic sampling data. The risks are unchanged as a result of information from the latest sampling effort (10^{-7}). This report, ES/ER-36&D2, is a companion document to ES/ER-36&D1, Remedial Investigation Report, Plating Shop Container Areas (S-334 and S-351), Oak Ridge Y-12 Plant, Oak Ridge, Tennessee.

562 (Y/ER-29) DARA Solid Storage Facility evaluation and recommendations, Y-12 Bear Creek Burial Grounds, Oak Ridge, Tennessee: Environmental Restoration Program. Barton, W.D. III; Hughey, J.C. Oak Ridge Y-12 Plant, TN (United States). Aug 1992. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OS21400. Order Number DE92041274. Source: OSTI; NTIS; INIS; GPO Dep.

The Disposal Area Remedial Action (DARA) Solid Storage Facility (SSF) is a rectangular concrete vault with two high-density Polyethylene (HDPE) liners and covered with a metal building. The SSF was originally designed and constructed to receive saturated sediments from the excavation of the Oil Retention Ponds and Tributary 7 at the Oak Ridge Y-12 Plant. The sediments placed in the SSF were generally high-water-content soils contaminated with polychlorinated biphenyls (PCBs) and volatile organic carbons. The facility was intended to dewater the sediments by allowing the free water to percolate to a 6-in. sand layer covering the entire floor of the facility. The sand layer then drained into sumps located at the east and west ends of the facility. An application for a Part-B Permit was submitted to the state of Tennessee in February 1992 (MMES 1992a). This report is being submitted to support approval of that permit application and to address certain issues known to the regulators regarding this facility.

563 (Y/ER-50) Y-12 Environmental Restoration Remedial Action Surveillance and Maintenance program plan, Oak Ridge Y-12 Plant, Oak Ridge, Tennessee: Environmental Restoration Program. Oak Ridge Y-12 Plant, TN (United States); Science Applications International Corp., Oak Ridge, TN (United States). Nov 1992. 156p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OS21400. Order Number DE93004698. Source: OSTI; NTIS; INIS; GPO Dep.

The Oak Ridge Y-12 Plant Environmental Restoration (ER) Program has been given the responsibility to manage the Remedial Action (RA) surveillance and maintenance (S&M) Program for environmental restoration projects at the Y-12 Plant. A primary purpose of the S&M Program is to maintain containment of hazardous wastes at source units. This plan describes the scope of the S&M Program and methods that will be used to carry out the program. Several Y-12 Plant organizations outside ER participate in the implementation of the S&M Program. Facilities that fall under the ER S&M Program include Resource Conservation and Recovery Act (RCRA)/Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) closed and capped landfills, including groundwater monitoring wells associated with the landfills; landfill units planned for future closure; operational and interim status treatment and storage facilities; hazardous waste study areas that are in the preliminary phase of the CERCLA process; roads and grounds dedicated to the above; and the dense nonaqueous phase liquid (DNAPL) monitoring wells. Generally, closed treatment, storage, and disposal (TSD) facilities will remain under the ER S&M Program for 3 years.

564 (Y/ER/Sub-90/VK168/4-D1) Proposed plan for the United Nuclear Corporation Disposal Site at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee. Oak Ridge Y-12 Plant, TN (United States); Science Applications International Corp., Oak Ridge, TN (United States). Feb 1991. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OS21400. (ES/ER-16-D1). Order Number DE92008046. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this document is to present and solicit for comment to the public and all interested parties the plan to remediate the United Nuclear Corporation (UNC) Disposal Site located at the Department of Energy-Oak Ridge Operations (DOE-ORO) Y-12 Plant, Oak Ridge, Tennessee. The preferred alternative for remediating the UNC Disposal Site is construction of a modified Resource Conservation and Recovery Act (RCRA) cap. A modified RCRA cap provides the best balance between long-term effectiveness and permanence, reduction of toxicity, mobility, or volume and short-term effectiveness among the alternatives. The cap provides a high degree of protection for human health and environment, complies with applicable or relevant and appropriate requirements (ARARs), and is easily implemented and cost effective.

565 (Y/ER/Sub-91-ALV96/1) **Postclosure permit application for Bear Creek Hydrogeologic Regime at the Oak Ridge Y-12 Plant S-3 Site.** Oak Ridge Y-12 Plant, TN (United States); Geraghty and Miller, Inc., Oak Ridge, TN (United States). Jul 1991. 409p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92005402. Source: OSTI; NTIS; INIS; GPO Dep.

The S-3 Site (S-3 pond waste management area) is located adjacent to the west end of the Department of Energy's (DOE) Y-12 Plant in Oak Ridge, Tennessee. The S-3 Site consists of one regulated unit, the S-3 Site Hazardous Waste Disposal Unit (HWDU). The S-3 Site HWDU, along with the Oil Landfill and the Burial Grounds Waste Management Areas (WMAs), comprise the Bear Creek Valley Waste Disposal Area (BCVWDA). Until the early 1980s, various types of hazardous wastes generated at the Y-12 Plant as part of, or incidental to, main production processes were disposed of in the BCVWDA. Hazardous-waste disposal at the S-3 Site was terminated in 1984. In 1988, the S-3 Site was closed as a landfill in accordance with the requirements of Tennessee Department of Environment and Conservation (TDEC) Rule 1200-1-11-.05(14)(e). In addition to sludges, a small volume of contaminated sediments was removed from Bear Creek and deposited in the ponds prior to capping. As required under the TDEC approved closure plan the sludges and sediments were stabilized with coarse aggregate and covered with a five-part engineered cap of low-permeability material. The S-3 Site has been closed as a hazardous-waste disposal unit and therefore will be subject to post-closure care. The closure plan for the S-3 Site HWDU detailing closure activities is presented in Appendix A.1. A post-closure plan for the S-3 Site is presented in Appendix A.2. The purpose of the post-closure plan is to identify and describe the activities that will be performed during the post-closure care period. This plan will be implemented and will continue throughout the post-closure care period.

MIXED WASTE CHARACTERIZATION, TREATMENT, AND DISPOSAL

Refer also to citation(s) 184, 185, 194, 195, 196, 197, 198, 199, 200, 201, 215, 216, 217, 218, 219, 220, 222, 296, 377, 416, 457, 458, 475, 476, 477, 487, 489, 496, 502, 507, 520, 529, 533, 1322, 1323, 1334, 1379, 1457, 1458, 1459, 1460, 1462, 1463, 1466, 1478, 1499, 1526, 1527, 1528, 1544, 1547, 1548, 1549, 1550, 1551, 1552, 1553, 1554, 1623, 1628, 1638, 1705, 1765, 1766, 1767, 1840, 1841, 2009, 2081, 2113, 2114, 2144, 2173, 2331, 2332, 2482, 2620

566 (ANL/CMT-ACL/CP-82220) **Analytical procedures for waste minimization and pollution prevention.** Green, D.W.; Smith, L.L.; Crain, J.S.; Boparai, A.S.; Schilling, J.B. Argonne National Lab., IL (United States). [1994]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940578-3: Pollution prevention conference, Denver, CO (United States), 3-5 May 1994). Order Number DE94011476. Source: OSTI; NTIS; GPO Dep.

Procedures exist for waste characterization, but waste minimization and pollution prevention have not usually played a role in development of these procedures. The US Department of Energy (DOE) expects to require several million characterizations over a 30-year period to accomplish the Department's goals in environmental restoration and waste management. The waste generated by the analytical procedures used for characterizations is a significant source of new DOE waste. We have begun investigating ways to reduce these secondary wastes, focusing on three areas: microanalysis using flow injection; reduction of solvent volume required for dissolution of waste samples for radiochemical analysis; and alternative samples preparation for analysis of organic constituents in waste samples. Preliminary results are reported.

567 (ANL/CMT-ACL/CP-82554) **Development of self-absorption coefficients for the determination of gamma-emitting radionuclides in environmental and mixed waste samples.** Streets, W.E. Argonne National Lab., IL (United States). [1994]. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940524-3: 8. symposium on radiation measurements and applications, Ann Arbor, MI (United States), 16-19 May 1994). Order Number DE94011491. Source: OSTI; NTIS; INIS; GPO Dep.

As the need for rapid and more accurate determinations of gamma-emitting radionuclides in environmental and mixed waste samples grows, there is continued interest in the development of theoretical tools to eliminate the need for some laboratory analyses and to enhance the quality of information from necessary analyses. In gamma spectrometry the use of theoretical self-absorption coefficients (SACs) can eliminate the need to determine the SAC empirically by counting a known source through each sample. This empirical approach requires extra counting time and introduces another source of counting error, which must be included in the calculation of results. The empirical determination of SACs is routinely used when the nuclides of interest are specified; theoretical determination of the SAC can enhance the information for the analysis of true unknowns, where there may be no prior knowledge about radionuclides present in a sample. Determination of an exact SAC does require knowledge about the total composition of a sample. In support of the Department of Energy's (DOE) Environmental Survey Program, the Analytical Chemistry Laboratory (ACL) at Argonne National Laboratory developed theoretical self-absorption models to estimate SACs for the determination of non-specified radionuclides in samples of unknown, widely-varying, compositions. Subsequently, another SAC model, in a different counting geometry and for specified nuclides, was developed for another application. These two models are now used routinely for the determination of gamma-emitting radionuclides in a wide variety of environmental and mixed waste samples.

568 (ANL/CMT/CP-78476) **Plant-scale anodic dissolution of unirradiated IFR fuel pins.** Gay, E.C.;

Tomczuk, Z.; Miller, W.E. Argonne National Lab., IL (United States). [1993]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930913-39: Global '93: future nuclear systems - emerging fuel cycles and waste disposal options, Seattle, WA (United States), 12-17 Sep 1993). Order Number DE93040236. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses anodic dissolution which is a major operation in the pyrometallurgical process for recycling spent metal fuels from the Integral Fast Reactor (IFR), an advanced reactor design developed at Argonne National Laboratory. This process involves electrorefining the heavy metals (uranium and plutonium) from chopped, steel-clad fuel segments. The heavy metals are electrotransported from anodic dissolution baskets to solid and liquid cathodes in a molten salt electrolyte (LiCl-KCl) at 500°C. Uranium is recovered on a solid cathode mandrel, while a uranium-plutonium mixture is recovered in a liquid cadmium cathode. The anode configuration consists of four baskets mounted on an anode shaft. These baskets provide parallel circuits in the electrolyte and salt flow through the chopped fuelbed as the baskets are rotated. The baskets for the engineering-scale tests were sized to contain up to 2.5 kg of heavy metal. Anodic dissolution of 10 kg batches of chopped, steel-clad simulated fuel (U-10% Zr and U-Zr-Fs alloy) was demonstrated.

569 (ANL/CMT/CP-80571) Glassy slags as novel waste forms for remediating mixed wastes with high metal contents. Feng, X.; Wronkiewicz, D.J.; Bates, J.K.; Brown, N.R.; Buck, E.C.; Gong, M.; Ebert, W.L. Argonne National Lab., IL (United States). [1994]. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940225-72: Waste management '94, Tucson, AZ (United States), 27 Feb - 3 mar 1994). Order Number DE94008464. Source: OSTI; NTIS; INIS; GPO Dep.

Argonne National Laboratory (ANL) is developing a glassy slag final waste form for the remediation of low-level radioactive and mixed wastes with high metal contents. This waste form is composed of various crystalline and metal oxide phases embedded in a silicate glass phase. This work indicates that glassy slag shows promise as final waste form because (1) it has similar or better chemical durability than high-level nuclear waste (HLW) glasses, (2) it can incorporate large amounts of metal wastes, (3) it can incorporate waste streams having low contents of flux components (boron and alkalis), (4) it has less stringent processing requirements (e.g., viscosity and electric conductivity) than glass waste forms, (5) its production can require little or no purchased additives, which can result in greater reduction in waste volume and overall treatment costs. By using glassy slag waste forms, minimum additive waste stabilization approach can be applied to a much wider range of waste streams than those amenable only to glass waste forms.

570 (ANL/CMT/CP-80987) An evaluation of vitrification technology: Application to mixed waste at Argonne National Laboratory. Mazer, J.J.; Devgun, J.S.; Beskid, N.J.; No, H.J. Argonne National Lab., IL (United States). [1994]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940225-64: Waste management '94, Tucson, AZ (United States), 27 Feb - 3 mar 1994). Order Number DE94008102. Source: OSTI; NTIS; INIS; GPO Dep.

Argonne National Laboratory-East (ANL-E) is evaluating the feasibility of using vitrification to treat mixed wastes. This

program is in the process of identifying glass compositions that can be produced from mixed wastes and additives, with an emphasis on maximizing the waste loading in the glass, and the overall waste volume reduction. Preliminary crucible glass studies with surrogate mixed waste streams have produced a glass composition that could be produced in commercially available melters. This same glass composition, spiked with Resource Conservation Recovery Act (RCRA) metals, pass the Toxic Characteristic Leaching Procedure (TCLP) test. Thus, the final waste form is a low-level radioactive waste. Additional crucible melts with actual mixed waste streams are in progress and will define a compositional envelope of acceptable glasses that will eventually be produced during full-scale melter operations. Evaluations of the likely off-gases from vitrification indicate that the primary off-gases produced during vitrification will include compounds of SO_x, NO_x and CO₂. These compounds are routinely treated in the off-gas portion of vitrification systems. The composition of the melter feed can be adjusted to control some of the off-gases produced, if necessary. The economics suggest that annual cost savings resulting from volume reduction and conversion of mixed waste to low-level waste may be substantial.

571 (ANL/CMT/CP-82230) Treatment of mixed radioactive liquid wastes at Argonne National Laboratory. Vandegrift, G.F. (and others); Chamberlain, D.B.; Conner, C. Argonne National Lab., IL (United States). [1994]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940225-73: Waste management '94, Tucson, AZ (United States), 27 Feb - 3 mar 1994). Order Number DE94008458. Source: OSTI; NTIS; INIS; GPO Dep.

Aqueous mixed waste at Argonne National Laboratory (ANL) is traditionally generated in small volumes with a wide variety of compositions. A cooperative effort at ANL between Waste Management (WM) and the Chemical Technology Division (CMT) was established, to develop, install, and implement a robust treatment operation to handle the majority of such wastes. For this treatment, toxic metals in mixed-waste solutions are precipitated in a semiautomated system using Ca(OH)₂ and, for some metals, Na₂S additions. This step is followed by filtration to remove the precipitated solids. A filtration skid was built that contains several filter types which can be used, as appropriate, for a variety of suspended solids. When supernatant liquid is separated from the toxic-metal solids by decantation and filtration, it will be a low-level waste (LLW) rather than a mixed waste. After passing a Toxicity Characteristic Leaching Procedure (TCLP) test, the solids may also be treated as LLW.

572 (ANL/CP-71902) Addressing data heterogeneity: Lessons learned from a multimedia risk assessment. Oezkaynak, H. (Harvard Univ., Cambridge, MA (United States)); Xue, Jianping; Butler, D.A.; Haroun, L.A.; MacDonell, M.M.; Fingleton, D.J. Argonne National Lab., IL (United States). [1991]. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-910659-34: 84. annual meeting and exhibition of the Air and Waste Management Association (AWMA), Vancouver (Canada), 16-21 Jun 1991). Order Number DE92003418. Source: OSTI; NTIS; INIS; GPO Dep.

Cleanup activities are currently being conducted by the US Department of Energy (DOE) at a former chemical plant site that has been inactive for more than 20 years. The Army produced nitroaromatic explosives at the 220-acre site during the 1940s, and radioactive materials of the uranium

and thorium series were processed there by DOE's predecessor agency during the 1950s and 1960s. Chemical and radioactive contaminants are present in soil, surface water, sediment, and groundwater at the site as a result of both past releases and disposal activities and subsequent contaminant migration. Samples have been collected from these media over a number of years under both DOE's environmental monitoring program and the site characterization program of the Superfund process. Results of samples analyses have been compiled in a computerized data base. These data are being evaluated in the context of potential exposure pathways that are currently present at the site or that may be present in the future, in order to estimate possible adverse impacts to human health and the environment in the absence of cleanup. This paper discusses the methodology used to address associated tasks and the lessons learned during the assessment process. Statistical issues and recommended future directions for dealing with technical aspects of this project and with similar multimedia risk assessment projects are addressed in the final discussion. 10 refs., 9 figs., 1 tab.

573 (ANL/CP-73026) R&D activities at DOE applicable to mixed waste. Erickson, M.D.; Devgun, J.S.; Brown, J.J.; Beskid, N.J. Argonne National Lab., IL (United States). [1991]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9110207-1: HazMat South '91: hazardous materials management conference and exhibition, Atlanta, GA (United States), 2-4 Oct 1991). Order Number DE91018561. Source: OSTI; NTIS; INIS; GPO Dep.

The Department of Energy (DOE) has established the Office of Environmental Restoration and Waste Management. Within the new organization, the Office of Technology Development (OTD) is responsible for research, development, demonstration, testing and evaluation (RDDT&E) activities aimed at meeting DOE cleanup goals, while minimizing cost and risk. Because of US governmental activities dating back to the Manhattan project, mixed radioactive and hazardous waste is an area of particular concern to DOE. The OTD is responsible for a number of R&D activities aimed at improving capabilities to characterize, control, and properly dispose of mixed waste. These activities and their progress to date will be reviewed. In addition, needs for additional R&D on managing mixed waste will be presented. 5 refs., 2 tabs.

574 (ANL/CP-75817) Considerations in recycling contaminated scrap metal and rubble. Kluk, A.F. (USDOE, Washington, DC (United States)); Hocking, E.K. Argonne National Lab., Washington, DC (United States). [1992]. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9203105-3: Department of Energy-Environmental Restoration and Waste Management (DOE-ERWM) technology development workshop, Charleston, SC (United States), 25 Mar 1992). Order Number DE92016188. Source: OSTI; NTIS; INIS; GPO Dep.

Management options for the Department of Energy's increasing amounts of contaminated scrap metal and rubble include reuse as is, disposal, and recycling. Recycling, with its promise of resource recovery, virgin materials conservation, and land disposal minimization, emerges as a preferred management technique. Implementing a cost effective recycling program requires resolution of several issues including: establishing release limits for contaminants, controlling use of recycled materials creating effective public communication programs; developing economical, reliable assay

technologies; managing secondary waste streams, expanding availability of unrestricted markets; and solving conflicting legal considerations.

575 (ANL/DIS/CP-80919) Assessment of recycling or disposal alternatives for radioactive scrap metal. Murphie, W.E. (US Dept. of Energy, Oak Ridge, TN (United States)); Lilly, M.J. III; Nieves, L.A.; Chen, S.Y. Argonne National Lab., IL (United States). [1993]. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9310215-1: Seminar on melting and recycling of metallic waste from decommissioning, Krefeld (Germany), 27-29 Oct 1993). Order Number DE94002363. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy, Office of Environmental Restoration and Waste Management, Oak Ridge Programs Division, is participating with the Organization for Economic Cooperation and Development in providing analytical support for evaluation of management alternatives for radioactive scrap metals. For this purpose, Argonne National Laboratory is assessing environmental and societal implications of recycling and/or disposal process alternatives. This effort includes development of inventory estimates for contaminated metals; investigation of scrap metal market structure, processes, and trends; assessment of radiological and nonradiological effects of recycling; and investigation of social and political factors that are likely to either facilitate or constrain recycling opportunities. In addition, the option of scrap metal disposal is being assessed, especially with regard to the environmental and health impacts of replacing these metals if they are withdrawn from use. This paper focuses on the radiological risk assessment and dose estimate sensitivity analysis. A "tiered" concept for release categories, with and without use restrictions, is being developed. Within the tiers, different release limits may be indicated for specific groupings of radionuclides. Depending on the spectrum of radionuclides that are present and the level of residual activity after decontamination and/or smelting, the scrap may be released for unrestricted public use or for specified public uses, or it may be recycled within the nuclear industry. The conservatism of baseline dose estimates is examined, and both more realistic parameter values and protective measures for workers are suggested.

576 (ANL/DIS/CP-80955) Assessment of recycling or disposal alternatives for radioactive scrap metal. Murphie, W.E. (USDOE Assistant Secretary for Environmental Restoration and Waste Management, Washington, DC (United States). Office of Environmental Restoration); Lilly, M.J. III; Nieves, L.A.; Chen, S.Y. Argonne National Lab., IL (United States). [1993]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-931095-20: Department of Energy environmental remediation conference, Augusta, GA (United States), 24-28 Oct 1993). Order Number DE94001476. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy, Office of Environmental Restoration and Waste Management, is participating with the Organization for Economic Cooperation and Development (OECD) in an evaluation of management alternatives for radioactive scrap metals. For this purpose, Argonne National Laboratory is assessing alternatives for radioactive scrap metals. For this purpose, Argonne National Laboratory is assessing environmental and societal implications of recycling and/or disposal process alternatives (with metal replacement). Findings will be presented in a report from the OECD Task Group. This paper focuses on the radiological

risk assessment and dose estimate sensitivity analysis. A "tiered" concept for release categories, with and without use restrictions, is being developed. Within the tiers, different release limits may be indicated for specific groupings of radionuclides. Depending on the spectrum of radionuclides that are present and the level of residual activity after decontamination and/or smelting, the scrap may be released for unrestricted public use or for specified public uses, or it may be recycled within the nuclear industry. The conservatism of baseline dose estimates is examined, and both more realistic parameter values and protective measures for workers are suggested.

577 (ANL/DIS/CP-82018) Health risk and impact evaluation for recycling of radioactive scrap metal. Nieves, L.A. (Argonne National Lab., IL (United States)); Chen, S.Y.; Murphie, W.E.; Lilly, M.J. III. Argonne National Lab., IL (United States). [1994]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940406-2: International symposium on decontamination and decommissioning, Knoxville, TN (United States), 27-29 Apr 1994). Order Number DE94007651. Source: OSTI; NTIS; INIS; GPO Dep.

The DoE, Office of Environmental Restoration and Waste Management, is participating with the Organization for Economic Cooperation and Development in providing analytical support for developing international standards for recycling of radioactive scrap metals. For this purpose, Argonne National Laboratory is assessing health, environmental and societal implications of recycling and/or disposal process alternatives. This effort includes development of international inventory estimates for contaminated metals; investigation of international scrap metal markets; assessment of radiological and non-radiological human health risks; impacts on environmental quality and resources; and investigation of social and political factors. The RSM disposal option is being assessed with regard to the environmental and health impacts of replacing the metals if they are withdrawn from use. Impact estimates are developed for steel as an illustrative example because steel comprises a major portion of the scrap metal inventory. Current and potential sources of RSM include nuclear power plants, fuel cycle and weapons production facilities, industrial and medical facilities and equipment, and petroleum and phosphate rock extraction equipment. Millions of metric tons (t) of scrap iron and steel, stainless steel, and copper, as well as lesser quantities of aluminum, nickel, lead, and zirconium, are likely to become available in the future as these facilities are withdrawn from service.

578 (ANL/EA/CP-79944) Modeling emissions and dispersion of contaminants from cleanup activities at a mixed waste site to estimate air impacts and risks. Chang, Y.S. (Argonne National Lab., IL (United States)); Menlove, S. Argonne National Lab., IL (United States). Sep 1993. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-931095-14: Department of Energy environmental remediation conference, Augusta, GA (United States), 24-28 Oct 1993). Order Number DE94001273. Source: OSTI; NTIS; INIS; GPO Dep.

The transport and dispersion of contaminants via the air pathway is a major concern during cleanup of contaminated sites. Impacts to air quality and human health during cleanup were evaluated for the Weldon Spring site by using site-specific information for source areas, activities, and receptor locations. In order to ensure protection of human

health and the environment, results are being used to focus on those cleanup activities for which release controls should be emphasized.

579 (ANL/EA/CP-80972) Hazardous waste storage facility accident scenarios for the U.S. Department of Energy Environmental Restoration and Waste Management Programmatic Environmental Impact Statement. Policastro, A. (Argonne National Lab., IL (United States)); Roglans-Ribas, J.; Marmar, D.; Lazaro, M.; Mueller, C.; Freeman, W. Argonne National Lab., IL (United States). [1994]. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940225-51: Waste management '94, Tucson, AZ (United States), 27 Feb - 3 Mar 1994). Order Number DE94007674. Source: OSTI; NTIS; INIS; GPO Dep.

This paper presents the methods for developing accident categories and accident frequencies for internally initiated accidents at hazardous waste storage facilities (HWSFs) at US Department of Energy (DOE) sites. This categorization is a necessary first step in evaluating the risk of accidents to workers and the general population at each of the sites. This risk evaluation is part of the process of comparing alternative management strategies in DOE's Environmental Restoration and Waste Management (EM) Programmatic Environmental Impact Statement (PEIS). Such strategies involve regionalization, decentralization, and centralization of waste treatment, storage, and disposal activities. Potential accidents at the HWSFs at the DOE sites are divided into categories of spill alone, spill plus fire, and other event combinations including spill plus fire plus explosion, fire only, spill and explosion, and fire and explosion. One or more accidents are chosen to represent the types of accidents for FY 1992 for 12 DOE sites were studied to determine the most representative set of possible accidents at all DOE sites. Each accident scenario is given a probability of occurrence that is adjusted, depending on the throughput and waste composition that passes through the HWSF at the particular site. The justification for the probabilities chosen is presented.

580 (ANL/EA/CP-80977) Collecting mixed waste information for Department of Energy Environmental Restoration activities. Tolbert-Smith, M. (Dept. of Energy, Germantown, MD (United States)); MacDonell, M.; Peterson, J. Argonne National Lab., IL (United States). [1994]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940225-50: Waste management '94, Tucson, AZ (United States), 27 Feb - 3 Mar 1994). Order Number DE94007655. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy (DOE) Office of Environmental Restoration is currently developing an integrated data structure to link information on wastes and contaminated media from environmental restoration activities with other program information, including waste management plans. Mixed wastes are a key element of this data system because of the reporting requirements of the recent Federal Facility Compliance Act. The first step taken to satisfy various environmental restoration program needs was to develop a data call that would capture information on contamination and cleanup projections for all environmental restoration sites.

581 (ANL/EA/CP-82020) Approach and issues toward development of risk-based release standards for radioactive scrap metal recycle and reuse. Chen, S.Y.;

Nieves, L.A.; Nabelssi, B.K.; LePoire, D.J. Argonne National Lab., IL (United States). [1994]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940406-3: International symposium on decontamination and decommissioning, Knoxville, TN (United States), 27-29 Apr 1994). Order Number DE94007652. Source: OSTI; NTIS; INIS; GPO Dep.

The decontamination and decommissioning of nuclear facilities is expected to generate large amounts of slightly radioactive scrap metal (RSM). It is likely that some of these materials will be suitable for recycling and reuse. The amount of scrap steel from DOE facilities, for instance, is estimated to be more than one million tons (Hertzler 1993). However, under current practice and without the establishment of acceptable recycling standards, the RSM would be disposed of primarily as radioactive low-level waste (LLW). In the United States, no specific standards have been developed for the unrestricted release of bulk contaminated materials. Although standards for unrestricted release of radioactive surface contamination (NRC 1974) have existed for about 20 years, the release of materials is not commonly practiced because of the lack of risk-based justifications. Recent guidance from international bodies (IAEA 1988) has established a basis for deriving risk-based release limits for radioactive materials. It is important, therefore, to evaluate the feasibility of recycling and associated issues necessary for the establishment of risk-based release limits for the radioactive metals.

582 (ANL/EAS/CP-80858) Issues in recycling and disposal of radioactively contaminated materials. Kluk, A.F. (Dept. of Energy, Washington, DC (United States)); Hocking, E.K.; Roberts, R.; Phillips, J.W. Argonne National Lab., IL (United States). [1993]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-931095-19: Department of Energy environmental remediation conference, Augusta, GA (United States), 24-28 Oct 1993). Order Number DE94001293. Source: OSTI; NTIS; INIS; GPO Dep.

The Department of Energy's present stock of potentially re-usable and minimally radioactively contaminated materials will increase significantly as the Department's remediation activities expand. As part of its effort to minimize wastes, the Department is pursuing several approaches to recover valuable materials such as nickel, copper, and steel, and reduce the high disposal costs associated with contaminated materials. Key approaches are recycling radioactively contaminated materials or disposing of them as non-radioactive waste. These approaches are impeded by a combination of potentially conflicting Federal regulations, State actions, and Departmental policies. Actions to promote or implement these approaches at the Federal, State, or Departmental level involve issues which must be addressed and resolved. The paramount issue is the legal status of radioactively contaminated materials and the roles of the Federal and State governments in regulating those materials. Public involvement is crucial in the debate surrounding the fate of radioactively contaminated materials.

583 (ANL/ET/CP-80828) Low-temperature setting phosphate ceramics for stabilization of DOE problem low level mixed-waste: I. Material and waste form development. Singh, D. (Argonne National Lab., Argonne, IL (United States)); Wagh, A.; Knox, L.; Mayberry, J. Argonne National Lab., IL (United States). Mar 1994. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940225-94: Waste management

'94, Tucson, AZ (United States), 27 Feb - 3 mar 1994). Order Number DE94009818. Source: OSTI; NTIS; INIS; GPO Dep.

Chemically bonded phosphate ceramics are proposed as candidates for solidification and stabilization of some of the "problem" DOE low-level mixed wastes at low-temperatures. Development of these materials is crucial for stabilization of waste streams which have volatile species and any use of high-temperature technology leads to generation of off-gas secondary waste streams. Several phosphates of Mg, Al, and Zr have been investigated as candidate materials. Monoliths of these phosphates were synthesized using chemical routes at room or slightly elevated temperatures. Detailed physical and chemical characterizations have been conducted on some of these phosphates to establish their durability. Magnesium ammonium phosphate has shown to possess excellent mechanical and as well chemical properties. These phosphates were also used to stabilize a surrogate ash waste with a loading ranging from 25-35 wt.%. Characterization of the final waste forms show that waste immobilization is due to both chemical stabilization and physical encapsulation of the surrogate waste which is desirable for waste immobilization.

584 (ANL/ET/CP-81294) Phosphate bonded ceramics as candidate final-waste-form materials. Singh, D. (Argonne National Lab., IL (United States)); Wagh, A.S.; Cunnane, J.; Sutaria, M.; Kurokawa, S.; Mayberry, J. Argonne National Lab., IL (United States). Apr 1994. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940416-4: 96. annual meeting of the American Ceramic Society, Indianapolis, IN (United States), 24-28 Apr 1994). Order Number DE94010433. Source: OSTI; NTIS; INIS; GPO Dep.

Room-temperature setting phosphate-bonded ceramics were studied as candidate materials for stabilization of DOE low-level problem mixed wastes which cannot be treated by other established stabilization techniques. Phosphates of Mg, Mg-Na, Al and Zr were studied to stabilize ash surrogate waste containing RCRA metals as nitrates and RCRA organics. We show that for a typical loading of 35 wt.% of the ash waste, the phosphate ceramics pass the TCLP test. The waste forms have high compression strength exceeding ASTM recommendations for final waste forms. Detailed X-ray diffraction studies and differential thermal analyses of the waste forms show evidence of chemical reaction of the waste with phosphoric acid and the host matrix. The SEM studies show evidence of physical bonding. The excellent performance in the leaching tests is attributed to a chemical solidification and physical as well as chemical bonding of ash wastes in these phosphate ceramics.

585 (ANL/EWM/CP-78035) Solutions for Dioctyl Phthalate (DOP) tested high efficiency particulate air (HEPA) filters destined for disposal at Hanford, Washington. Gablin, K.A. Argonne National Lab., IL (United States). Nov 1992. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-921137-6: 14. low-level radioactive waste management conference, Phoenix, AZ (United States), 18-20 Nov 1992). Order Number DE93004232. Source: OSTI; NTIS; INIS; GPO Dep.

In January 1992, Argonne National Laboratory East, Environmental and Waste Management Program, learned that a chemical material used for testing of all HEPA filters at the primary source, Flanders Filter, Inc. in Washington, NC, was

considered a hazardous chemical by Washington State Dangerous Waste Regulations. These regulations are under the jurisdiction of the Washington Administration Code, Chapter 173-303, and therefore directly under impact the Hanford Site Solid Waste Acceptance Criteria. Dioctyl Phthalate, "DOP" as it is referred to in chemical abbreviation form, is added in small test quantities at the factory, at three Department of Energy (DOE) operated HEPA filter test facilities, and in the installed duct work at various operating laboratories or production facilities. When small amounts of radioactivity are added to the filter media in operation, the result is a mixed waste. This definition would normally only develop in the state of Washington since their acceptance criteria is ten times more stringent than the US Environmental Protection Agency's (US EPA). Methods of Processing will be discussed, which will include detoxification, physical separation, heat and vacuum separation, and compaction. The economic impact of a mixed waste definition in the State of Washington, and an Low Level Waste (LLW) definition in other locations, may lend this product to be a prime candidate for commercial disposal in the future, or a possible de-listing by the State of Washington.

586 (ANL/EWM/CP-80486) Requirements for shipment of DOE radioactive mixed waste. Gablin, K.; No, Hyo; Herman, J. Argonne National Lab., IL (United States). [1993]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930873-22: 2. international mixed waste symposium, Baltimore, MD (United States), 17-20 Aug 1993). Order Number DE93019019. Source: OSTI; NTIS; INIS; GPO Dep.

There are several sources of radioactive mixed waste (RMW) at Argonne National Laboratory which, in the past, were collected at waste tanks and/or sludge tanks. They were eventually pumped out by special pumps and processed in an evaporator located in the waste operations area in Building No. 306. Some of this radioactive mixed waste represents pure elementary mercury. These cleaning tanks must be manually cleaned up because the RMW material was too dense to pump with the equipment in use. The four tanks being discussed in this report are located in Building No. 306. They are the Acid Waste Tank, IMOX/FLOC Tanks, Evaporation Feed Tanks, and Waste Storage Tanks. All of these tanks are characterized and handled separately. This paper discusses the process and the requirements for characterization and the associated paperwork for Argonne Waste to be shipped to Westinghouse Hanford Company for storage.

587 (ANL/MCT/CP-77586) Chemically bonded phosphate ceramics for radioactive and mixed waste solidification and stabilization. Wagh, A.S.; Cunnane, J.C.; Singh, D.; Reed, D.T.; Armstrong, S.; Subhan, W.; Chawla, N. Argonne National Lab., IL (United States). Jan 1993. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930205-20: Waste management '93, Tucson, AZ (United States), 28 Feb - 4 mar 1993). Order Number DE93008646. Source: OSTI; NTIS; INIS; GPO Dep.

Results of an initial investigation of low temperature setting chemically bonded magnesium ammonium phosphate (MAP) ceramics as waste form materials, for solidification and stabilization of radioactive and mixed waste, are reported. The suitability of MAP for solidifying and encapsulating waste materials was tested by encapsulating zeolites at loadings up to ~50 wt%. The resulting composites exhibited very good compressive strength characteristics.

Microstructure studies show that zeolite grains remain unreacted in the matrix. Potential uses for solidifying and stab wastes are discussed.

588 (BNL-46158) Waste management technology development and demonstration programs at Brookhaven National Laboratory. Kalb, P.D.; Colombo, P. Brookhaven National Lab., Upton, NY (United States). [1991]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-911231-3: Technology 2001: 2nd national technology transfer conference and exposition, San Jose, CA (United States), 3-5 Dec 1991). Order Number DE92005028. Source: OSTI; NTIS; INIS; GPO Dep.

Two thermoplastic processes for improved treatment of radioactive, hazardous, and mixed wastes have been developed from bench-scale through technology demonstration: polyethylene encapsulation and modified sulfur cement encapsulation. The steps required to bring technologies from the research and development stage through full-scale implementation are described. Both systems result in durable waste forms that meet current Nuclear Regulatory Commission and Environmental Protection Agency regulatory criteria and provide significant improvements over conventional solidification systems such as hydraulic cement. For example, the polyethylene process can encapsulate up to 70 wt % nitrate salt, compared with a maximum of about 20 wt % for the best hydraulic cement formulation. Modified sulfur cement waste forms containing as much as 43 wt % incinerator fly ash have been formulated, whereas the maximum quantity of this waste in hydraulic cement is 16 wt %.

589 (BNL-48252) In situ containment and stabilization of buried waste: Annual report FY 1992. Allan, M.L.; Kukacka, L.E.; Heiser, J.H. Brookhaven National Lab., Upton, NY (United States). Nov 1992. 80p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE93008563. Source: OSTI; NTIS; INIS; GPO Dep.

The objective of the project was to develop, demonstrate and implement advanced grouting materials for the in-situ installation of impermeable, durable subsurface barriers and caps around waste sites and for the in-situ stabilization of contaminated soils. Specifically, the work was aimed at remediation of the Chemical Waste (CWL) and Mixed Waste Landfills (MWL) at Sandia National Laboratories (SNL) as part of the Mixed Waste Landfill Integrated Demonstration (MWLID). This report documents this project, which was conducted in two subtasks. These were (1) Capping and Barrier Grouts, and (2) In-situ Stabilization of Contaminated Soils. Subtask 1 examined materials and placement methods for in-situ containment of contaminated sites by subsurface barriers and surface caps. In Subtask 2 materials and techniques were evaluated for in-situ chemical stabilization of chromium in soil.

590 (BNL-48921) Polymer solidification national program: Letter report on FY 1992 activities. Kalb, P.D.; Colombo, P. Brookhaven National Lab., Upton, NY (United States). Apr 1993. 51p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE93015913. Source: OSTI; NTIS; INIS; GPO Dep.

Brookhaven National Laboratory (BNL) has developed several new and innovative polymer processes for the solidification of low-level radioactive, hazardous and mixed wastes streams. Polyethylene and modified sulfur cement solidification technologies have undergone steady, gradual

development at BNL over the past nine years. During this time they have progressed through each of the stages necessary for logical technology maturation: from process conception, parameter optimization, waste form testing, evaluation of long-term durability, economic analysis, and scale-up feasibility. This technology development represents a significant investment which can potentially provide DOE with both short- and long-term savings.

591 (BNL-49709) In-situ containment and stabilization of buried waste: Annual report FY 1993. Allan, M.L.; Kukacka, L.E. Brookhaven National Lab., Upton, NY (United States). Oct 1993. 94p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE94005145. Source: OSTI; NTIS; INIS; GPO Dep.

In FY 1993 research continued on development and testing of grout materials for in-situ containment and stabilization of buried waste. Specifically, the work was aimed at remediation of the Chemical Waste Landfill (CWL) at Sandia National Laboratories (SNL) in Albuquerque, New Mexico as part of the Mixed Waste Landfill Integrated Demonstration (MWLID). The work on grouting materials was initiated in FY 1992 and the accomplishments for that year are documented in the previous annual report (Allan, Kukacka and Heiser, 1992). The remediation plan involves stabilization of the chromium plume, placement of impermeable vertical and horizontal barriers to isolate the landfill and installation of a surface cap. The required depth of subsurface barriers is approximately 33 m (100 ft). The work concentrated on optimization of grout formulations for use as grout and soil cement barriers and caps. The durability of such materials was investigated, in addition to shrinkage cracking resistance, compressive and flexural strength and permeability. The potential for using fibers in grouts to control cracking was studied. Small scale field trials were conducted to test the practicality of using the identified formulations and to measure the long term performance. Large scale trials were conducted at Sandia as part of the Subsurface Barrier Emplacement Technology Program. Since it was already determined in FY 1992 that cementitious grouts could effectively stabilize the chromium plume at the CWL after pre-treatment is performed, the majority of the work was devoted to the containment aspect.

592 (BNL-49736) Polyethylene encapsulation of single-shell tank low-level wastes: FY-93 Interim progress report. Kalb, P.D. Brookhaven National Lab., Upton, NY (United States). Jun 1993. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE94008091. Source: OSTI; NTIS; INIS; GPO Dep.

For the past 50 years, the US Department of Energy and its predecessor agencies have stored large volumes of defense-related radioactive and mixed wastes in underground tanks. Initially, these tanks were constructed of single steel walls surrounded by reinforced concrete and are known as single-shell tanks (SSTs). Over time, the highly corrosive contents caused many of the tanks to begin to leak. As part of its effort to remediate leaking and potentially leaky tanks, DOE has established the Underground Storage Tank Integrated Demonstration (UST-ID). The overall objectives of the UST-ID include facilitating the development and demonstration of enhanced technologies that will lead to improved treatment and stabilization of underground storage tank wastes. The host site for the UST-ID is Hanford, but the program addresses potential use of these emerging technologies in remediation of tanks at five DOE facilities:

Hanford, Fernald, Idaho, Oak Ridge, and Savannah River. In order to meet its objectives, the UST-ID supports technology development in six focus areas including: (1) waste characterization, (2) high- and low-level waste treatment and disposal, (3) retrieval, transfer, and storage, (4) waste separation, (5) in situ treatment and disposal, and (6) site closure. This report describes work supported by the UST-ID, conducted at Brookhaven National Laboratory, to develop and demonstrate a polyethylene waste encapsulation process for low-level radioactive and hazardous mixed wastes stored in underground tanks. The objective of Phase I is to investigate the potential impacts of residual heat and high radiation doses on key waste forms properties including mechanical integrity, strength, and leachability.

593 (BNL-49841) Northeast Waste Management Alliance (NEWMA): Annual report FY 1993. Goland, A.N.; Kaplan, E. Brookhaven National Lab., Upton, NY (United States). Nov 1993. 55p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE94005507. Source: OSTI; NTIS; INIS; GPO Dep.

Funding was provided to Brookhaven National Laboratory in the fourth quarter of FY93 to establish a regional alliance as defined by Dr. Clyde Frank during his visit to BNL on March 7, 1993. In collaboration with the Long Island Research Institute (LIRI), BNL developed a business plan for the Northeast Waste Management Alliance (NEWMA). Concurrently, informal discussions were initiated with representatives of the waste management industry, and meetings were held with local and state regulatory and governmental personnel to obtain their enthusiasm and involvement. A subcontract to LIRI was written to enable it to formalize interactions with companies offering new waste management technologies selected for their dual value to the DOE and local governments in the Northeast. LIRI was founded to develop and coordinate economic growth via introduction of new technologies. As a not-for-profit institution it is in an ideal position to manage the development of NEWMA through ready access to venture capital and strong interactions with the business community, universities, and BNL. Another subcontract was written with a professor at SUNY/Stony Brook to perform an evaluation of new pyrolytic processes, some of which may be appropriate for development by NEWMA. Independent endorsement of the business plan recently by another organization, GETF, with broad knowledge of DOE/EM-50 objectives, provides a further incentive for moving rapidly to implement the NEWMA strategy. This report describes progress made during the last quarter of FY93.

594 (CAPE-3030) Preliminary design for the Waste Receiving And Processing Facility Module 1: Volume 2, Title 1 drawings [Engineering Materials]. United Engineers and Constructors, Inc., Englewood, CO (United States). Western Operations. Mar 1992. 141p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-91RL11946. (DOE/RL/11946-1-Vol.2). Source: OSTI.

141 35-mm aperture cards. These drawings accompany report no. DOE/RL/11946-1-Vol.1.

This report consists of drawings of the WRAP facility at Hanford. WRAP is a radioactive waste processing, certification facility for transuranic, mixed, and low-level radioactive wastes. (CBS)

595 (CAPE-3035) Conceptual design for the Waste Receiving And Processing facility Module 2A: Volume 4,

Conceptual drawings [Engineering Materials]. United Engineers and Constructors, Inc., Englewood, CO (United States). Western Operations. Jul 1992. 108p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-91RL11946. (DOE/RL/11946-2-Vol.4). Source: OSTI.

108 35-mm aperture cards. These drawings accompany report No. DOE/RL/11946-2-Vol.1, DOE/RL/11946-2-Vol.2, DOE/RL/11946-2-Vol.3, DOE/RL/11946-2-Vol.5.

This conceptual Design Report (CDR) is for the Waste Receiving and Processing (WRAP) Module 2A facility. The mission of the WRAP Module 2A facility is to receive, process, package, certify, and ship for permanent burial at the Hanford site disposal facilities those contact handled (CH) low-level radioactive mixed wastes (LLMW) that: (1) are currently in retrievable storage at the Hanford Central Waste Complex (HCWC) awaiting a treatment capability to permit permanent disposal compliant with the Land Disposal Restrictions and; (2) are forecasted to be generated over the next 30 years. This volume, Volume IV, provides a complete set of the conceptual design drawings. Once reviewed and approved, these drawings will be utilized as a baseline to support the advanced Conceptual Design effort.

596 (CONF-910849-5) Handling 78,000 drums of mixed-waste sludge. Berry, J.B.; Harrington, E.S.; Mattus, A.J. Oak Ridge National Lab., TN (United States). [1991]. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 1. international mixed waste symposium; Baltimore, MD (United States); 26-29 Aug 1991. Order Number DE91018846. Source: OSTI; NTIS; INIS; GPO Dep.

The Oak Ridge Gaseous Diffusion Plant (now known as the Oak Ridge K-25 Site) closed two mixed-waste surface impoundments by removing the sludge and contaminated pond-bottom clay and attempting to process it into durable, nonleachable, concrete monoliths. Interim, controlled, above-ground storage included delisting the stabilized sludge from hazardous to nonhazardous and disposing of the delisted monoliths as Class 1 radioactive waste. Because of schedule constraints and process design and control deficiencies, ~46,000 drums of material in various stages of solidification and ~32,000 barrels of unprocessed sludge are stored. The abandoned treatment facility still contains ~16,000 gal of raw sludge. Such storage of mixed waste does not comply with the Resource Conservation and Recovery Act (RCRA) guidelines. This paper describes actions that are under way to bring the storage of ~78,000 drums of mixed waste into compliance with RCRA. Remediation of this problem by treatment to meet regulatory requirements is the focus of the discussion. 3 refs., 2 figs., 4 tabs.

597 (CONF-9110229-1) Overview of tumulus design, construction, and operating experience. Jordan, E.A. (USDOE, Washington, DC (United States)); Radcliffe, L.L.; Van Hoesen, S.D.; Mezga, L.J. Oak Ridge National Lab., TN (United States). [1991]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From International Atomic Energy Agency (IAEA) low level waste disposal conference; Paris (France); 1-4 Oct 1991. Order Number DE92000434. Source: OSTI; NTIS; INIS; GPO Dep.

The Tumulus Disposal Demonstration (Tumulus 1), Tumulus 2, and the Interim Waste Management Facility (IWMF) are being utilized to demonstrate the acceptability of tumulus disposal technology while at the same time providing disposal capacity for solid low-level radioactive waste (LLW)

generated at Oak Ridge National Laboratory (ORNL). The planning process resulting in selection and ultimate implementation of tumulus disposal technology for the Oak Ridge Reservation is still on-going and consists of four major phases: alternatives identification and evaluation; technology demonstration; limited operational implementation; and full operational implementation at a new site. This document discusses these phases. 2 figs., 1 tab.

598 (CONF-911114-8) Oak Ridge low-level waste disposal facility designs. Van Hoesen, S.D.; Jones, L.S. Oak Ridge National Lab., TN (United States). [1991]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 13. annual DOE low-level waste management conference; Atlanta, GA (United States); 19-21 Nov 1991. Order Number DE92010291. Source: OSTI; NTIS; INIS; GPO Dep.

The strategic planning process that culminates in the identification, selection, construction, and ultimate operation of treatment, storage, and disposal facilities for all types of low-level waste (LLW) generated on the Oak Ridge Reservation (ORR) was conducted under the Low-Level Waste Disposal Development and Demonstration (LLWDDD) Program. This program considered management of various concentrations of short half-life radionuclides generated principally at Oak Ridge National Laboratory (ORNL) and long half-life radionuclides (principally uranium) generated at the Oak Ridge Y-12 Plant and the Oak Ridge K-25 Plant. The LLWDDD Program is still ongoing and involves four phases: (1) alternative identification and evaluation, (2) technology demonstration, (3) limited operational implementation, and (4) full operational implementation. This document provides a discussion of these phases.

599 (CONF-920107-2) Elements of uncertainty in a radiological performance assessment of a Saltstone Disposal Facility for low level waste. McDowell-Boyer, L.M.; Little, C.A. Oak Ridge National Lab., TN (United States). [1991]. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 25. midyear topical meeting of the Health Physics Society; Dearborn, MI (United States); 12-16 Jan 1992. Order Number DE92002804. Source: OSTI; NTIS; INIS; GPO Dep.

Oak Ridge National Laboratory is currently conducting a radiological performance assessment for the Saltstone Disposal Facility at the Savannah River Site near Aiken, South Carolina. Saltstone is a solidified, low-level waste form which contains very low levels of radionuclides but considerable levels of nitrate. The preliminary results of the performance assessment indicate that the final outcome will be very sensitive to the degradation scenario for the cover and containment system for this facility. The uncertainty in the results beyond several hundred years, arising from the choice of elements in this scenario, is extremely large due to the limited knowledge of the behavior of the clay and cementitious materials beyond this time frame. Design of low-level waste facilities should address this uncertainty, and policy makers and regulators should decide both what the tolerable level of uncertainty is and the length of time over which a facility's performance should be predictively evaluated. 6 refs., 4 figs.

600 (CONF-920307-13) Assessing the performance of the saltstone wasteform at the Savannah River Site. McDowell-Boyer, L.M. (Oak Ridge National Lab., TN (United States)); Kocher, D.C.; Cook, J.R. Oak Ridge National Lab., TN (United States). [1992]. 10p. Sponsored by USDOE,

Washington, DC (United States). DOE Contract AC05-84OR21400. From Waste management '92; Tucson, AZ (United States); 1-5 Mar 1992. Order Number DE92007539. Source: OSTI; NTIS; INIS; GPO Dep.

The radiological performance of the saltstone disposal facility (SDF) for low-level waste (LLW) at the Savannah River Site is being assessed in accordance with a US Department of Energy Order which was issued in 1988. Saltstone is a high-nitrate concrete matrix formed as a result of solidification of LLW streams. Potential human exposures to radionuclides that will be disposed of in the facility are being addressed. Engineered features of the SDF reduce and retard releases of radionuclides from the facility, but degradation of the features must be considered. Because prediction of the extent and timing of degradation becomes more uncertain over time, predicted releases also become more uncertain, particularly for long-lived radionuclides still present in the facility far into the future. Preliminary analyses indicate that long-lived radionuclides are the saltstone constituents of greatest concern for radiological protection of groundwater resources. Application of federal drinking water standards to untreated groundwater may be a limiting requirement for LLW disposal facilities like the SDF, where the groundwater pathway is the most important for human exposure to radionuclides. The 4-mrem annual dose limit imposed by these standards is well below limits imposed by other regulations with which the disposal facilities must comply.

601 (CONF-920466-4) Expert system for liquid low-level waste management. Ferrada, J.J. Oak Ridge National Lab., TN (United States). [1992]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Engineering and technology conference on waste management and environmental restoration; San Juan (Puerto Rico); 9-11 Apr 1992. Order Number DE92011092. Source: OSTI; NTIS; INIS; GPO Dep.

An expert system prototype has been developed to support system analysis activities at the Oak Ridge National Laboratory (ORNL) for waste management tasks. This expert system will aid in prioritizing radioactive waste streams for treatment and disposal by evaluating the severity and treatability of the problem as well as the final waste form. The objectives of the expert system development included: (1) collecting information on process treatment technologies for liquid low-level waste (LLLW) that can be incorporated in the knowledge base of the expert system, and (2) producing a prototype that suggests processes and disposal technologies for the ORNL LLLW system. The concept under which the expert system has been designed is integration of knowledge. There are many sources of knowledge (data bases, text files, simulation programs, etc.) that an expert would regularly consult in order to solve a problem of liquid waste management. The expert would normally know how to extract the information from these different sources of knowledge. The general scope of this project would be to include as much pertinent information as possible within the boundaries of the expert system. As a result, the user, who may not be an expert in every aspect of liquid waste management, may be able to apply the content of the information to a specific waste problem. This paper gives the methodological steps to develop the expert system under this general framework.

602 (CONF-920466-7) Opportunities for artificial intelligence application in computer-aided management

of mixed waste incinerator facilities. Rivera, A.L.; Ferrada, J.J.; Singh, S.P.N. Oak Ridge National Lab., TN (United States). [1992]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Engineering and technology conference on waste management and environmental restoration; San Juan (Puerto Rico); 9-11 Apr 1992. Order Number DE92011785. Source: OSTI; NTIS; INIS; GPO Dep.

The Department of Energy/Oak Ridge Field Office (DOE/OR) operates a mixed waste incinerator facility at the Oak Ridge K-25 Site. It is designed for the thermal treatment of incinerable liquid, sludge, and solid waste regulated under the Toxic Substances Control Act (TSCA) and the Resource Conservation and Recovery Act (RCRA). This facility, known as the TSCA Incinerator, services seven DOE/OR installations. This incinerator was recently authorized for production operation in the United States for the processing of mixed (radioactively contaminated-chemically hazardous) wastes as regulated under TSCA and RCRA. Operation of the TSCA Incinerator is highly constrained as a result of the regulatory, institutional, technical, and resource availability requirements. These requirements impact the characteristics and disposition of incinerator residues, limits the quality of liquid and gaseous effluents, limit the characteristics and rates of waste feeds and operating conditions, and restrict the handling of the waste feed inventories. This incinerator facility presents an opportunity for applying computer technology as a technical resource for mixed waste incinerator operation to facilitate promoting and sustaining a continuous performance improvement process while demonstrating compliance. Demonstrated computer-aided management systems could be transferred to future mixed waste incinerator facilities.

603 (CONF-920501-2) Long-term uncertainty in radiological performance assessments of low-level waste facilities at Savannah River Site. McDowell-Boyer, L.M. Oak Ridge National Lab., TN (United States). [1991]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 8. International Radiation Protection Association (IRPA) world congress; Vancouver (Canada); 10-22 May 1992. Order Number DE92002803. Source: OSTI; NTIS; INIS; GPO Dep.

Radiological performance assessments are being conducted for the Saltstone Disposal Facility and the E-Area Vaults at the Savannah River Site near Aiken, South Carolina. Saltstone is a solidified waste form which will contain very low levels of radionuclides but considerable levels of nitrate. The E-Area Vaults will contain solid, radioactively contaminated waste. Preliminary results of the assessments indicate that adequate performance will be very sensitive to the degradation scenario adopted for the cover and containment systems for these facilities. 2 refs.

604 (CONF-920527-2) Laboratory measurements of metal adsorption from simulated incinerator flue gases: Sorbent selection for cesium capture. Crosley, S.M.; Kedi, R.J. Oak Ridge National Lab., TN (United States). [1992]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 1992 incineration conference; Albuquerque, NM (United States); 11-15 May 1992. Order Number DE92013287. Source: OSTI; NTIS; INIS; GPO Dep.

The Environmental Protection Agency (EPA) has proposed that the emission of acid gases, particulates, and ten specific metals in the flue gas of incineration be regulated.

In addition, the Department of Energy is interested in minimizing the emission of radioactive metals in such flue gas. Dry scrubbing is an attractive alternative to wet scrubbing for the removal of these materials. Laboratory-scale experiments were conducted to measure the adsorption of cesium by silica at 1000–1300°F. Silica was found to be an effective sorbent for cesium. A methodology was developed for pre-selecting suitable sorbents for specific metals for future testing.

605 (CONF-920527–6) **Levelized cost-risk reduction prioritization of waste disposal options.** Wilkinson, V.K.; Young, J.M. Oak Ridge National Lab., TN (United States). [1992]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 1992 incineration conference; Albuquerque, NM (United States); 11-15 May 1992. Order Number DE92013860. Source: OSTI; NTIS; INIS; GPO Dep.

The prioritization of solid waste disposal options in terms of reduced risk to workers, the public, and the environment has recently generated considerable governmental and public interest. In this paper we address the development of a methodology to establish priorities for waste disposal options, such as incineration, landfills, long-term storage, waste minimization, etc. The study is one result of an overall project to develop methodologies for Probabilistic Risk Assessments (PRAs) of non-reactor nuclear facilities for the US Department of Energy. Option preferences are based on a levelized cost-risk reduction analysis. Option rankings are developed as functions of disposal option cost and timing, relative long- and short-term risks, and possible accident scenarios. We examine the annual costs and risks for each option over a large number of years. Risk, in this paper, is defined in terms of annual fatalities (both prompt and long-term) and environmental restoration costs that might result from either an accidental release or long-term exposure to both plant workers and the public near the site or facility. We use event timing to weigh both costs and risks; near-term costs and risks are discounted less than future expenditures and fatalities. This technique levels the timing of cash flows and benefits by converting future costs and benefits to present value costs and benefits. We give an example Levelized Cost-Benefit Analysis of incinerator location options to demonstrate the methodology and required data.

606 (CONF-920851–11) **Mixed-waste technology: Research, development, demonstration, testing, and evaluation.** Berry, J.B. (Oak Ridge National Lab., TN (United States)); Gillins, R.; Larsen, M.; Hain, K.; Ordaz, G.; Moats, R. Oak Ridge National Lab., TN (United States). [1992]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Spectrum '92: nuclear and hazardous waste management international topical meeting; Boise, ID (United States); 23-27 Aug 1992. Order Number DE92013873. Source: OSTI; NTIS; GPO Dep.

The absence of mixed-waste regulation and technology necessary to implement treatment and remediation of wastes stored and generated at both DOE and commercial sites hinders progress, despite some regulatory drivers. There is clearly a need, therefore, to develop a suite of technologies that will treat mixed wastes to acceptable criteria which can aid those objectives of EM-30 and 40 in attaining their goals of supporting implementation of mixed-waste treatment guided by both relevant RCRA and CERCLA requirements. This paper describes the EM-50 organization

and its goals as they relate to similar waste types and treatment technologies secular to the various categories of waste. The Mixed-Waste Research, Development, Demonstration, Testing and Evaluation (RDDT&E) program under EM-50 will strive to develop or locate existing technologies that will meet or exceed baseline goals under EM-30, while providing support data and system design.

607 (CONF-9209165–1) **Management challenges in remediating a mixed waste site at the Oak Ridge National Laboratory.** Riddle, S.P. (USDOE Oak Ridge Field Office, TN (United States)); Wilson, R.C.; Branscom, K.S. Oak Ridge National Lab., TN (United States). Jul 1992. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 65. annual conference of the water environment federation; New Orleans, LA (United States); 23 Sep 1992. Order Number DE92019476. Source: OSTI; NTIS; INIS; GPO Dep.

Martin Marietta Energy Systems, Inc., manages the Oak Ridge National Laboratory (ORNL) for the US Department of Energy (DOE). Since ORNL's beginning in the 1940's, a variety of solid and liquid low-level radioactive waste (LLW), hazardous waste, and mixed waste has been generated. The solid wastes have been disposed of on site, primarily in shallow trenches called solid waste storage areas (SWSAs). SWSA 6, opened in 1969, is the only operational disposal site at ORNL for solid LLW. In 1984, SWSA 6 was closed for three months when it was discovered that wastes regulated by the Resource Conservation and Recovery Act (RCRA) were being inadvertently disposed of there. SWSA 6 was then added to ORNL's Part A RCRA permit, administrative controls were modified to exclude RCRA regulated wastes from being disposed of at SWSA 6, and a RCRA closure plan was prepared. This paper describes the regulatory challenges of integrating RCRA, the Comprehensive Environmental Response, Compensation, and Liability Act; and the National Environmental Policy Act into a cohesive remediation strategy while managing the project with multiple DOE contractors and integrating the regulatory approval cycle with the DOE budget cycle. The paper does not dwell on the recommended alternative but presents instead a case study of how some difficult challenges, unique to DOE and other federal facilities, were handled.

608 (CONF-921029–4) **Application of the observational approach to environmental restoration at the Oak Ridge National Laboratory.** Garland, S.B. II (Oak Ridge National Lab., TN (United States)); Holm, L.A.; Riddle, S.P. Oak Ridge National Lab., TN (United States). Jul 1992. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Annual Department of Energy model conference on waste management and environmental restoration; Oak Ridge, TN (United States); 19-22 Oct 1992. Order Number DE93000978. Source: OSTI; NTIS; INIS; GPO Dep.

Martin Marietta Energy Systems, Inc., (Energy Systems) manages the Oak Ridge National Laboratory (ORNL) for the US Department of Energy (DOE). Since ORNL's beginning in the 1940's, a variety of solid and liquid low-level radioactive waste, hazardous waste, and mixed waste has been generated. These wastes primarily have been disposed of on-site by shallow land burial, which has caused the contamination of soil, surface water, sediments, and groundwater. The Environmental Restoration Program (ERP) was initiated to remediate this legacy of contamination and to eliminate the associated risk to the public and the environment. In an effort to streamline the process and accelerate remediation

activities, DOE, EPA, and TDEC agreed to utilize the Observational Approach in order to reduce time and cost and to use limited resources more effectively and efficiently. This paper briefly explains the Observational Approach, discusses its use in long-range planning and Remedial Investigations, and describes several specific applications.

609 (CONF-921029-5) Implementation of environmental compliance for operating radioactive liquid waste systems at the Oak Ridge National Laboratory. Hooyman, J.H.; Robinson, S.M. Oak Ridge National Lab., TN (United States). 19 Oct 1992. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Annual Department of Energy model conference on waste management and environmental restoration; Oak Ridge, TN (United States); 19-22 Oct 1992. Order Number DE93000433. Source: OSTI; NTIS; INIS; GPO Dep.

This paper addresses methods being implemented at the Oak Ridge National Laboratory (ORNL) to continue operating while achieving compliance with new standards for liquid low level waste (LLW) underground storage tank systems. The Superfund Amendment and Reauthorization Act (SARA) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) required that the Department of Energy (DOE) execute a Federal Facility Agreement (FFA) with the Environmental Protection Agency (EPA) within 6 months of listing of the ORNL on the National Priorities List. An FFA for ORNL became effective January 1, 1992 among the EPA, DOE, and the Tennessee Department of Environment and Conservation (TDEC). The agreement ensures that environmental impacts resulting from operations at the Oak Ridge Reservation are investigated and remediated to protect the public health, welfare, and environment.

610 (CONF-921029-11) Performance of a feasibility study for remediation of WAG 6 at Oak Ridge National Laboratory. Kubarewicz, J. (CH2M Hill, Oak Ridge, TN (United States)); Pfeffer, J.; Garland, S.B. II; Riddle, S.P.; Branscom, K.S. Oak Ridge National Lab., TN (United States). Oct 1992. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Annual Department of Energy model conference on waste management and environmental restoration; Oak Ridge, TN (United States); 19-22 Oct 1992. Order Number DE93003020. Source: OSTI; NTIS; INIS; GPO Dep.

This paper describes the process of preparing a feasibility study (FS) for remediation of a low-level radioactive waste (LLW) disposal site at Oak Ridge National Laboratory (ORNL). ORNL conducts research and development and is one of three DOE-owned facilities on the Oak Ridge Reservation (ORR). Waste Area Grouping (WAG) 6 is located in Melton Valley, approximately 2 miles southwest of the plant in Roane County, Tennessee. WAG 6 includes Solid Waste Storage Area (SWSA) 6, which is still used for shallow land burial of LLW and nonradioactive materials and was the primary focus of the FS. SWSA 6 covers 68 acres, 19 of which contain wastes such as low-level radioactive liquids, solids, sludges, asbestos, and biological and associated laboratory wastes. During the first 15 years of operation, the site also received chemical wastes, but since 1986, it has been used only for LLW. Until 1986, wastes were placed in unlined trenches and auger holes, but since then, wastes have been disposed in greater confinement disposal silos, lined pipe wells and auger holes, and above-ground tumulus units. A list of the sitewide alternatives initially developed for WAG 6

remediation is presented. The alternatives combined capping, structural stabilization (dynamic compaction/grouting), waste consolidation, and groundwater collection/treatment components. In situ vitrification was also considered for areas with significant long-life source inventories.

611 (CONF-921029-13) The role of the observational approach in RI planning: WAG 5 case study. Brill, A.K. (Ogden Environmental and Energy Services, Oak Ridge, TN (United States)); Kuhaida, A.J. Jr. Oak Ridge National Lab., TN (United States). Oct 1992. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Annual Department of Energy model conference on waste management and environmental restoration; Oak Ridge, TN (United States); 19-22 Oct 1992. Order Number DE93003025. Source: OSTI; NTIS; INIS; GPO Dep.

A Remedial Investigation (RI) Plan was developed for the Oak Ridge National Laboratory (ORNL) Waste Area Grouping (WAG) 5 in March 1988 and submitted to the Environmental Protection Agency (EPA) Region IV and the State of Tennessee for review and approval. The observational approach was evaluated by the ORNL Environmental Restoration (ER) Program and accepted by EPA as an accelerated and cost-effective approach to the RI/Feasibility Study (FS) process for remediation of WAG 5. The traditional approach used in preparing the 1988 RI Plan focused on data completeness, included a typical range of RI data-gathering activities for determining the nature and extent of contamination at WAG 5, and used multiple iterations of sampling activities to deal with uncertainties without consideration of potential deviations. In fall 1991, a revised Field Sampling Plan (FSP) was developed that used the observational approach to integrate site characterization with site remediation needs. This approach recognized the uncertainties of site characterization/remedial planning and developed contingency plans for dealing with them. The observational approach emphasizes data sufficiency to support remedial planning decisions for WAG 5.

612 (CONF-921029-15) On-site laboratory support of the Oak Ridge National Laboratory remedial investigation/feasibility study. Burn, J.L.E. (Bechtel National, Inc., Oak Ridge, TN (United States)); Brooksbank, R.D.; Dillener, J.L.; Jeskie, T.R. Oak Ridge National Lab., TN (United States). Oct 1992. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Annual Department of Energy model conference on waste management and environmental restoration; Oak Ridge, TN (United States); 19-22 Oct 1992. Order Number DE93003030. Source: OSTI; NTIS; INIS; GPO Dep.

In 1987, a remedial investigation/feasibility study (RI/FS) was begun at Oak Ridge National Laboratory (ORNL). ORNL had established a number of waste area groupings (WAGs), each of which was to be studied and characterized separately. Although the nature and extent of contamination at the WAGs vary widely, samples from each WAG might be radiologically and/or chemically contaminated. To comply with Department of Transportation (DOT) regulations regarding the shipment of hazardous and radioactive materials, all samples are screened for radioactivity before shipment to independent laboratories for further analysis. In 1989 a Close Support Laboratory (CSL) was established at the RI/FS Field Operations Facility at ORNL. The CSL began as a screening facility and has evolved into a laboratory where high-quality analytical results on a number of different parameters are usually available within 24 hours of sampling.

CSL capabilities include three basic areas: radiochemistry, volatile organic analysis (VOA), and wet chemistry.

613 (CONF-921137-2) Environmental monitoring of the tumulus low-level waste disposal facilities at Oak Ridge National Laboratory. Morrissey, C.M.; Ashwood, T.L. Oak Ridge National Lab., TN (United States). [1992]. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 14. low-level radioactive waste management conference; Phoenix, AZ (United States); 18-20 Nov 1992. Order Number DE93004112. Source: OSTI; NTIS; INIS; GPO Dep.

The tumulus facilities at Oak Ridge National Laboratory (ORNL) were constructed beginning in 1987 as a means of above-grade disposal of low-level radioactive waste (LLW). The facilities consist of Tumulus I, Tumulus II, and the Interim Waste Management Facility (IWMF). They are designed to meet performance criteria that require no release of radioactive contaminants to the environment for a period of one hundred years. This paper describes the tumulus facilities, the environmental monitoring program, and what we have learned from the program over approximately three years of operation. Our data suggest that the tumulus facilities are an effective means of disposal of low-level radioactive waste. However, problems with high pH and the leaching of ^{40}K , and potentially other elements from the concrete disposal pads and vaults, need to be addressed with regard to the long-term performance of the facilities.

614 (CONF-921137-4) Integration and interpretation of results from performance assessments of low-level radioactive waste disposal facilities. Lee, D.W.; Kocher, D.C.; Bownds, J.M. Oak Ridge National Lab., TN (United States). [1992]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 14. low-level radioactive waste management conference; Phoenix, AZ (United States); 18-20 Nov 1992. Order Number DE93004115. Source: OSTI; NTIS; INIS; GPO Dep.

This paper reviews efforts towards integrating and interpreting the results of the preliminary performance assessments prepared for DOE sites to demonstrate compliance with the performance objectives contained in DOE Order 5820.2A. The review illustrates the nature of uncertainties associated with performance assessments and identifies several issues being addressed. A method for providing quantitative estimates of the uncertainty in performance assessments is presented which is useful in identifying areas of the performance assessment that would most benefit from additional investigation.

615 (CONF-921137-5) Strategy for upgrade of ORNL treatment facilities to minimize secondary waste generation. Robinson, S.M.; DePaoli, S.M.; Kent, T.E. Oak Ridge National Lab., TN (United States). [1992]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 14. low-level radioactive waste management conference; Phoenix, AZ (United States); 18-20 Nov 1992. Order Number DE93004173. Source: OSTI; NTIS; INIS; GPO Dep.

Oak Ridge National Laboratory (ORNL) has implemented an aggressive waste minimization program that has resulted in significant reductions in many types of wastes in recent years. This program encompasses both near-term and long-term aspects of waste reduction for all types of wastes at the generation source as well as the waste handling and treatment facilities. This paper focuses primarily on the

methodology used to incorporate waste minimization into the long-term waste management strategies for radioactive liquid waste generated at ORNL.

616 (CONF-921137-14) Environmental monitoring of subsurface low-level waste disposal facilities at Oak Ridge National Laboratory. Ashwood, T.L.; Hicks, D.S. Oak Ridge National Lab., TN (United States). [1992]. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 14. low-level radioactive waste management conference; Phoenix, AZ (United States); 18-20 Nov 1992. Order Number DE93005763. Source: OSTI; NTIS; INIS; GPO Dep.

Oak Ridge National Laboratory (ORNL) generates low-level waste (LLW) as part of its research and isotope production activities. This waste is managed in accordance with US Department of Energy (DOE) Order 5820.2A. Solid LLW management includes disposal in above-ground, tumulus-type facilities as well as in various types of subsurface facilities. Since 1986, subsurface disposal has been conducted using various designs employing greater-confinement-disposal (GCD) techniques. The purpose of this paper is to present monitoring results that document the short-term performance of these GCD facilities.

617 (CONF-930205-1) Implementation of environmental compliance for operating radioactive liquid waste systems at the Oak Ridge National Laboratory. Hooyman, J.H. Oak Ridge National Lab., TN (United States). [1993]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Waste management '93; Tucson, AZ (United States); 28 Feb - 4 mar 1993. Order Number DE93002342. Source: OSTI; NTIS; INIS; GPO Dep.

This paper addresses methods being implemented at the Oak Ridge National Laboratory (ORNL) to continue operating while achieving compliance with new standards for liquid low level waste (LLLW) underground storage tank systems. The Superfund Amendment and Reauthorization Act (SARA) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) required that the Department of Energy (DOE) execute a Federal Facility Agreement (FFA) with the Environmental Protection Agency (EPA) within 6 months of listing of the ORNL on the National Priorities List. An FFA for ORNL became effective January 1, 1992 among the EPA, DOE, and the Tennessee Department of Environment and Conservation (TDEC). The objective of the FFA as it relates to these tank systems is to ensure that structural integrity, containment, leak detection capability, and LLLW source control are maintained until final remedial action. The FFA requires that leaking LLLW tank systems be immediately removed from service, and that active tank systems be doubly contained, cathodically protected, and have leak detection capability. LLLW tank systems that do not meet requirements are to be either upgraded or replaced, but can remain in service if they do not leak in the interim.

618 (CONF-930205-13) A method for evaluating the structural integrity of buried liquid low level waste tanks. Kincaid, J.H.; Peet, M.R.; Thompson, W.T. Oak Ridge National Lab., TN (United States). [1993]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Waste management '93; Tucson, AZ (United States); 28 Feb - 4 mar 1993. Order Number DE93007819. Source: OSTI; NTIS; GPO Dep.

An analytical method for evaluating the structural integrity of buried (underground) tanks with specific emphasis on

buckling collapse is presented. As an example, a typical tank which is part of the liquid low-level waste (LLLW) storage tank systems located at the Oak Ridge National Laboratory (ORNL) as evaluated and a margin of safety was computed. Codes associated with buried underground structure which could be used to establish design adequacy of underground storage tanks are identified. A finite element model of the soil and tank with nonlinear interface elements with representative soil overburden loading was developed. The effects of soil properties and variations of tank.

619 (CONF-930205-75) **An application of the Ultrasonic Ranging and Data System (USRADS) as a verification tool.** Smith, S.M. (Oak Ridge Inst. for Science and Education, Grand Junction, CO (United States)); Wilson, M.J.; Espegren, M.L. Oak Ridge National Lab., TN (United States). [1993]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Waste management '93; Tucson, AZ (United States); 28 Feb - 4 mar 1993. Order Number DE93015206. Source: OSTI; NTIS; INIS; GPO Dep.

The Ultrasonic Ranging and Data System (USRADS) is a computerized data collection system that enables the correlation between geographic location and data gathered at that location. The USRADS employs ultrasonics, radio frequency transmission, and microcomputers to gather data for site characterization. In the case of a radiological survey, radiation measurements are gathered to confirm that remedial action has successfully removed contamination to levels below applicable guidelines or standards. The Pollutant Assessments Group of Oak Ridge National Laboratory (ORNL), Grand Junction, Colorado, was directed by the Department of Energy (DOE) to verify the adequacy of remedial action taken at various sites throughout the western United States. The USRADS was utilized at the Monticello Remedial Action Program, a National Priorities List site in Monticello, Utah, following remedial action of approximately 15 cm of soil contaminated by wind-dispersed uranium mill tailings. The verification was conducted in a 15,300 square meter property that resides on the periphery of the mill site and was vacant land. Remedial action at this location was conducted to bring the site's radiation levels below those specified in 40 CFR 192. The radiological verification survey was conducted following excavation of the contaminated material. The USRADS was configured with a Victoreen gamma scintillometer and was operated by a two-man survey team. There are several advantages to verifying with the USRADS over conventional gamma radiation survey methods. First, survey coverage can be instantly verified, allowing the survey team to confirm complete survey coverage. Second, the data may be analyzed on site, enabling the team to identify areas of elevated gamma radiation exposure rates and to select biased sample locations. Finally, the USRADS provides both high quality graphical illustrations for permanent documentation and data storage that can be easily retrieved for site certification.

620 (CONF-930205-76) **Selective leaching of uranium from uranium-contaminated soils.** Francis, C.W. (Oak Ridge National Lab., TN (United States)); Mattus, A.J.; Farr, L.L.; Lee, S.Y.; Elless, M.P. Oak Ridge National Lab., TN (United States). [1993]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Waste management '93; Tucson, AZ (United States); 28 Feb - 4 mar 1993. Order Number DE93015461. Source: OSTI; NTIS; GPO Dep.

Three soils and a sediment contaminated with uranium were used to determine the effectiveness of sodium carbonate and citric acid leaching to decontaminate or remove uranium to acceptable regulatory levels. The objective was to selectively extract uranium using a soil washing/extraction process without seriously degrading the soil's physicochemical characteristics or generating a secondary waste form that would be difficult to manage and/or dispose of. Two of the soils were surface soils from the DOE facility formerly called the Feed Materials Production Center (FMPC) at Fernald, Ohio. One of the soils is from near the Plant 1 storage pad and the other soil was taken from near a waste incinerator used to burn low-level contaminated trash. The third soil was a surface soil from an area formally used as a landfill for the treatment of spent oils at the Oak Ridge Y-12 Plant. The sediment sample was material sampled from a storm sewer sediment trap at the Oak Ridge Y-12 Plant. Uranium concentrations in the Fernald soils ranged from 450 to 550 $\mu\text{g U/g}$ of soil while the samples from the Y-12 Plant ranged from 150 to 200 $\mu\text{g U/g}$ of soil.

621 (CONF-930255-1) **Application of surfactant to in situ bioremediation.** Strong-Gunderson, J.M.; Palumbo, A.V. Oak Ridge National Lab., TN (United States). [1993]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Department of Energy's information exchange meeting on waste retrieval treatment and processing; Washington, DC (United States); Feb 1993. Order Number DE93007247. Source: OSTI; NTIS; INIS; GPO Dep.

The main objective of this research was to evaluate the potential use of biosurfactants to increase contaminant desorption from the soil matrix, thereby increasing contaminant bioavailability and degradation rates. A secondary objective was the evaluation of the bioluminescent lux bacterial biosensor to measure the bioavailability of contaminants. Various microbial isolates were assayed for biosurfactant production and growth conditions optimized. A hydrophobic fertilizer was used to examine its ability to selectively stimulate biosurfactant producing bacteria within the microbial community.

622 (CONF-930304-12) **The effect of treatment parameters and detergent additions on the softening of radioactively contaminated process wastewater at the Oak Ridge National Laboratory.** Roe, M.M.; Kent, T.E. Oak Ridge National Lab., TN (United States). [1993]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 205. American Chemical Society national meeting; Denver, CO (United States); 28 Mar - 2 apr 1993. Order Number DE93009720. Source: OSTI; NTIS; INIS; GPO Dep.

Oak Ridge National Laboratory (ORNL) is a research facility owned by the Department of Energy and operated by Martin Marietta Energy Systems. At ORNL, research is performed in a wide range of areas including nuclear energy research, environmental sciences, materials research, health and safety research, and production of radioisotopes. These activities generate 70 million gallons per year of process wastewater which is basically tap water and ground water containing trace amounts of radioactive compounds. This water is treated for removal of contaminants at the Process Waste Treatment Plant (PWTP) before discharge to the environment.

623 (CONF-930364-1) **Development of treatment technologies for the processing of US Department of**

Energy mixed waste. Backus, P.M. (Oak Ridge National Lab., TN (United States)); Berry, J.B.; Coyle, G.J.; Lurk, P.W.; Wolf, S.M. Oak Ridge National Lab., TN (United States). [1993]. 38p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Spring national meeting of the American Institute of Chemical Engineers; Houston, TX (United States); 28 Mar - 1 Apr 1993. Order Number DE93010831. Source: OSTI; NTIS; INIS; GPO Dep.

Waste contaminated with chemically hazardous and radioactive species is defined as mixed waste. Significant technology development has been conducted for separate treatment of hazardous and radioactive waste, but technology development addressing mixed-waste treatment has been limited. Management of mixed waste requires treatment which must meet the standards established by the US Environmental Protection Agency for the specific hazardous constituents while also providing adequate control of the radionuclides. Technology has not been developed, demonstrated, or tested to produce a low-risk final waste form specifically for mixed waste. Throughout the US Department of Energy (DOE) complex, mixed waste is a problem because definitive treatment standards have not been established and few disposal facilities are available. Treatment capability and capacity are also limited. Site-specific solutions to the management of mixed waste have been initiated; however, site-specific programs result in duplication of technology development between various sites. Significant progress is being made in developing technology for mixed waste under the Mixed Waste Integrated Program. The status of the technical initiatives in chemical/physical treatment, destruction/stabilization technology, off-gas treatment, and final waste form production/assessment is described in this paper.

624 (CONF-930396-9) Implementation of in situ vitrification technology for remediation of Oak Ridge contaminated soil sites: Past results and future plans. Tixier, J.S. (Pacific Northwest Lab., Richland, WA (United States)); Powell, T.D.; Spalding, B.P.; Jacobs, G.K. Oak Ridge National Lab., TN (United States). [1993]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400 ; AC06-76RL01830. From Waste management '93; Tucson, AZ (United States); 1-5 Mar 1993. Order Number DE93010335. Source: OSTI; NTIS; INIS; GPO Dep.

In situ vitrification is a thermal treatment technology being developed for remediation of contaminated soils. The process transforms easily leached, contaminated soils into a relatively inert, leach-resistant, vitreous and crystalline monolith. This paper presents the results of the recent highly successful ISV demonstration conducted jointly by PNL and ORNL on a tracer-level quantity of radioactive sludge in a model trench at ORNL. A retention of 90Sr in the vitreous and crystalline product of greater than 99.9999% was measured with a reduction in mobility of more than 2 orders of magnitude. The paper also presents the current plans for continued collaboration on a two setting treatability test on one portion of an old seepage pit at ORNL.

625 (CONF-930403-15) Kerr Hollow Quarry Remediation Project: Environmental Restoration and Waste Management Program. Walker, K.L. Oak Ridge National Lab., TN (United States). [1993]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 5. topical meeting on robotics and remote systems; Knoxville, TN (United States); 26-29 Apr

1993. Order Number DE93007249. Source: OSTI; NTIS; INIS; GPO Dep.

The Kerr Hollow Quarry is a 3-acre flooded limestone quarry located near the Y-12 Facility on the Oak Ridge Reservation. The quarry was used in the 1940s as a source of construction material for the Department of Energy in Oak Ridge, Tennessee. Its use was discontinued in the early 1950s, and it was allowed to flood with water. The quarry presently has a maximum water depth of approximately 55 ft. During the period between the early 1950s until about 1988, the quarry was used for the treatment and disposal of a variety of materials including water-reactive, alkali metals, shock-sensitive chemicals, and compressed gas cylinders. For some of these materials, the treatment consisted of dropping the vessels containing the materials into the quarry from a high bluff located on one side of the quarry. The vessels were then punctured by gun shot, and the materials were allowed to react with the water and sink to the bottom of the quarry. Very few disposal records exist for the period from 1952 to 1962. The records after that time, from 1962 until 1988, indicate some 50 t of hazardous and nonhazardous materials were disposed of in the quarry. This report documents remediation efforts that have taken place at the quarry beginning in September 1990.

626 (CONF-930483-10) A life-cycle model approach to multimedia waste reduction measuring performance for environmental cleanup projects. Phifer, B.E. Jr. (Martin Marietta Energy Systems, Inc., Oak Ridge, TN (US)); George, S.M. Martin Marietta Energy Systems, Inc., Oak Ridge, TN (United States). [1993]. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 9. waste minimization and pollution prevention conference; San Francisco, CA (United States); 13-15 Apr 1993. Order Number DE93016234. Source: OSTI; NTIS; INIS; GPO Dep.

The Martin Marietta Energy Systems, Inc. (Energy Systems), Environmental Restoration (ER) Program adopted a Pollution Prevention Program in March 1991. The program's mission is to minimize waste and prevent pollution in remedial investigations (RIs), feasibility studies, decontamination and decommissioning, and surveillance and maintenance site program activities. Mission success will result in volume and/or toxicity reduction of generated waste. The ER Program waste generation rates are projected to steadily increase through the year 2005 for all waste categories. Standard production units utilized to measure waste minimization apply to production/manufacturing facilities. Since ER inherited contaminated waste from previous production processes, no historical production data can be applied. Therefore, a more accurate measure for pollution prevention was identified as a need for the ER Program. The Energy Systems ER Program adopted a life-cycle model approach and implemented the concept of numerically scoring their waste generators to measure the effectiveness of pollution prevention/waste minimization programs and elected to develop a numerical scoring system (NSS) to accomplish these measurements. The prototype NSS, a computerized, user-friendly information management database system, was designed to be utilized in each phase of the ER Program. The NSS was designed to measure a generator's success in incorporating pollution prevention in their work plans and reducing investigation-derived waste (IDW) during RIs. Energy Systems is producing a fully developed NSS and actually scoring the generators of IDW at six ER Program sites. Once RI waste generators are scored utilizing the NSS, the

numerical scores are distributed into six performance categories: training, self-assessment, field implementation, documentation, technology transfer, and planning.

627 (CONF-930589-1) **US Department of Energy, Office of Technology Development, Mixed-Waste Treatment Research, Development, Demonstration, Testing, and Evaluation.** Berry, J.B. (Oak Ridge National Lab., TN (United States)); Coyle, G.J. Jr.; Lurk, P. Oak Ridge National Lab., TN (United States). [1992]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 4. international conference on contaminated soil; Berlin (Germany); 3-7 May 1993. Order Number DE93006214. Source: OSTI; NTIS; INIS; GPO Dep.

Both chemically hazardous and radioactive species contaminate mixed waste. Historically, technology has been developed to treat either hazardous or radioactive waste. Technology specifically designed to produce a low-risk final waste form for mixed low-level waste has not been developed, demonstrated, or tested. Site-specific solutions to management of mixed waste have been initiated; however, site-specific programs result in duplication of technology development effort between various sites. There is a clear need for technology designed to meet the unique requirements for mixed-waste processing and a system-wide integrated strategy for developing technology and managing mixed waste. This paper discusses the US Department of Energy (DOE) approach to addressing these unique requirements through a national technology development effort

628 (CONF-930873-26) **The challenge of packaging and transporting mixed waste samples and residues arising from the Department of Energy's Analytical Services Program.** Pope, R.B. (Oak Ridge National Lab., TN (United States)); Blalock, L.G.; Conroy, M.J. Oak Ridge National Lab., TN (United States). [1993]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 2. international mixed waste symposium; Baltimore, MD (United States); 17-20 Aug 1993. Order Number DE93019165. Source: OSTI; NTIS; INIS; GPO Dep.

This paper discusses the background and magnitude of challenges that the US Department of Energy (DOE) faces in accomplishing its task to characterize and remediate wastes at its sites. The analytical-sample-shipment needs are discussed, anticipated packaging and transport problems are assessed, and the way in which DOE's Transportation Management Division is preparing to support other DOE organizations in addressing these challenges is summarized. Many challenges arising from the need to ship analytical samples are centered upon resolving packaging issues. Resolution of these challenges will require further efforts to define and quantify packaging requirements better and to develop methods for addressing resultant issues in a timely, an efficient, and a safe manner.

629 (CONF-9308150-5) **Contaminated scrap metal management on the Oak Ridge Reservation.** Hayden, H.W. (Martin Marietta Energy Systems, Inc., Oak Ridge, TN (United States)); Stephenson, M.J.; Bailey, J.K.; Weir, J.R.; Gilbert, W.C. Oak Ridge National Lab., TN (United States). [1993]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Environmentally conscious manufacturing congress '93; Arlington, VA (United States); 30 Aug - 1 Sep 1993. Order Number DE94000338. Source: OSTI; NTIS; INIS; GPO Dep.

Large quantities of scrap metal are accumulating at the various Department of Energy (DOE) installations across the country as a result of ongoing DOE programs and missions in concert with present day waste management practices. DOE Oak Ridge alone is presently storing around 500,000 tons of scrap metal. The local generation rate, currently estimated at 1,400 tons/yr, is expected to increase sharply over the next couple of years as numerous environmental restoration and decommissioning programs gain momentum. Projections show that 775,000 tons of scrap metal could be generated at the K-25 Site over the next ten years. The Y-12 Plant and Oak Ridge National Laboratory (ORNL) have similar potentials. The history of scrap metal management at Oak Ridge and future challenges and opportunities are discussed.

630 (CONF-931043-6) **Molten salt oxidation of mixed wastes: Separation of radioactive materials and Resource Conservation and Recovery Act (RCRA) materials.** Bell, J.T.; Haas, P.A.; Rudolph, J.C. Oak Ridge National Lab., TN (United States). [1993]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 8. symposium on separation science and technology for energy applications; Knoxville, TN (United States); 24-28 Oct 1993. Order Number DE94003587. Source: OSTI; NTIS; INIS; GPO Dep.

The Oak Ridge National Laboratory (ORNL) is involved in a program to apply a molten salt oxidation (MSO) process to the treatment of mixed wastes at Oak Ridge and other Department of Energy (DOE) sites. Mixed wastes are defined as those wastes that contain both radioactive components, which are regulated by the atomic energy legislation, and hazardous waste components, which are regulated under the Resource Conservation and Recovery Act (RCRA). A major part of our ORNL program involves the development of separation technologies that are necessary for the complete treatment of mixed wastes. The residues from the MSO treatment of the mixed wastes must be processed further to separate the radioactive components, to concentrate and recycle residues, or to convert the residues into forms acceptable for final disposal. This paper is a review of the MSO requirements for separation technologies, the information now available, and the concepts for our development studies.

631 (CONF-931119-2) **Performance modelling of concrete/metal barriers used in low-level waste disposal.** Shuman, R. (Rogers and Associates Engineering Corp., Salt Lake City, UT (United States)); Chau, Nam; Icenhour, A.S.; Godbee, H.W.; Tharp, M.L. Oak Ridge National Lab., TN (United States). [1993]. 42p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 3. international symposium on stabilization/solidification of hazardous, radioactive and mixed wastes; Williamsburg, VA (United States); 1-5 Nov 1993. Order Number DE94002540. Source: OSTI; NTIS; INIS; GPO Dep.

Low-Level radioactive wastes generated in government and commercial operations involving nuclear materials need to be isolated from the environment almost in perpetuity. An increasing number of disposal sites are using concrete/metal barriers (so called "engineered" barriers) to isolate these wastes from the environment. Two major concerns hamper the use of engineered barriers; namely, the lack of ability to reliably predict the service life of these barriers and to estimate the confidence level of the service life predicted. Computer codes (SOURCE1 and SOURCE2) for estimating

the long-term (centuries to millennia) service life of these barriers are presented. These codes use mathematical models (based on past observations, currently accepted data, and established theories) to predict behavior into the future. Processes modeled for concrete degradation include sulfate attack, calcium hydroxide leaching, and reinforcement corrosion. The loss of structural integrity due to cracking is also modeled. Mechanisms modeled for nuclide leaching include advection and diffusion. The coupled or linked effects of these models are addressed in the codes. Outputs from the codes are presented and analyzed.

632 (CONF-940212-3) Inventory and characteristics of current and projected low-level radioactive materials and waste in the United States. Bisaria, A. (Oak Ridge National Lab., TN (United States)); Bugos, R.G.; Pope, R.B.; Salmon, R.; Storch, S.N.; Lester, P.B. Oak Ridge National Lab., TN (United States). [1994]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Seminar on developments in radioactive waste transport; Vienna (Austria); 21-25 Feb 1994. Order Number DE94012331. Source: OSTI; NTIS; INIS; GPO Dep.

The Integrated Data Base (IDB), under US Department of Energy (DOE) funding and guidance, provides an annual update of compiled data on current and projected inventories and characteristics of DOE and commercially owned radioactive wastes. The data base addresses also the inventories of DOE and commercial spent fuel. These data are derived from reliable information from government sources, open literature, technical reports, and direct contacts. The radioactive materials considered are spent nuclear fuel, high-level waste (HLW), transuranic (TRU) waste, low-level waste (LLW), commercial uranium mill tailings, environmental restoration wastes, and mixed-LLW. This paper primarily focuses on LLW inventory and characterization.

633 (CONF-940225-82) An experimental investigation of the thermal/fluid properties of the NAC product slurry. Muguercla, J. (Florida International Univ., Miami, FL (United States)). Dept. of Mechanical Engineering; Yang, G.; Li, W.; Ebadian, M.A.; Mattus, A.J.; Lee, D.D.; Hunt, R.D. Oak Ridge National Lab., TN (United States). [1994]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Waste management '94; Tucson, AZ (United States); 27 Feb - 3 mar 1994. Order Number DE94009174. Source: OSTI; NTIS; INIS; GPO Dep.

As regulation of the waste decontamination process becomes increasingly restrictive, the safe storage of liquid nuclear waste is one of the major challenges worldwide. Over the past 50 years, more than 242,700 tons of low-level radioactive waste (LLW) has been generated at various U.S. weapons facilities. This LLW is temporarily stored at U.S. Department of Energy facilities such as the single-shell tanks at the Hanford site, the Savannah River site, the Melton Valley storage tanks at Oak Ridge National Laboratory, and the Pad A Waste site at Idaho Falls. The characteristics of this sodium nitrate-based waste, in addition to the levels of radioactivity, are as follows: pH, either < 1 or > 12, with a total salt content of > 5 M, and a sodium content of > 1.5 M. Radioactive waste in the liquid state poses a great threat due to the potential for seeping into groundwater supplies. Therefore, it must be immobilized before final disposal. Currently, the most common immobilized method for LLW is the use of cement-based grout. Unfortunately, radioactive leaching is a major obstacle for this

technology since the nitrate anion is very difficult to immobilize, especially in the relatively porous cement-based grout.

634 (CONF-940225-111) Development and demonstration of treatment technologies for the processing of US Department of Energy mixed waste. Berry, J.B. (Oak Ridge National Lab., TN (United States)); Bloom, G.A.; Kuchynka, D.J. Oak Ridge National Lab., TN (United States). [1994]. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Waste management '94; Tucson, AZ (United States); 27 Feb - 3 mar 1994. Order Number DE94012332. Source: OSTI; NTIS; INIS; GPO Dep.

Mixed waste is defined as waste contaminated with chemically hazardous (governed by the Resource Conservation and Recovery Act) and radioactive species [governed by US Department of Energy (DOE) orders]. The Mixed Waste Integrated Program (MWIP) is responding to the need for DOE mixed waste treatment technologies that meet these dual regulatory requirements. MWIP is developing emerging and innovative treatment technologies to determine process feasibility. Technology demonstrations will be used to determine whether processes are superior to existing technologies in reducing risk, minimizing life-cycle cost, and improving process performance. The Program also provides a forum for stakeholder and customer involvement in the technology development process. MWIP is composed of six technical areas that support a mixed-waste treatment system: (1) systems analysis, (2) materials handling, (3) chemical/physical separation, (4) waste destruction and stabilization, (5) off-gas treatment, and (6) final waste form stabilization. The status of the technical initiatives and the current research, development, and demonstration in each of these areas is described in this paper.

635 (CONF-940433-6) A negative bioventing feasibility test. DePaoli, D.W. (Oak Ridge National Lab., TN (United States)); Greene, D.W.; Herbes, S.E.; Walzel, A.D. Oak Ridge National Lab., TN (United States). [1994]. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Spring meeting of the American Institute of Chemical Engineers; Atlanta, GA (United States); 17-21 Apr 1994. Order Number DE94012653. Source: OSTI; NTIS; INIS; GPO Dep.

A bioventing feasibility test was conducted at a hydrocarbon fuel spill site at Oak Ridge National Laboratory. The soils at this site are generally of low air permeability and are representative of the clayey soils encountered at several Department of Energy sites and throughout the southeastern United States. The tests included an in situ air permeability test and in situ respiration tests at three well where highest soil contamination was measured. The in situ respiration tests showed that there was the potential for significant biodegradation in the soil with adequate oxygenation. The in situ permeability tests indicated that the majority of flow was through fractures, rather than through the bulk soils. A helium tracer test verified that injected gas flowed directly to the surface through a small number of fractures, with no flow reaching the monitoring wells. These results indicate that oxygen transport to the bulk soils would be severely limited by diffusion, such that bioventing was deemed not feasible for this site. In light of these results, the importance of testing for fracture flow in soils of lower permeability is stressed — whether the technology is bioventing or conventional soil venting.

636 (CONF-940501-2) Environmental restoration and management of low-level radioactive and mixed waste at Oak Ridge National Laboratory. Kendrick, C.M. Oak Ridge National Lab., TN (United States). [1994]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 9. Pacific basin nuclear conference; Sydney (Australia); 1-5 May 1994. Order Number DE94007213. Source: OSTI; NTIS; INIS; GPO Dep.

Management of radioactive waste at Oak Ridge National Laboratory (ORNL) must address several major challenges. First, contaminants from some disposed wastes are leaching into the groundwater and these disposal sites must be remediated. Second, some of these "legacy" wastes, as well as currently generated radioactive wastes, are also contaminated with chemicals, including polychlorinated biphenyls (PCBs), solvents, and metals (i.e., mixed waste). Third, wastes containing long-lived radionuclides in concentrations above established limits have been determined unsuited for disposal on the Oak Ridge Reservation. Reflecting these challenges, ORNL's strategy for managing its radioactive wastes continues to evolve with the development of improved technologies and site-specific adaptation of some standard technologies.

637 (DOE/EA-0491) Environmental assessment for Retech, Inc.'s Plasma Centrifugal Furnace Evaluation. USDOE, Washington, DC (United States). May 1991. 43p. Sponsored by USDOE, Washington, DC (United States). Order Number DE91015815. Source: OSTI; NTIS; INIS; GPO Dep.

The US DOE and the US EPA are conducting a hazardous waste demonstration program in cooperation with the EPA Superfund Innovative Technology Evaluation (SITE) program. The program is testing Retech, Inc.'s Plasma Centrifugal Furnace (PCF) technology. Since shakedown/preliminary testing is nearly complete, DOE proposed to begin Phase I studies to examine the applicability of this technology to treatment/destruction of typical Idaho National Engineering Laboratory wastes and industrial water treatment sludges. Pending the results of the Phase I study, the EPA will decide their level of involvement. The timeframe for the EPA and Phase II of DOE testing will be decided at the conclusion of the Phase I study. This document focuses primarily on the environmental impact of the two DOE phases; however, impact analysis will also be performed for the EPA feedstock. 25 refs., 1 fig.

638 (DOE/EIS-0185D-074-Vol.1) Remedial investigation for the chemical plant area of the Weldon Spring Site: Volume 1. USDOE Oak Ridge Field Office, TN (United States). Weldon Spring Site Remedial Action Project; MK-Ferguson Co., Weldon Spring, MO (United States); Jacobs Engineering Group, Inc., Weldon Spring, MO (United States). Nov 1992. 565p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-86OR21548. (DOE/OR/21548-074-Vol.1). Order Number DE93003926. Source: OSTI; NTIS; INIS; GPO Dep.

Engineering drawings for this project are identified as CAPE-3064. Inquiries may be directed to: Office of Scientific and Technical Information, P.O. Box 62, Oak Ridge, TN 37831.

The US Department of Energy (DOE) is responsible for management of the Weldon Spring Site Remedial Action Project (WSSRAP) under its Environmental Restoration and Waste Management Program. Major goals include eliminating potential public and environmental hazards due to site contamination and releasing the property for alternate uses

to the maximum extent practicable. The purpose of the remedial investigation described in this report was to determine the extent of contamination associated with the portion of the Weldon Spring site known as the chemical plant and raffinate pit area. The DOE has assumed responsibility for investigating and remediating all on-site soil contamination and off-site soil which is radiologically contaminated as a result of uranium and thorium processing operations. The DOE has also assumed the responsibility for radiologically contaminated groundwater on and off site. The Weldon Spring site remedial investigation also involved the evaluation of the sources, nature and extent, and environmental fate and transport of contaminants to provide a basis for defining the risks that the contaminants may pose to human health and the environment. Data are included in this report to support the screening of remedial technologies and to permit the development and detailed analysis of alternatives for remedial action at the site during the feasibility study process.

639 (DOE/EIS-0185D-074-Vol.2) Remedial investigation for the chemical plant area of the Weldon Spring Site: Volume 2. USDOE Oak Ridge Field Office, TN (United States). Weldon Spring Site Remedial Action Project; MK-Ferguson Co., Weldon Spring, MO (United States); Jacobs Engineering Group, Inc., Weldon Spring, MO (United States). Nov 1992. 424p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-86OR21548. (DOE/OR/21548-074-Vol.2). Order Number DE93003927. Source: OSTI; NTIS; INIS; GPO Dep.

Engineering drawings for this project are identified as CAPE-3064. Inquiries may be directed to: Office of Scientific and Technical Information, P.O. Box 62, Oak Ridge, TN 37831.

This volume contains figures such as charts and maps identifying areas of contamination, and tables of compiled data on the types and amount of contamination.

640 (DOE/EIS-0185D-091) Baseline assessment for the chemical plant area of the Weldon Spring site. USDOE Oak Ridge Field Office, TN (United States); Argonne National Lab., IL (United States). Nov 1992. 568p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-86OR21548 ; W-31109-ENG-38. (DOE/OR/21548-091). Order Number DE93003627. Source: OSTI; NTIS; INIS; GPO Dep.

The Weldon Spring site is located in St. Charles County, Missouri, about 48 km (30 mi) west of St. Louis. The site became contaminated as a result of processing and disposal activities that took place from the 1940s through the 1960s, and it is listed on the National Priorities List (NPL) of the US Environmental Protection Agency (EPA). The US Department of Energy (DOE) is responsible for cleanup activities at the site under its Environmental Restoration and Waste Management Program. The major goals of this program are to eliminate potential hazards to human health and the environment that are associated with contaminated DOE sites and to make surplus property available for other uses, to the extent possible. Cleanup of the Weldon Spring site consists of several integrated components. TWs baseline assessment (BA) addresses potential human health and environmental impacts associated with the chemical plant area of the site under both current and hypothetical future conditions in the absence of cleanup. The assessment provides a framework for developing risk information that can be used to support cleanup decisions for the chemical plant area, and it serves to focus the selection of appropriate cleanup

remedies. Other components of the integrated site remediation process are described.

641 (DOE/EIS-0185D-148-Vol.1) **Feasibility study for remedial action at the chemical plant area of the Weldon Spring Site: Volume 1, Main text.** USDOE Oak Ridge Field Office, TN (United States). Weldon Spring Site Remedial Action Project. Nov 1992. 408p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-86OR21548 ; W-31109-ENG-38. (DOE/OR/21548-148-Vol.1). Order Number DE93003925. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy (DOE) is responsible for cleanup activities at the Weldon Spring site under its Environmental Restoration and Waste Management Program. The major goals of this program are to eliminate potential hazards to human health and the environment that are associated with contamination and to make surplus real property available for other uses, to the extent possible. This feasibility study (FS) addresses remedial action alternatives for the chemical plant area and related properties outside the site fence that are contaminated as a result of past site activities and ongoing releases. These properties include ten areas of localized soil contamination, which have been designated vicinity properties, and three lakes nearby. Although this report focuses on the chemical plant area and related properties, most of the waste from the quarry is also included because it will be stored at the chemical plant area following its upcoming excavation from the quarry under an interim action. Contamination remaining at the quarry area and other locations is also considered in the context of comprehensive planning to develop an integrated disposal decision for all site waste at this major stage of site cleanup.

642 (DOE/EIS-0185D-148-Vol.2) **Feasibility study for remedial action at the chemical plant area of the Weldon Spring Site: Volume 2, Appendixes.** USDOE Oak Ridge Field Office, TN (United States). Weldon Spring Site Remedial Action Project. Nov 1992. 507p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-86OR21548 ; W-31109-ENG-38. (DOE/OR/21548-148-Vol.2). Order Number DE93003924. Source: OSTI; NTIS; INIS; GPO Dep.

The Weldon Spring site is radioactively and chemically contaminated at levels that exceed certain standards and guidelines for protecting human health and the environment. The ongoing site characterization and environmental monitoring programs provide information on the nature and extent of contamination, including information for off-site areas to which contaminants have migrated or could migrate in the future. Although humans and biota are not adversely impacted by site contaminants at this time, the purpose of DOE's remedial action program is to preclude the potential for such impacts in the future by implementing long-term environmental restoration and waste management decisions. The DOE is addressing long-term management of the Weldon Spring site through an integrated environmental decision-making process. Supporting information for the feasibility study is provided in Appendixes A through J. This information addresses scoping (Appendix A), engineering technologies (Appendix B), potential health and environmental impacts (Appendixes C, D, E, F, H and I), regulatory requirements (Appendix G), and letters of consultation received from the various agencies contacted (Appendix J). Additional engineering information is presented in supporting technical reports.

643 (DOE/EIS-0185D-160) **Proposed plan for remedial action at the chemical plant area of the Weldon Spring site.** USDOE Oak Ridge Field Office, TN (United States); Argonne National Lab., IL (United States). Nov 1992. 73p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-86OR21548 ; W-31109-ENG-38. (DOE/OR/21548-160). Order Number DE93003923. Source: OSTI; NTIS; INIS; GPO Dep.

This proposed plan addresses the management of contaminated material at the chemical plant area of the Weldon Spring site and nearby properties in St. Charles County, Missouri. The site consists of a chemical plant area and a noncontiguous limestone quarry, both of which are radioactively and chemically contaminated as a result of past processing and disposal activities. Explosives were produced at the chemical plant in the 1940s, and uranium and thorium materials were processed in the 1950s and 1960s. Various liquid, sludge, and solid wastes were disposed of at the chemical plant area and in the quarry during that time. The Weldon Spring site is listed on the National Priorities List (NPL) of the US Environmental Protection Agency (EPA), and the US Department of Energy (DOE) is conducting cleanup activities at the site under its Environmental Restoration and Waste Management Program. The proposed plan is organized as follows: Chapter 2 presents the history and setting of the Weldon Spring site and briefly describes the contaminated material at the chemical plant area. Chapter 3 defines the scope of the remedial action and its role in the Weldon Spring Site Remedial Action Project. Chapter 4 summarizes the risks associated with possible exposures to site contaminants in the absence of remedial action and identifies proposed cleanup levels for soil. Chapter 5 briefly describes the final alternatives considered for the remedial action. Chapter 6 summarizes the evaluation of final alternatives for managing the contaminated material, identifies the currently preferred alternative, and discusses a possible contingency remedy to provide treatment flexibility. Chapter 7 presents the community's role in this action. Chapter 8 is a list of the references cited in this proposed plan.

644 (DOE/EIS-0185F-387) **Responses to comments on the Remedial Investigation/Feasibility Study-Environmental Impact Statement for Remedial Action at the chemical plant area of the Weldon Spring Site, November 1992.** USDOE Oak Ridge Field Office, TN (United States); Argonne National Lab., IL (United States). Jun 1993. 182p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (DOE/OR/21548-387). Order Number DE93019015. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy (DOE) is responsible for cleanup activities at the Weldon Spring site in St. Charles County, Missouri. The site consists of a chemical plant area and a noncontiguous limestone quarry; both areas are radioactively and chemically contaminated as a result of past processing and disposal activities. Explosives were produced by the US Army at the chemical plant in the 1940s, and uranium and thorium materials were processed by DOE's predecessor agency in the 1950s and 1960s. During that time, various wastes were disposed of at both areas of the site. The Weldon Spring site is on the National Priorities List (NPL) of the US Environmental Protection Agency (EPA). The DOE is conducting cleanup activities at the site under its Environmental Restoration and Waste Management Program. The RI/FS-EIS for remedial action at the chemical plant area of the Weldon Spring site was issued to

the public on November 20, 1992. This public comment response document presents a summary of the major issues identified in both oral and written comments on the RI/FS-EIS and DOE's responses to those issues. This document also provides individual responses to the written comments.

645 (DOE/EM-0006P) 1989 Annual report on low-level radioactive waste management progress: Report to Congress in response to Public Law 99-240. USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). Oct 1990. 187p. Sponsored by USDOE, Washington, DC (United States). Order Number DE91006746. Source: OSTI; NTIS; INIS; GPO Dep.

This report summarizes the progress during 1989 of states and compacts in establishing new low-level radioactive waste disposal facilities. It also provides summary information on the volume of low-level waste received for disposal in 1989 by commercially operated low-level waste disposal facilities. This report is in response to Section 7(b) of Title I of Public Law 99-240, the Low-Level Radioactive Waste Policy Amendments Act of 1985. 2 figs., 5 tabs.

646 (DOE/EM-0057P) Summary of expenditures of rebates from the low-level radioactive waste surcharge escrow account for calendar year 1990: Report to Congress in response to Public Law 99-240. USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). Jun 1991. 22p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92002628. Source: OSTI; NTIS; INIS; GPO Dep.

This is the fifth report submitted to Congress under Title 1, section 5(d)(2)(E) of Public Law 99-240, "The Low-Level Radioactive Waste Policy Amendments Act of 1985" (the Act). This section of the Act requests the Department of Energy (DOE) to summarize the annual expenditures of funds disbursed from the DOE surcharge escrow account and to assess compliance of these expenditures with the specified limitations. The Act places limitations on the use of these funds and requires the nonsited compact regions and nonmember States to provide DOE with an itemized report of their expenditures on December 31 of each year in which funds are expended. Within 6 months after receiving the individual reports, DOE is to furnish Congress a summary of the reported expenditures and an assessment of compliance with the limitations on the use of these funds specified in the Act. This report fulfills that requirements. DOE disbursed funds totaling \$15,006,587.76 to the States and compact regions following the July 1, 1986, January 1, 1988, and January 1, 1990, milestones. Of this amount, \$4,328,340.44 was expended during calendar year 1990 and \$2,239,205.80 was expended during the prior 4 years. At the end of December 1990, \$8,439,041.52 was unexpended. 5 tabs.

647 (DOE/EM-0059P) Report to Congress in response to Public Law 99-240: 1990 Annual report on low-level radioactive waste management progress. USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). Sep 1991. 144p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92007162. Source: OSTI; NTIS; INIS; GPO Dep.

This report summarizes the progress during 1990 of states and compact regions in establishing new low-level radioactive waste disposal facilities. It also provides summary information on the volume of low-level radioactive waste

received for disposal in 1990 by commercially operated low-level radioactive waste disposal facilities. This report is in response to section 7 (b) of the Low-Level Radioactive Waste Policy Act, as amended by Public Law 99-240.

648 (DOE/EM-0088P) Summary of expenditures of rebates from the low-level radioactive waste surcharge escrow account for calendar year 1991: Report to Congress in response to Public Law 99-240. USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). Jun 1992. 27p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93003135. Source: OSTI; NTIS; INIS; GPO Dep.

This is the sixth report submitted to Congress under section 5(d)(2)(E)(ii)(II) of the Low-Level Radioactive Waste Policy Act of 1985 (the Act). This section of the Act directs the Department of Energy (DOE) to summarize the annual expenditures of funds disbursed from the DOE surcharge escrow account and to assess compliance of these expenditures with the limitations specified in the Act. In addition to placing limitations on the use of these funds, the Act also requires the nonsited compact regions and nonmember States to provide DOE with an itemized report of their expenditures on December 31 of each year in which funds are expended. Within 6 months after receiving the individual reports, the Act requires the Secretary to furnish Congress with a summary of the reported expenditures and an assessment of compliance with the specified usage limitations. This report fulfills that requirement. DOE disbursed funds totaling \$15,037,778.91 to the States and compact regions following the July 1, 1986, January 1, 1988, and January 1, 1990, milestones specified in the Act. Of this amount, \$3,517,020.56 was expended during calendar year 1991 and \$6,602,546.24 was expended during the prior 5 years. At the end of December 1991, \$4,918,212.11 was unexpended. DOE has reviewed each of the reported expenditures and concluded that all reported expenditures comply with the spending limitations stated in section 5(d)(2)(E)(i) of the Act.

649 (DOE/EM-0091P) 1991 annual report on low-level radioactive waste management progress: Report to Congress in response to Public Law 99-240. USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). Nov 1992. 173p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93006957. Source: OSTI; NTIS; INIS; GPO Dep.

This report summarizes the progress during 1991 of States and compact regions in establishing new low-level radioactive waste disposal capacity. It has been prepared in response to requirements in Section 7 (b) of Title I of Public Law 99-240, the Low-Level Radioactive Waste Policy Amendments Act of 1985 (the Act). By the end of 1991, 9 compact regions (totaling 42 States) were functioning with plans to establish low-level radioactive waste disposal facilities: Appalachian, Central, Central Midwest, Midwest, Northeast, Northwest, Rocky Mountain, Southeast, and Southwestern. Also planning to construct disposal facilities, but unaffiliated with a compact region, are Maine, Massachusetts, New York, Texas, and Vermont. The District of Columbia, New Hampshire, Puerto Rico, Rhode Island and Michigan are unaffiliated with a compact region and do not plan to construct a disposal facility. Michigan was the host State for the Midwest compact region until July 1991 when the Midwest Interstate Compact Commission revoked Michigan's membership. Only the Central, Central Midwest, and

Southwestern compact regions met the January 1, 1992, milestone in the Act to submit a complete disposal license application. None of the States or compact regions project meeting the January 1, 1993, milestone to have an operational low-level radioactive waste disposal facility. Also summarized are significant events that occurred in low-level radioactive waste management in 1991 and early 1992, including the 1992 United States Supreme Court decision in *New York v. United States* in which New York challenged the constitutionality of the Act, particularly the "take-title" provision. Summary information is also provided on the volume of low-level radioactive waste received for disposal in 1991 by commercially operated low-level radioactive waste disposal facilities.

650 (DOE/EM-0096) Summary of expenditures of rebates from the low-level radioactive waste surcharge escrow account for calendar year 1992. USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). Jun 1993. 18p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93018386. Source: OSTI; NTIS; INIS; GPO Dep.

Report to Congress in response to public law 99-240.

This is the seventh report submitted to Congress in accordance with section 5(d)(2)(E)(ii)(II) of Title I—Low-Level Radioactive Waste Policy Amendments Act of 1985 (the Act). This section of the Act directs the Department of Energy (DOE) to summarize the annual expenditures of funds disbursed from the DOE surcharge escrow account and to assess compliance of these expenditures with the limitations specified in the Act. In addition to placing limitations on the use of these funds, the Act also requires the nonsited compact regions and nonmember States to provide DOE with an itemized report of their expenditures on December 31 of each year in which funds are expended. Within 6 months after receiving the individual reports, the Act requires the Secretary to furnish Congress with a summary of the reported expenditures and an assessment of compliance with the specified usage limitations. This report fulfills that requirement. DOE disbursed funds totaling \$15,037,778.91 to the States and compact regions following the July 1, 1986, January 1, 1988, and January 1, 1990, milestones specified in the Act. Of this amount, \$1,445,701.61 was expended during calendar year 1992 and \$10,026,763.87 was expended during the prior 6 years. At the end of December 1992, \$3,565,313.43 was unexpended. DOE has reviewed each of the reported expenditures and concluded that all reported expenditures comply with the spending limitations stated in section 5(d)(2)(E)(i) of the Act.

651 (DOE/EM-0121P) Supercritical Water Oxidation Program (SCWOP): Technology summary. USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). Office of Technology Development. Feb 1994. 26p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94008853. Source: OSTI; NTIS; INIS; GPO Dep.

Purpose of SCWOP is to develop and demonstrate supercritical water oxidation as a viable technology for treating DOE hazardous and mixed wastes and to coordinate SCWO research, development, demonstration, testing, and evaluation activities. The process involves bringing together organic waste, water, and an oxidant (air, O₂, etc.) to temperatures and pressures above water's critical point (374 C, 22.1 MPa); organic destruction is >99.99% efficient, and the resulting effluents (mostly water, CO₂) are relatively benign. Pilot-scale (300–500 gallons/day) SCWO units are to be

constructed and demonstrated. Two phases will be conducted: hazardous waste pilot plant demonstration and mixed waste pilot demonstration. Contacts for further information and for getting involved are given.

652 (DOE/EM-0125P) Mixed Waste Integrated Program (MWIP): Technology summary. USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). Office of Technology Development. Feb 1994. 101p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94008857. Source: OSTI; NTIS; INIS; GPO Dep.

The mission of the Mixed Waste Integrated Program (MWIP) is to develop and demonstrate innovative and emerging technologies for the treatment and management of DOE's mixed low-level wastes (MLLW) for use by its customers, the Office of Waste Operations (EM-30) and the Office of Environmental Restoration (EM-40). The primary goal of MWIP is to develop and demonstrate the treatment and disposal of actual mixed waste (MMLW and MTRU). The vitrification process and the plasma hearth process are scheduled for demonstration on actual radioactive waste in FY95 and FY96, respectively. This will be accomplished by sequential studies of lab-scale non-radioactive testing followed by bench-scale radioactive testing, followed by field-scale radioactive testing. Both processes create a highly durable final waste form that passes leachability requirements while destroying organics. Material handling technology, and off-gas requirements and capabilities for the plasma hearth process and the vitrification process will be established in parallel.

653 (DOE/EM-0126P) Efficient Separations and Processing Integrated Program (ESP-IP): Technology summary. USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). Office of Technology Development. Feb 1994. 79p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94008858. Source: OSTI; NTIS; INIS; GPO Dep.

The Efficient Separations and Processing Integrated Program (ESPIP) was created in 1991 to identify, develop and perfect separations technologies and processes to treat wastes and address environmental problems throughout the DOE Complex. These wastes and environmental problems, located at more than 100 contaminated installations in 36 states and territories, are the result of half a century of nuclear processing activities by DOE and its predecessor organizations. The cost of cleaning up this legacy has been estimated to be of the order of hundreds of billions of dollars, and ESPIP's origin came with the realization that if new separations and processes can produce even a marginal reduction in cost then billions of dollars will be saved. The ultimate mission for ESPIP, as outlined in the ESPIP Strategic Plan, is: to provide Separations Technologies and Processes (STPS) to process and immobilize a wide spectrum of radioactive and hazardous defense wastes; to coordinate STP research and development efforts within DOE; to explore the potential uses of separated radionuclides; to transfer demonstrated separations and processing technologies developed by DOE to the US industrial sector, and to facilitate competitiveness of US technology and industry in the world market. Technology research and development currently under investigation by ESPIP can be divided into four broad areas: cesium and strontium removal; TRU and other HLW separations; sludge technology, and other technologies.

654 (DOE/EM-0128P) Mixed Waste Landfill Integrated Demonstration: Technology summary. USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). Office of Technology Development. Feb 1994. 87p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94008860. Source: OSTI; NTIS; INIS; GPO Dep.

The mission of the Mixed Waste Landfill Integrated Demonstration (MWLID) is to demonstrate, in contaminated sites, new technologies for clean-up of chemical and mixed waste landfills that are representative of many sites throughout the DOE Complex and the nation. When implemented, these new technologies promise to characterize and remediate the contaminated landfill sites across the country that resulted from past waste disposal practices. Characterization and remediation technologies are aimed at making clean-up less expensive, safer, and more effective than current techniques. This will be done by emphasizing in-situ technologies. Most important, MWLID's success will be shared with other Federal, state, and local governments, and private companies that face the important task of waste site remediation. MWLID will demonstrate technologies at two existing landfills. Sandia National Laboratories' Chemical Waste Landfill received hazardous (chemical) waste from the Laboratory from 1962 to 1985, and the Mixed-Waste Landfill received hazardous and radioactive wastes (mixed wastes) over a twenty-nine year period (1959-1988) from various Sandia nuclear research programs. Both landfills are now closed. Originally, however, the sites were selected because of Albuquerque's and climate and the thick layer of alluvial deposits that overlay groundwater approximately 480 feet below the landfills. This thick layer of "dry" soils, gravel, and clays promised to be a natural barrier between the landfills and groundwater.

655 (DOE/EM-0129P) Heavy Metals Contaminated Soil Project, Resource Recovery Project, and Dynamic Underground Stripping Project. USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). Office of Technology Development. Feb 1994. 27p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94008861. Source: OSTI; NTIS; INIS; GPO Dep.

The Department of Energy (DOE) established the Office of Technology Development (EM-50) (OTD) as an element of Environmental Restoration and Waste Management (EM) in November, 1989. OTD has begun to search out, develop, test and demonstrate technologies that can now or in the future be applied to the enormous remediation problem now facing the DOE and the United States public in general. Technology demonstration projects have been designed to attack a separate problem as defined by DOE. The Heavy Metals Contaminated Soil Project was conceived to test and demonstrate off-the-shelf technologies (dominantly from the mining industry) that can be brought to bear on the problem of radionuclide and heavy metal contamination in soils and sediments. The Resource Recovery Project is tasked with identifying, developing, testing, and evaluating new and innovative technologies for the remediation of metal contaminated surface and groundwater. An innovative twist on this project is the stated goal of recovering the metals, formerly disposed of as a waste, for reuse and resale, thereby transforming them into a usable resource. Finally, the Dynamic Underground Stripping Project was developed to demonstrate and remediate underground spills of hydrocarbons from formations that are (1) too deep for excavation, and/or (2) require in-situ remediation efforts of long duration. This

project has already been shown effective in reducing the time for remediation by conventional methods from an estimated 200 years at the Lawrence Livermore National Laboratory (LLNL) to less than one year. The savings in time and dollars from this technology alone can be immeasurable.

656 (DOE/EM-0134P) In Situ Remediation Integrated Program: Technology summary. USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). Office of Technology Development. Feb 1994. 82p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94008862. Source: OSTI; NTIS; INIS; GPO Dep.

The In Situ Remediation Integrated Program (ISR IP) was instituted out of recognition that in situ remediation could fulfill three important criteria: significant cost reduction of cleanup by eliminating or minimizing excavation, transportation, and disposal of wastes; reduced health impacts on workers and the public by minimizing exposure to wastes during excavation and processing; and remediation of inaccessible sites, including: deep subsurfaces, in, under, and around buildings. Buried waste, contaminated soils and groundwater, and containerized wastes are all candidates for in situ remediation. Contaminants include radioactive wastes, volatile and non-volatile organics, heavy metals, nitrates, and explosive materials. The ISR IP intends to facilitate development of in situ remediation technologies for hazardous, radioactive, and mixed wastes in soils, groundwater, and storage tanks. Near-term focus is on containment of the wastes, with treatment receiving greater effort in future years. ISR IP is an applied research and development program broadly addressing known DOE environmental restoration needs. Analysis of a sample of 334 representative sites by the Office of Environmental Restoration has shown how many sites are amenable to in situ remediation: containment-243 sites; manipulation-244 sites; bioremediation-154 sites; and physical/chemical methods-236 sites. This needs assessment is focused on near-term restoration problems (FY93-FY99). Many other remediations will be required in the next century. The major focus of the ISR EP is on the long term development of permanent solutions to these problems. Current needs for interim actions to protect human health and the environment are also being addressed.

657 (DOE/EM-0135P) VOCs in Non-Arid Soils Integrated Demonstration: Technology summary. USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). Office of Technology Development. Feb 1994. 86p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94008863. Source: OSTI; NTIS; INIS; GPO Dep.

The Volatile Organic Compounds (VOCs) in Non-Arid Soils Integrated Demonstration (ID) was initiated in 1989. Objectives for the ID were to test the integrated demonstration concept, demonstrate and evaluate innovative technologies/systems for the remediation of VOC contamination in soils and groundwater, and to transfer technologies and systems to internal and external customers for use in fullscale remediation programs. The demonstration brought together technologies from DOE laboratories, other government agencies, and industry for demonstration at a single test bed. The Savannah River Site was chosen as the location for this ID as the result of having soil and groundwater contaminated with VOCs. The primary contaminants, trichloroethylene and tetrachloroethylene, originated from an

underground process sewer line servicing a metal fabrication facility at the M-Area. Some of the major technical accomplishments for the ID include the successful demonstration of the following: In situ air stripping coupled with horizontal wells to remediate sites through air injection and vacuum extraction; Crosshole geophysical tomography for mapping moisture content and lithologic properties of the contaminated media; In situ radio frequency and ohmic heating to increase mobility, of the contaminants, thereby speeding recovery and the remedial process; High-energy corona destruction of VOCs in the off-gas of vapor recovery wells; Application of a Brayton cycle heat pump to regenerate carbon adsorption media used to trap VOCs from the offgas of recovery wells; In situ permeable flow sensors and the colloidal borescope to determine groundwater flow; Chemical sensors to rapidly quantify chlorinated solvent contamination in the subsurface; In situ bioremediation through methane/nutrient injection to enhance degradation of contaminants by methanotrophic bacteria.

658 (DOE/EM-0136P) VOCs In Arid soils: Technology summary. USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). Office of Technology Development. Feb 1994. 91p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94008864. Source: OSTI; NTIS; INIS; GPO Dep.

The Volatile Organic Compounds In Arid Soils Integrated Demonstration (VOC-Arid ID) focuses on technologies to clean up volatile organic compounds and associated contaminants in soil and groundwater at arid sites. The initial host site is the 200 West Area at DOE's Hanford site in southeastern Washington state. The primary VOC contaminant is carbon tetrachloride, in association with heavy metals and radionuclides. An estimated 580-920 metric tons of carbon tetrachloride were disposed of between 1955 and 1973, resulting in extensive soil and groundwater contamination. The VOC-Arid ID schedule has been divided into three phases of implementation. The phased approach provides for: rapid transfer of technologies to the Environmental Restoration (EM-40) programs once demonstrated; logical progression in the complexity of demonstrations based on improved understanding of the VOC problem; and leveraging of the host site EM-40 activities to reduce the overall cost of the demonstrations. During FY92 and FY93, the primary technology demonstrations within the ID were leveraged with an ongoing expedited response action at the Hanford 200 West Area, which is directed at vapor extraction of VOCs from the vadose (unsaturated) zone. Demonstration efforts are underway in the areas of subsurface characterization including: drilling and access improvements, off-gas and borehole monitoring of vadose zone VOC concentrations to aid in soil vapor extraction performance evaluation, and treatment of VOC-contaminated off-gas. These current demonstration efforts constitute Phase 1 of the ID and, because of the ongoing vadose zone ERA, can result in immediate transfer of successful technologies to EM-40.

659 (DOE/EM-0139P) Technical review of Molten Salt Oxidation. USDOE Assistant Secretary for Environmental Restoration and Waste Management, Washington, DC (United States). Dec 1993. 154p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94007838. Source: OSTI; NTIS; INIS; GPO Dep.

The process was reviewed for destruction of mixed low-level radioactive waste. Results: extensive development work and scaleup has been documented on coal gasification and hazardous waste which forms a strong experience base

for this MSO process; it is clearly applicable to DOE wastes such as organic liquids and low-ash wastes. It also has potential for processing difficult-to-treat wastes such as nuclear grade graphite and TBP, and it may be suitable for other problem waste streams such as sodium metal. MSO operating systems may be constructed in relatively small units for small quantity generators. Public perceptions could be favorable if acceptable performance data are presented fairly; MSO will likely require compliance with regulations for incineration. Use of MSO for offgas treatment may be complicated by salt carryover. Figs, tabs, refs.

660 (DOE/EM-0143P) 1992 annual report on low-level radioactive waste management progress: Report to Congress in response to Public Law 99-240. USDOE Assistant Secretary for Environmental Restoration and Waste Management, Washington, DC (United States). Nov 1993. 132p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94008981. Source: OSTI; NTIS; INIS; GPO Dep.

This report summarizes the progress States and compact regions made during 1992 in establishing new low-level radioactive waste disposal facilities. It also provides summary information on the volume of low-level radioactive waste received for disposal in 1992 by commercially operated low-level radioactive waste disposal facilities. This report is in response to section 7 (b) of the Low-Level Radioactive Waste Policy Act.

661 (DOE/EM-0149P) Buried Waste Integrated Demonstration: Technology summary. USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). Office of Technology Development. Mar 1994. 67p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94012772. Source: OSTI; NTIS; INIS; GPO Dep.

The Buried Waste Integrated Demonstration (BWID) supports the applied research, development, demonstration, and evaluation of a suite of advanced technologies that offer promising solutions to the problems associated with the remediation of buried waste. BWID addresses the difficult remediation problems associated with DOE complex-wide buried waste, particularly transuranic (TRU) contaminated buried waste. BWID has implemented a systems approach to the development and demonstration of technologies that will characterize, retrieve, treat, and dispose of DOE buried wastes. This approach encompasses the entire remediation process from characterization to post-monitoring. The development and demonstration of the technology is predicated on how a technology fits into the total remediation process. To address all of these technological issues, BWID has enlisted scientific expertise of individuals and groups from within the DOE Complex, as well as experts from universities and private industry. The BWID mission is to support development and demonstration of a suite of technologies that, when integrated with commercially-available technologies, forms a comprehensive, remediation system for the effective and efficient remediation of buried waste throughout the DOE Complex. BWID will evaluate and validate demonstrated technologies and transfer this information and equipment to private industry to support the Office of Environmental Restoration (ER), Office of Waste Management (WM), and Office of Facility Transition (FT) remediation planning and implementation activities.

662 (DOE/EW/50616-T13) **Earth Penetration Radar Imaging System (EPRIS): Final report.** Coleman Research Corp., Orlando, FL (United States). Aug 1993. 83p. Sponsored by USDOE, Washington, DC (United States); Department of Defense, Washington, DC (United States). DOE Contract AI01-92EW50616. Contract DAAA21-90-D-0007. Order Number DE93019890. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The Earth Penetration Radar Imaging System (EPRIS) has been developed and has the capability to detect and locate buried mines, buried ordnance delivered by precision munitions, buried drums, buried waste/contaminants, and geological structures/features. The detected objects or features are mapped in three dimensions with high resolution. This information is then available for integration into a site characterization study. The EPRIS is a significant improvement in non-intrusive sensing and imaging capability. This phase of the EPRIS development has been extremely successful. Coleman Research Corporation (CRC) has implemented significant advances in technology into the EPRIS equipment. The frequency stepped radar sensor design has a very wide dynamic signal range and improved sensitivity over currently available equipment. The two- and three-dimensional image processing algorithms allow high-resolution placement and sizing of buried objects and/or features. The discussions related to the analog-to-digital converter and the spiral antenna, define the source of the dynamic range capability realized by EPRIS. The processing for this new radar makes use of unique synthetic aperture imaging (SAI) algorithms developed by CRC for frequency stepped radar systems. The SAI algorithms are necessary to obtain excellent spatial resolution on objects buried up to seven meters. The sensor signal processing represents a significant improvement in imaging systems. The CRC test facility permitted tests on objects buried up to 2.44 meters.

663 (DOE/HWP-106-Vol.1) **An assessment of thermal destruction technologies for application to Department of Energy mixed wastes: Volume 1, Technology assessment.** Oak Ridge K-25 Site, TN (United States); Science Applications International Corp., Idaho Falls, ID (United States). Waste Management Technology Div. Aug 1991. 81p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OT21400. Order Number DE91018445. Source: OSTI; NTIS; INIS; GPO Dep.

As evidenced by the Department of Energy (DOE) Environmental Restoration and Waste Management Five-Year Plan, the Department is committing to a long-range waste management program. A category of waste that represents a sizable portion of the total DOE waste picture and also presents significant complications in management is waste that contains both hazardous and radioactive components. This category of wastes, referred to as mixed waste (MW), is present at all but a few of the Department's sites. The presence of radioactive constituents in this waste category implies that it be managed, like radioactive-only wastes, on DOE-owned property. Thermal treatment of MW's offers a variety of benefits in the final disposition of the waste. One obvious benefit is volume reduction of the waste if it contains organics because most of the organics are converted to gases and water, leaving only the inert material or ash. Another benefit is the destruction of hazardous materials by thermal conversion to simple, nonhazardous gases water. A third benefit, for some thermal technologies, is that the thermal process yields a process residue that meets disposal requirements for both hazardous and radioactive constituents without further processing. 2 refs., 47 figs., 8 tabs.

664 (DOE/HWP-106-Vol.2) **An assessment of thermal destruction technologies for application to Department of Energy mixed wastes: Volume 2, Technology data sheets.** Oak Ridge K-25 Site, TN (United States); Science Applications International Corp., Idaho Falls, ID (United States). Waste Management Technology Div. Aug 1991. 150p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OT21400. Order Number DE91018446. Source: OSTI; NTIS; INIS; GPO Dep.

A study of known operational and emerging thermal treatment technologies was conducted for the Department of Energy's (DOE's) Office of Technology Development (OTD) through the Hazardous Waste Remedial Actions Program (HAZWRAP). This study addressed thermal treatment of mixed wastes (MWs), for which the most comprehensive set of waste has been divided into two volumes. Volume 1 contains the details and results of the technology assessments and comparisons between technologies. This volume (Volume 2) contains the comprehensive data collected on each technology, including descriptions, process and cost data, comments on advantages and deficiencies, types of waste treatable and by-products of these wastes, and reference information. 2 figs.

665 (DOE/HWP-108) **Proceedings of the US Department of Energy, Office of Environmental Restoration and Waste Management: Waste Reduction Workshop 6.** Oak Ridge K-25 Site, TN (United States). Apr 1991. 322p. Sponsored by USDOE, Washington, DC (USA). DOE Contract AC05-84OT21400. (CONF-9102116-: 6. waste reduction workshop, Atlanta, GA (United States), 6-7 Feb 1991). Order Number DE91012211. Source: OSTI; NTIS; INIS; GPO Dep.

The sixth of a series of waste reduction workshops was held at the Airport Hilton Hotel in Atlanta, Georgia, on February 6-7, 1991. These workshops are held under the auspices of the Department of Energy's (DOE's) Office of Environmental Restoration and Waste Management (EM). The focus of this workshop was the review of guidance and the status of conducting process waste assessments (PWAs). Other highlights of the workshop were the status of the Environmental Protection Agency's (EPA's) Pollution Prevention Program, and presentations on budgeting for waste reduction and the impact of the toxic release inventory (TRI) reporting requirements on pollution prevention activities. Concurrent sessions on the second day included case studies of the experiences at various sites on the subjects of recycling, incentives, source reduction, volume and toxicity reduction, and material procurement. The impact of new state laws on waste reduction efforts at Oak Ridge, Lawrence Livermore National Laboratory, and Hanford were also reviewed by representatives from those sites. These workshops assist DOE waste-generating sites in implementing waste minimization (WMIN) plans and programs, thus providing for optimal waste reduction within the DOE complex. All wastes are considered liquid, solid, and airborne, within the categories of high-level waste, transuranic waste (TRU), low-level waste (LLW), hazardous waste, mixed waste, office waste, and sanitary wastes. Topics of discussion within workshops encompass a wide range of subjects, including any method or technical activity from waste generation to disposal, such as process design or improvement, substitution of materials, waste segregation and recycling/reuse, waste treatment and processing, and administrative controls (procurement and waste awareness training). Consideration is also given to activities for remedial action and for decontamination and disposal.

666 (DOE/HWP-116) Proceedings of the US Department of Energy Office of Environmental Restoration and Waste Management: Waste reduction workshop 7. Oak Ridge National Lab., TN (United States). HAZWRAP Support Contractor Office. Nov 1991. 188p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (CONF-9108124-Summ.: 7. DOE waste reduction workshop, Kansas City, MO (United States), 6-8 Aug 1991). Order Number DE92005255. Source: OSTI; NTIS; INIS; GPO Dep.

The focus of this workshop was on goal setting and the methods of establishing meaningful goals for a waste minimization program. These workshops assist DOE waste-generating sites in implementing waste minimization plans and programs, thus providing for optimal waste reduction within the DOE complex. All wastes are considered liquid, solid, and airborne within the categories of high-level waste, transuranic waste (TRU), low-level waste (LLW), hazardous waste, mixed waste, office waste, and sanitary waste. Topics of discussion within workshops encompass a wide range of subjects. Subjects include any method or technical activity from waste generation to disposal, such as process design or improvements, substitution of materials, waste segregation and recycling/reuse, waste treatment and processing, and administrative controls (procurement and waste awareness training). Consideration is also given to activities for remedial action and for decontamination and decommissioning.

667 (DOE/ID-10054(90)) Radioactive waste management information for 1990 and record-to-date. Litteer, D.L.; Peterson, C.N.; Sims, A.M. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jul 1991. 600p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92003314. Source: OSTI; NTIS; INIS; GPO Dep.

This document presents detailed data and graphics on volume, radioactivity, isotopic identity, origin, and decay status of radioactive waste for the calendar year 1990. It also summarizes the radioactive waste data records compiled from 1952 to present for the Idaho National Engineering Laboratory (INEL). The data presented are from the INEL Radioactive Waste Management Information System (RWMIS).

668 (DOE/ID-10054(91)) Radioactive Waste Management Information for 1991 and Record-to-Date. Litteer, D.L.; Peterson, C.N.; Sims, A.M. EG and G Idaho, Inc., Idaho Falls, ID (United States). Apr 1993. 479p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93016401. Source: OSTI; NTIS; INIS; GPO Dep.

This document presents detailed data, bar graphs, and pie charts on volume, radioactivity, isotopic identity, origin, and decay status of radioactive waste for the calendar year 1991. It also summarizes the radiative waste data records compiled from 1952 to present for the Idaho National Engineering Laboratory (INEL). The data presented are from the INEL Radioactive Waste Management Information System.

669 (DOE/ID-10054(92)) Radioactive Waste Management Information for 1992 and record-to-date. Litteer, D.L.; Randall, V.C.; Sims, A.M.; Taylor, K.A. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jul 1993. 514p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94002936. Source: OSTI; NTIS; INIS; GPO Dep.

This document provides detailed data and graphics on air borne and liquid effluent releases, fuel oil and coal consumption, water usage, and hazardous and mixed waste generated for calendar year 1992. This report summarizes industrial waste data records compiled since 1971 for the Idaho National Engineering Laboratory (INEL). The data presented are from the INEL Nonradiological Waste Management Information System.

670 (DOE/ID-10057(90)) Industrial waste management information for 1990 and record-to-date. Litteer, D.L.; Peterson, C.N.; Sims, A.M. EG and G Idaho, Inc., Idaho Falls, ID (United States). Aug 1991. 115p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92003268. Source: OSTI; NTIS; INIS; GPO Dep.

This product provides detailed data and graphics on airborne and liquid effluent releases, fuel oil consumption, and water usage for the calendar year 1990. It summarizes industrial waste data records compiled since 1971 for the Idaho National Engineering Laboratory (INEL). The data presented are from the INEL Industrial Waste Management Information System (IWMIS).

671 (DOE/ID-10057(92)) Idaho National Engineering Laboratory Nonradiological Waste Management Information for 1992 and record to date. Randall, V.C.; Sims, A.M. EG and G Idaho, Inc., Idaho Falls, ID (United States). Aug 1993. 179p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94002935. Source: OSTI; NTIS; GPO Dep.

This document provides detailed data and graphics on airborne and liquid effluent releases, fuel oil and coal consumption, water usage, and hazardous and mixed waste generated for calendar year 1992. This report summarizes industrial waste data records compiled since 1971 for the Idaho National Engineering Laboratory (INEL). The data presented are from the INEL Nonradiological Waste Management Information System.

672 (DOE/ID-10253) Environmental Restoration and Waste Management site specific plan for DOE-ID: Overview. USDOE Idaho Operations Office, Idaho Falls, ID (United States). Task Force. May 1990. 288p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE90015473. Source: NTIS, PC A13/MF A01 - OSTI; GPO Dep.

The purpose of this site specific plan is to outline how the Environmental Restoration and Waste Management Five-Year Plan published in August 1989 by the Department of Energy (DOE) will be implemented at the DOE Idaho Operations Office (DOE-ID) sites. These sites include the Idaho National Engineering Laboratory (INEL) near Idaho Falls, Idaho; Plasma Arc Research and Development Program in Butte, Montana; Monticello Millsite in Utah; Grand Junction Projects Office facilities in Grand Junction, Colorado; and West Valley Nuclear Services facilities near West Valley, New York. This overview encompasses activities and costs for corrective activities, environmental restoration, and waste management operations under the jurisdiction of DOE-ID. Corrective activities are those required to bring active and standby facilities into compliance with air, water and solid waste regulatory requirements and agreements. Environmental restoration is defined as those remedial actions required at all inactive/surplus facilities and sites contaminated with radioactive, hazardous, or mixed waste. Waste

management operations are those connected with minimization, treatment, storage, and disposal of all radioactive, hazardous, mixed, and sanitary wastes generated as a result of ongoing operations at active facilities. 6 figs., 11 tabs.

673 (DOE/ID-10412) Resource Conservation and Recovery Act closure plan for the Intermediate-Level Transuranic Storage Facility mixed waste container storage units. Nolte, E.P. (MSE, Inc., Idaho Falls, ID (United States)); Spry, M.J.; Stanisich, S.N. EG and G Idaho, Inc., Idaho Falls, ID (United States); MSE, Inc., Idaho Falls, ID (United States). Nov 1992. 40p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93007120. Source: OSTI; NTIS; INIS; GPO Dep.

This document describes the proposed plan for clean closure of the Intermediate-Level Transuranic Storage Facility mixed waste container storage units at the Idaho National Engineering Laboratory in accordance with the Resource Conservation and Recovery Act closure requirements. Descriptions of the location, size, capacity, history, and current status of the units are included. The units will be closed by removing waste containers in storage, and decontamination structures and equipment that may have contacted waste. Sufficient sampling and documentation of all activities will be performed to demonstrate clean closure. A tentative schedule is provided in the form of a milestone chart.

674 (DOE/ID-10415) Waste handling plan for the INEL Oversight Program (As required under the Waste Handling Memorandum of Agreement). EG and G Idaho, Inc., Idaho Falls, ID (United States). Feb 1993. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. (INEL/MISC-93014). Order Number DE93012171. Source: OSTI; NTIS; INIS; GPO Dep.

The State of Idaho will generate various quantities and types of waste during monitoring activities associated with the Idaho National Engineering Laboratory (INEL) Oversight Program. This waste, referred to as INEL Oversight Program (IOP) waste, is the waste resulting from field season activities of the IOP. Wastes generated at the INEL are broadly categorized by the types of contaminants they contain. These include: hazardous waste; high-level waste; low-level waste; mixed waste; sanitary waste; and transuranic waste. To the extent possible, generation of allowable MOA (Waste Handling Memorandum of Agreement) wastes should be minimized. Minimization of waste includes waste prevention, reduction of waste components, and recycling. The following are some general waste minimization techniques which pertain to current monitoring activities such as purging and sampling existing monitoring wells and associated activities. Regulations affecting the management of IOP can differ depending upon the site designation of the waste generation point. Possible site designations at the INEL include: non-regulated sites; comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sites; sites regulated under the authority of RCRA; and newly discovered contaminated sites. (AT)

675 (DOE/ID/12584-97) Technology needs assessment: Evaluation of the molten salt oxidation process technology. Chem-Nuclear Geotech, Inc., Grand Junction, CO (United States). 24 Jan 1992. 69p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-86ID12584. (GJPO-105). Order Number DE92040889. Source: OSTI; NTIS; INIS; GPO Dep.

Molten salt oxidation (MSO) is a potential treatment technology for numerous US DOE waste forms. This report is a baseline evaluation of MSO technology (as developed by Energy Technology Engineering Center and Rockwell International) to establish its present and potential readiness to treat DOE wastes, particularly mixed wastes. Much of the information in this report was derived from a peer review meeting in Woodland Hills, California, on November 12-14, 1991. The panel members and other participants provided expertise in treatment technologies, DOE's waste problems, safety and systems analyses, and regulatory and public issues and concerns. The basic concept of MSO is to introduce wastes and air into a bed of molten salt, oxidize organic wastes in the molten salt, use the heat of oxidation to keep the salt molten, retain metals and radionuclides within the salt melt, and remove the salt for disposal or for processing and recycling. Sodium carbonate, or sodium carbonate mixed with other salts (e.g., potassium carbonate or NaCl) is typical of the salts used as the melt. The most common operating temperatures are 900 to 1000 C, and the feed stocks may be gases, solids, organic liquids, aqueous solutions, or slurries. The molten salt acts as catalyst for the oxidation reactions; enhances organic compound destruction; helps retain ash and soot; and helps capture/react with heavy metals, radionuclides, and acid gases. MSO, used as a primary or secondary treatment system, acts as an acid gas scrubber and requires a particulate treatment system to clean the off gas. As part of evaluation process, the Peer Review Panel examined MSO as a treatment technology for specific waste groups. The Peer Review Panel concluded that the MSO process could potentially treat a variety of DOE wastes, particularly the mixed and hazardous wastes. Advantages and disadvantages of MSO over incineration are identified. The formation of an MSO task force is recommended.

676 (DOE/ID/12584-148) TTP AL921102: An integrated geophysics program for non-intrusive characterization of mixed-Waste landfill sites: Final report. Hasbrouck, J.C. Chem-Nuclear Geotech, Inc., Grand Junction, CO (United States). Sep 1993. 47p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-86ID12584. (GJPO-GP-7). Order Number DE94006804. Source: OSTI; NTIS; GPO Dep.

This Technical Task conducted for the US Department of Energy Office of Technology Development demonstrates the effectiveness of integrating several surface geophysical techniques to nonintrusively characterize mixed-waste landfill sites. An integrated approach enables an area to be characterized faster and cheaper because repeated access is not necessary and offers data and interpretations not attainable by a single technique. Field demonstrations using the complex galvanic resistivity, spontaneous potential (SP), ground-penetrating radar (GPR), time-domain electromagnetic (TDEM), shear-wave (S-wave) seismic and compressional-wave (P-wave) seismic geophysical techniques were conducted at the Mixed-Waste Landfill Integrated Demonstration (MWLID) test site at the Sandia National Laboratories/New Mexico in Albuquerque. Data were acquired in two areas that have both known and unknown attributes. Although data from numerous profiles were analyzed, three lines were chosen as representative of the landfill site: Line 20E that crosses both the known Chromic Acid and Organics Pits, Line 60E that transects an essentially barren area, and Line 125E located in an area with unknown subsurface conditions.

677 (DOE/ID/12584-T2) **Commercially available broadband electromagnetic systems for US Department of Energy waste-site characterization.** MacLean, H.D. Chem-Nuclear Geotech, Inc., Grand Junction, CO (United States). Jun 1992. 80p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-86ID12584. Order Number DE93002871. Source: OSTI; NTIS; INIS; GPO Dep.

Commercially available induction electromagnetic (EM) systems were investigated and evaluated to identify systems that could be readily and optimally configured for the characterization of US Department of Energy (DOE) waste disposal sites. In general, the evaluation addresses modern broadband EM (BBEM) systems that can locate conductive objects three dimensionally and provide information on the size-conductivity parameter of the conductor. In addition commercially available interpretation systems and software applicable to the analysis and interpretation of the BBEM data were reviewed. Nineteen EM systems were categorized by their coil configuration as moving coil or fixed transmitter and by their method of data acquisition as frequency domain (FDEM) and time domain (TDEM). Tables 1 and 2 summarize the systems examined in this study. For characterization of waste sites, the TDEM systems offer definite advantages: the systems acquire BBEM data rapidly, are highly sensitive, and can be configured to operate in either the moving-coil or the fixed-transmitter mode. TDEM systems that acquire data in the absence of the primary field are highly sensitive and relatively free of noise caused by variations in the system geometry. Three TDEM systems were identified that operate over a large equivalent frequency range and have the other characteristics deemed necessary for site characterization work: (1) the Geonics PROTEM, (2) the Zonge GDP-16, and (3) the Zonge Nanotem. These systems were also selected for future field evaluation.

678 (DOE/ID/13215-T1) **INEL cold test pit demonstration of improvements in information derived from non-intrusive geophysical methods over buried waste sites: Phase 1, Final report.** Coleman Energy and Environmental Systems, Golden, CO (United States). Blackhawk Geosciences Div. 8 Sep 1993. 94p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-93ID13215. Order Number DE93040363. Source: OSTI; NTIS; INIS; GPO Dep.

The objectives of this research project were to lay the foundation for further improvement in the use of geophysical methods for detection of buried wastes, and to increase the information content derived from surveys. Also, an important goal was to move from mere detection to characterization of buried wastes. The technical approach to achieve these objectives consisted of: (1) Collect a data set of high spatial density; (2) Acquire data with multiple sensors and integrate the interpretations inferred from the various sensors; (3) Test a simplified time domain electromagnetic system; and (4) Develop imaging and display formats of geophysical data readily understood by environmental scientists and engineers. The breadth of application of this work is far reaching. Not only are uncontrolled waste pits and trenches, abandoned underground storage tanks, and pipelines found throughout most US DOE facilities, but also at military installations and industrial facilities. Moreover, controlled land disposal sites may contain "hot spots" where drums and hazardous material may have been buried. The technologies addressed by the R&D will benefit all of these activities.

679 (DOE/ID/13215-T2) **INEL cold test pit demonstration of improvements in information derived from**

non-intrusive geophysical methods over buried waste sites: Phase 2, Final report. Coleman Energy and Environmental Systems, Golden, CO (United States). Blackhawk Geosciences Div. 29 Apr 1994. 72p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-93ID13215. Order Number DE94011114. Source: OSTI; NTIS; INIS; GPO Dep.

Under Contract between US DOE Idaho National Engineering Laboratory (INEL) and the Blackhawk Geosciences Division of Coleman Research Corporation (BGD-CRC), geophysical investigations were conducted to improve the detection of buried wastes. Site characterization is a costly and time consuming process with the most costly components being drilling, sampling, and chemical analysis of samples. There is a focused effort at US DOE and other agencies to investigate methodologies that reduce costs and shorten the time between characterization and clean-up. These methodologies take the form of employing non-invasive (geophysical) and minimal invasive (e.g., cone penetrometer driving) techniques of characterization, and implementing a near real-time, rational decision-making process (Expedited Site Characterization). Over the Cold Test Pit (CTP) at INEL, data were acquired with multiple sensors on a dense grid. Over the CTP the interpretations inferred from geophysical data are compared with the known placement of various waste forms in the pit. The geophysical sensors employed were magnetics, frequency and time domain electromagnetics, and ground penetrating radar. Also, because of the high data density acquired, filtering and other data processing and imaging techniques were tested. The conclusions derived from the geophysical surveys were that pit boundaries, berms between cells within the pit, and individual objects placed in the pit were best mapped by the new Geonics EM61 time domain EM metal detector. Part of the reason for the effectiveness of the time domain metal detector is that objects buried in the pit are dominantly metallic. Also, the utility of geophysical data is significantly enhanced by dimensional and 3-dimensional imaging formats. These images will particularly assist remediation engineers in visualizing buried wastes.

680 (DOE/ID/13215-T2-Attach.) **INEL cold test pit demonstration of improvements in information derived from non-intrusive geophysical methods over buried waste sites: Phase 2, Final report: Attachment.** Coleman Energy and Environmental Systems, Golden, CO (United States). Blackhawk Geosciences Div. 9 May 1994. 37p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-93ID13215. Order Number DE94011115. Source: OSTI; NTIS; INIS; GPO Dep.

Under contract between US DOE Idaho National Engineering Laboratory (INEL) and the Blackhawk Geosciences Division of Coleman Research Corporation (BGD-CRC), geophysical investigations were conducted to improve the detection of buried wastes. Over the Cold Test Pit (CTP) at INEL, data were acquired with multiple sensors on a dense grid. Over the CTP the interpretations inferred from geophysical data are compared with the known placement of various waste forms in the pit. The geophysical sensors employed were magnetics, frequency and time domain electromagnetics, and ground penetrating radar. Also, because of the high data density acquired, filtering and other data processing and imaging techniques were tested. After completion and analysis of the survey and interpretation over the CTP, the second phase of investigation consisted of testing geophysical methods over the Idaho Chemical Processing

Plant (ICPP). The sections of the ICPP surveyed are underlain by a complex network of buried utility lines of different dimensions and composition, and with placement at various depths up to 13 ft. Further complications included many metallic objects at the surface, such as buildings, reinforced concrete pads, and debris. Although the multiple geophysical sensor approach mapped many buried utilities, they mapped far from all utilities shown on the facility drawings. This report consists of data collected from these geophysical surveys over the ICPP.

681 (DOE/LLW-93) Performance assessment review guide for DOE low-level radioactive waste disposal facilities. Dodge, R.L. (Dames and Moore, Denver, CO (United States)); Hansen, W.R.; Kennedy, W.E. Jr.; Layton, D.W.; Lee, D.W.; Maheras, S.T.; Neuder, S.M.; Wilhite, E.L.; Curl, R.U.; Grahm, K.F.; Heath, B.A.; Turner, K.H. EG and G Idaho, Inc., Idaho Falls, ID (United States); Dames and Moore, Denver, CO (United States). Oct 1991. 46p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92010806. Source: OSTI; NTIS; INIS; GPO Dep.

This report was prepared under the direction of the Performance Assessment Peer Review Panel. The intent is to help Department of Energy sites prepare performance assessments that meet the Panel's expectations in terms of detail, quality, content, and consistency. Information on the Panel review process and philosophy are provided, as well as important technical issues that will be focused on during a review. This guidance is not intended to provide a detailed review plan as in NUREG-1200, Standard Review Plan for Review of a License Application for a Low-Level Radioactive Waste Disposal Facility (January 1988). The focus and intent of the Panel's reviews differ significantly from a regulatory review. The review of a performance assessment by the Panel uses the collective professional judgment of the members to ascertain that the approach taken the methodology used, the assumptions made, etc., are technically sound and adequately justified. The results of the Panel's review will be used by Department of Energy Headquarters in determining compliance with the requirements of DOE Order 5820.2A, "Radioactive Waste Management."

682 (DOE/LLW-99) DOE site performance assessment activities: Radioactive Waste Technical Support Program. EG and G Idaho, Inc., Idaho Falls, ID (United States); Rogers and Associates Engineering Corp., Salt Lake City, UT (United States). Jul 1990. 180p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94005183. Source: OSTI; NTIS; INIS; GPO Dep.

Information on performance assessment capabilities and activities was collected from eight DOE sites. All eight sites either currently dispose of low-level radioactive waste (LLW) or plan to dispose of LLW in the near future. A survey questionnaire was developed and sent to key individuals involved in DOE Order 5820.2A performance assessment activities at each site. The sites surveyed included: Hanford Site (Hanford), Idaho National Engineering Laboratory (INEL), Los Alamos National Laboratory (LANL), Nevada Test Site (NTS), Oak Ridge National Laboratory (ORNL), Paducah Gaseous Diffusion Plant (Paducah), Portsmouth Gaseous Diffusion Plant (Portsmouth), and Savannah River Site (SRS). The questionnaire addressed all aspects of the performance assessment process; from waste source term to dose conversion factors. This report presents the information developed from the site questionnaire and provides a

comparison of site-specific performance assessment approaches, data needs, and ongoing and planned activities. All sites are engaged in completing the radioactive waste disposal facility performance assessment required by DOE Order 5820.2A. Each site has achieved various degrees of progress and have identified a set of critical needs. Within several areas, however, the sites identified common needs and questions.

683 (DOE/LLW-101) User's guide for remote access of the Performance Assessment Center. Peterson, C.R.; Kostelnik, K.M. EG and G Idaho, Inc., Idaho Falls, ID (United States). National Low-Level Waste Management Program. Mar 1991. 70p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92017836. Source: OSTI; NTIS; INIS; GPO Dep.

The Performance Assessment Center (PAC) was established by the Department of Energy's National Low-Level Waste Management Program to provide technical assistance to support the development of low-level radioactive waste disposal facilities. This user's manual provides guidance to remote users of the PAC. Information is presented on how remote users may most effectively access and use the systems available at the Performance Assessment Center in Idaho Falls, Idaho. Access requirements and operating procedures are presented to assist the first-time PAC user. This manual also provides brief descriptions of each code available on the system.

684 (DOE/LLW-111-Draft) Comparative analysis of DOE Order 5820.2A, NRC, and EPA radioactive and mixed waste management requirements. EG and G Idaho, Inc., Idaho Falls, ID (United States); International Technology Corp., Denver, CO (United States). Jul 1991. 102p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. (MISC-91090-Draft). Order Number DE92018815. Source: OSTI; NTIS; INIS; GPO Dep.

As directed by DOE-Headquarters and DOE-Idaho, the Radioactive Waste Technical Support Program (TSP) drafted an analysis of DOE Order 5820.2A on "Radioactive Waste Management" to develop guidelines and criteria for revising the Order. This comparative matrix is a follow up to the earlier analysis. This matrix comparing the requirements of DOE Order 5820.2A with Nuclear Regulatory Commission (NRC) and Environmental Protection Agency (EPA) regulations was prepared at the request of EM-30. The matrix compares DOE Order 5820.2A with the following: NRC regulations in 10 CFR Part 61 on "Licensing Requirements for Land Disposal of Radioactive Waste"; NRC regulations in 10 CFR Part 60 on "Disposal of High-Level Radioactive Waste in Geologic Repositories"; EPA regulations in 40 CFR Part 191 on "Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Waste"; EPA regulations in 40 FR Part 192 on "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailing"; and EPA regulations under the Resource Conservation and Recovery Act.

685 (DOE/LLW-114) Greater-than-Class C low-level radioactive waste characterization: Estimated volumes, radionuclide activities, and other characteristics: Greater-Than-Class C Low-Level Waste Management Program. Hulse, R.A. EG and G Idaho, Inc., Idaho Falls, ID (United States). Aug 1991. 521p. Sponsored by USDOE,

Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92003291. Source: OSTI; NTIS; INIS; GPO Dep.

Includes Appendices A-I.

Planning for storage or disposal of greater-than-Class C low-level radioactive waste (GTCC LLW) requires characterization of that waste to estimate volumes, radionuclide activities, and waste forms. Data from existing literature, disposal records, and original research were used to estimate the characteristics and project volumes and radionuclide activities to the year 2035. GTCC LLW is categorized as: nuclear utilities waste, sealed sources waste, DOE-held potential GTCC LLW; and, other generator waste. It has been determined that the largest volume of those wastes, approximately 57%, is generated by nuclear power plants. The Other Generator waste category contributes approximately 10% of the total GTCC LLW volume projected to the year 2035. Waste held by the Department of Energy, which is potential GTCC LLW, accounts for nearly 33% of all waste projected to the year 2035; however, no disposal determination has been made for that waste. Sealed sources are less than 0.2% of the total projected volume of GTCC LLW.

686 (DOE/LLW-116) Greater-than-Class C low-level radioactive waste packaging and transportation elements report: National Low-Level Waste Management Program. EG and G Idaho, Inc., Idaho Falls, ID (United States). Oct 1991. 99p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. (MISC-91117). Order Number DE92010845. Source: OSTI; NTIS; INIS; GPO Dep.

The Federal Government is responsible for disposal of greater-than-Class C low-level radioactive waste (GTCC LLW). The Department of Energy (DOE) has proposed a disposal system which includes storage, treatment, packaging, transportation, and disposal. This report describes program elements necessary to conduct packaging and transportation activities to support dedicated storage and disposal. Packaging and transportation elements discusses are: program background and roles of participants; waste generators and waste forms; transportation packaging (casks); waste containers and handling systems; system safety and risk analysis; quality assurance; regulatory compliance; operations; safeguards, security, and emergency preparedness; and program management. For each of these elements there is important information that must be considered and issues that need to be resolved.

687 (DOE/LLW-117) National Low-Level Waste Management Program Radionuclide Report Series: Volume 1, Introduction. Rudin, M.J.; Garcia, R.S. EG and G Idaho, Inc., Idaho Falls, ID (United States). National Low-Level Waste Management Program. Feb 1992. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93007046. Source: OSTI; NTIS; INIS; GPO Dep.

This volume serves as an introduction to the National Low-Level Radioactive Waste Management Program Radionuclide Report Series. This report includes discussions of radionuclides listed in Title 10 of the Code of Federal Regulations Part 61.55, Tables 1 and 2 (including alpha-emitting transuranics with half-lives greater than five years). Each report includes information regarding radiological and chemical characteristics of specific radionuclides. Information is also included discussing waste streams and waste forms that may contain each radionuclide, and radionuclide behavior in

the environment and in the human body. Not all radionuclides commonly found at low-level radioactive waste sites are included in this report. The discussion in this volume explains the rationale of the radionuclide selection process.

688 (DOE/LLW-118) National Low-Level Waste Management Program Radionuclide Report Series: Volume 2, Technetium-99. Rudin, M.J.; Stanton, C.; Patterson, R.G.; Garcia, R.S. EG and G Idaho, Inc., Idaho Falls, ID (United States). National Low-Level Waste Management Program. Feb 1992. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93007047. Source: OSTI; NTIS; INIS; GPO Dep.

This report, Volume 2 of the National Low-Level Radioactive Waste Management Program Radionuclide Report Series, discusses radiological and chemical characteristics of technetium-99. This report also includes discussions about waste streams in which technetium-99 can be found, waste forms that contain technetium-99, and technetium-99's behavior in the environment and in the human body.

689 (DOE/LLW-119) National Low-Level Waste Management Program Radionuclide Report Series: Volume 3, Carbon-14. Rudin, M.J.; Garcia, R.S. EG and G Idaho, Inc., Idaho Falls, ID (United States). National Low-Level Waste Management Program. Feb 1992. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93007048. Source: OSTI; NTIS; INIS; GPO Dep.

This report, Volume 3 of the National Low-Level Radioactive Waste Management Program Radionuclide Report Series, discusses the radiological and chemical characteristics of carbon-14. The report also discusses waste streams that contain carbon-14, waste forms that contain carbon-14, and carbon-14 behavior in the environment and in the human body.

690 (DOE/LLW-120) National Low-Level Waste Management Program Radionuclide Report Series: Volume 4, Iodine-129. Rudin, M.J.; Garcia, R.S. EG and G Idaho, Inc., Idaho Falls, ID (United States). National Low-Level Waste Management Program. Feb 1992. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93007049. Source: OSTI; NTIS; INIS; GPO Dep.

This report, Volume 4 of the National Low-Level Radioactive Waste Management Program Radionuclide Report Series, discusses radiological and chemical characteristics about iodine-129. This report also includes discussions about waste streams that contain iodine-129, waste forms that contain iodine-129, and iodine-129's behavior in the environment, as well as in the human body.

691 (DOE/LLW-133) Considerations for closure of low-level radioactive waste engineered disposal facilities. EG and G Idaho, Inc., Idaho Falls, ID (United States). National Low-Level Waste Management Program; MK-Environmental Services, San Francisco, CA (United States). Jan 1992. 164p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93007226. Source: OSTI; NTIS; INIS; GPO Dep.

Proper stabilization and closure of low-level radioactive waste disposal facilities require detailed planning during the early stages of facility development. This report provides considerations for host States, compact regions, and unaffiliated States on stabilization and closure of engineered

low-level radioactive waste and mixed waste disposal facilities. A time line for planning closure activities, which identifies closure considerations to be addressed during various stages of a facility's development, is presented. Current Federal regulatory requirements and guidance for closure and post-closure are outlined. Significant differences between host State and Federal closure requirements are identified. Design features used as stabilization measures that support closure, such as waste forms and containers, backfill materials, engineered barrier systems, and site drainage systems, are described. These design features are identified and evaluated in terms of how they promote long-term site stability by minimizing water infiltration, controlling subsidence and surface erosion, and deterring intrusion. Design and construction features critical to successful closure are presented for covers and site drainage. General considerations for stabilization and closure operations are introduced. The role of performance and environmental monitoring during closure is described.

692 (DOE/LLW-135) Performance assessment handbook for low-level radioactive waste disposal facilities. Seitz, R.R.; Garcia, R.S.; Kostelnik, K.M.; Starmer, R.J. EG and G Idaho, Inc., Idaho Falls, ID (United States). National Low-Level Waste Management Program. Feb 1992. 49p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92017835. Source: OSTI; NTIS; INIS; GPO Dep.

Performance assessments of proposed low-level radioactive waste disposal facilities must be conducted to support licensing. This handbook provides a reference document that can be used as a resource by management and staff responsible for performance assessments. Brief discussions describe the performance assessment process and emphasize selected critical aspects of the process. References are also provided for additional information on many aspects of the performance assessment process. The user's manual for the National Low-Level Waste Management Program's Performance Assessment Center (PAC) on the Idaho National Engineering Laboratory Cray computer is included as Appendix A. The PAC provides users an opportunity to experiment with a number of performance assessment computer codes on a Cray computer. Appendix B describes input data required for 22 performance assessment codes.

693 (DOE/LLW-137) Input data required for specific performance assessment codes: National Low-Level Waste Management Program. Seitz, R.R.; Garcia, R.S.; Starmer, R.J.; Dicke, C.A.; Leonard, P.R.; Maheras, S.J.; Rood, A.S.; Smith, R.W. EG and G Idaho, Inc., Idaho Falls, ID (United States). Low-Level Waste Management Program. Feb 1992. 42p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92017837. Source: OSTI; NTIS; INIS; GPO Dep.

The Department of Energy's National Low-Level Waste Management Program at the Idaho National Engineering Laboratory generated this report on input data requirements for computer codes to assist States and compacts in their performance assessments. This report gives generators, developers, operators, and users some guidelines on what input data is required to satisfy 22 common performance assessment codes. Each of the codes is summarized and a matrix table is provided to allow comparison of the various input required by the codes. This report does not determine or recommend which codes are preferable.

694 (DOE/LLW-141) Low-Level Radioactive Waste temporary storage Issues. EG and G Idaho, Inc., Idaho Falls, ID (United States). National Low-Level Waste Management Program. Apr 1992. 48p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92019892. Source: OSTI; NTIS; INIS; GPO Dep.

The Low-Level Radioactive Waste Policy Act of 1980 gave responsibility for the disposal of commercially generated low-level radioactive waste to the States. The Low-Level Radioactive Waste Policy Amendments Act of 1985 attached additional requirements for specific State milestones. Compact regions were formed and host States selected to establish disposal facilities for the waste generated within their borders. As a result of the Low-Level Radioactive Waste Policy Amendments Act of 1985, the existing low-level radioactive waste disposal sites will close at the end of 1992; the only exception is the Richland, Washington, site, which will remain open to the Northwest Compact region only. All host States are required to provide for disposal of low-level radioactive waste by January 1, 1996. States also have the option of taking title to the waste after January 1, 1993, or taking title by default on January 1, 1996. Low-level radioactive waste disposal will not be available to most States on January 1, 1993. The most viable option between that date and the time disposal is available is storage. Several options for storage can be considered. In some cases, a finite storage time will be permitted by the Nuclear Regulatory Commission at the generator site, not to exceed five years. If disposal is not available within that time frame, other options must be considered. There are several options that include some form of extension for storage at the generator site, moving the waste to an existing storage site, or establishing a new storage facility. Each of these options will include differing issues specific to the type of storage sought.

695 (DOE/LLW-144) Guidelines for mixed waste minimization. Owens, C. EG and G Idaho, Inc., Idaho Falls, ID (United States). Feb 1992. 94p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93017394. Source: OSTI; NTIS; INIS; GPO Dep.

Currently, there is no commercial mixed waste disposal available in the United States. Storage and treatment for commercial mixed waste is limited. Host States and compacts region officials are encouraging their mixed waste generators to minimize their mixed wastes because of management limitations. This document provides a guide to mixed waste minimization.

696 (DOE/LLW-145) Potential GTCC LLW sealed radiation source recycle Initiatives: National Low-Level Waste Management Program. Fischer, D. EG and G Idaho, Inc., Idaho Falls, ID (United States). Apr 1992. 16p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92017750. Source: OSTI; NTIS; INIS; GPO Dep.

This report suggests 11 actions that have the potential to facilitate the recycling (reuse or radionuclide) of surplus commercial sealed radiation sources that would otherwise be disposed of as greater-than-Class C low-level radioactive waste. The suggestions serve as a basis for further investigation and discussion between the Department of Energy, Nuclear Regulatory Commission, Agreement States, and the commercial sector. Information is also given that describes sealed sources, how they are used, and problems associated with recycling, including legal concerns. To illustrate the

nationwide recycling potential, Appendix A gives the estimated quantity and application information for sealed sources that would qualify for disposal in commercial facilities if not recycle. The report recommends that the Department of Energy initiate the organization of a forum to explore the suggested actions and other recycling possibilities.

697 (DOE/LLW-146) Annotated list of regulations and guidance applicable to temporary storage of commercial Low-Level Radioactive Waste. EG and G Idaho, Inc., Idaho Falls, ID (United States). National Low-Level Waste Management Program. Apr 1992. 63p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92019893. Source: OSTI; NTIS; INIS; GPO Dep.

Compliance with the Low-Level Radioactive Waste Policy Amendments Act of 1985 (the Act) (Public Law 99-240), requires that States be responsible for the management and disposal of low-level radioactive waste (LLW) generated within their borders on January 1, 1993. Many States have indicated that they will not have LLW disposal capacity by the deadline and will need to consider other waste management options. A major option will be temporary storage of LLW. This document was prepared to help current and potential LLW storage management systems comply with applicable regulations. A list of major agencies and Federal laws applicable to storage of LLW and an annotated listing of regulations, guidance, and reference material applicable to temporary storage of LLW are provided. Also, the regulations and guidance are categorized into seven major areas of applicability concerning temporary storage of LLW. When considering temporary storage, States and compact regions have two broad options: (1) storage by the generators and brokers at the point of generation or collection, and (2) storage at a centralized temporary storage facility. Centralized temporary storage could take place at more than one facility, and States could choose to combine the options with some centralized storage and some storage at the generators.

698 (DOE/LLW-147) Evaluation of Department of Energy-held potential Greater-Than-Class C Low-Level Radioactive Waste: National Low-Level Waste Management Program: Final draft. EG and G Idaho, Inc., Idaho Falls, ID (United States). Mar 1992. 332p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012308. Source: OSTI; NTIS; INIS; GPO Dep.

A number of commercial facilities have generated potential Greater-Than-Class C Low-Level Radioactive Waste (GTCC LLW), and through contractual arrangements with the US Department of Energy (DOE) and/or for health and safety reasons, the waste is being stored by DOE. A determination is required, considering specific circumstances under which DOE accepted the waste, whether disposal is a US Nuclear Regulatory Commission-licensed facility or by DOE in a non-licensed facility is appropriate. This report presents the preliminary results of an assessment conducted by EG&G Idaho, Inc. legal counsel and GTCC LLW Program staff.

699 (DOE/LLW-151) Treatment methods and waste forms for long-term storage and ultimate disposal of radioactive biological materials: National Low-Level Waste Management Program. EG and G Idaho, Inc., Idaho Falls, ID (United States). National Low-Level Waste Management Program; International Technology Corp., Albuquerque, NM (United States). Sep 1992. 65p. Sponsored

by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. (INEL/MISC-92068). Order Number DE93005247. Source: OSTI; NTIS; INIS; GPO Dep.

Various methods are available to help States and compact regions manage commercial low-level radioactive biological waste. This report identifies both established methods and innovative techniques and technologies that may help make low-level radioactive biological waste easier to store until disposal capacity is available. Technical considerations are described for implementing technologies to meet the requirements for treatment, final waste forms, long-term storage, and ultimate disposal of low-level radioactive biological waste. Topics for discussion include waste characteristics, packaging techniques, containers, and treatment techniques.

700 (DOE/LLW-156) GTCC LLW mixed waste assessment final report: National low-level waste management program. EG and G Idaho, Inc., Idaho Falls, ID (United States); Ebasco Environmental (United States). Sep 1992. 78p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. (INEL/MISC-92084). Order Number DE93005177. Source: OSTI; NTIS; INIS; GPO Dep.

This report uses information from a previous US Department of Energy study to identify greater-than-class C low-level radioactive waste (GTCC LLW) that might also be hazardous (GTCC LLW mixed waste). The report describes how to classify the waste as GTCC LLW mixed waste and then uses that process to estimate volumes and types of GTCC LLW mixed waste that are in storage and that are likely to be generated through the year 2035.

701 (DOE/LLW-159) Greater-Than-Class C low-level radioactive waste treatment technology evaluation. Garrison, T.W.; Fischer, D.K. EG and G Idaho, Inc., Idaho Falls, ID (United States). National Low-Level Waste Management Program. Jan 1993. 38p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. (INEL/MISC-92174). Order Number DE93007647. Source: OSTI; NTIS; INIS; GPO Dep.

This report was developed to provide the Greater-Than-Class C Low-Level Radioactive Waste Management Program with criteria and a methodology to select candidate treatment technologies for Greater-Than-Class C low-level radioactive waste (GTCC LLW) destined for dedicated storage and ultimately disposal. The technology selection criteria are provided in a Lotus spreadsheet format to allow the methodology to evolve as the GTCC LLW Program evolves. It is recognized that the final disposal facility is not yet defined; thus, the waste acceptance criteria and other facility-specific features are subject to change. The spreadsheet format will allow for these changes as they occur. As additional treatment information becomes available, it can be factored into the analysis. The technology selection criteria were established from program goals, draft waste acceptance criteria for dedicated storage (including applicable regulations), and accepted remedial investigation methods utilized under the Comprehensive Environmental Response, Compensation, and Liability Act. Kepner-Tregoe decisionmaking techniques are used to compare and rank technologies against the criteria.

702 (DOE/LLW-161) Characterization of decommissioned reactor internals: Direct-assay method assessment. Cline, J.E. EG and G Idaho, Inc., Idaho Falls, ID (United States); Cline (J.E.) and Associates, Inc.,

Rockville, MD (United States). Mar 1993. 53p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93013739. Source: OSTI; NTIS; INIS; GPO Dep.

This study describes the direct-assay technique for measuring activation levels of irradiated reactor component hardware. It also compares the direct-assay technique with calculational analysis methods that predict activation levels. Direct assay is performed in four steps: (a) planning and component selection, (b) onsite measurements, (c) radiochemical analysis, and (d) data analysis and classification. Uncertainties are estimated for each step of this process, and an overall uncertainty in the classification accuracy is calculated as about $\pm 35\%$. Numerous research ideas are identified to help reduce the uncertainty level; many of these ideas would improve activation determinations performed by either direct assay or by calculational analysis methods.

703 (DOE/LLW-162) Management plan for revision for DOE Order 5820.2A: National Low-Level Waste Management Program. Kudera, D.E.; McMurtrey, C.D. EG and G Idaho, Inc., Idaho Falls, ID (United States). Feb 1993. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. (INEL/MISC-92154). Order Number DE93012170. Source: OSTI; NTIS; GPO Dep.

This document discusses how the US Department of Energy (DOE) will manage the revision of DOE Order 5820.2A, "Radioactive Waste Management," and describes personnel involved in the effort, estimated cost and schedule, and administrative and reporting requirements. The organizational structure and responsibilities and approval authorities for the revision are discussed. A planning package is included that provides details on the schedule, budget, and justification and assumptions used in developing the plan for revision.

704 (DOE/LLW-164) Offsite hazardous waste shipment data collection. Page, L.A.; Rohe, M.J.; Casey, C. EG and G Idaho, Inc., Idaho Falls, ID (United States). Dec 1992. 57p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93007229. Source: OSTI; NTIS; INIS; GPO Dep.

Past practices at the US Department of Energy (DOE) sites for offsite release of hazardous waste are being reviewed to determine if radioactively contaminated hazardous wastes were released to commercial treatment, storage, and disposal facilities. Records indicating the presence of radioactivity in waste shipped to and treated at a commercial incineration facility led to a ban on offsite hazardous waste shipments and investigation of past practices for offsite release of hazardous waste from the DOE sites. Hazardous waste shipment data collected from some DOE sites revealed contaminated waste shipments were sent to commercial treatment, storage, and disposal facilities during the 1980 through 1991 reporting period. These waste shipments were determined to be radioactive based on current standards. To follow up on past shipments of waste from all DOE facilities, a data request was sent to the DOE field sites for completion. The data request required the sites to categorize the past waste shipments according to current standards as clean, likely clean, likely radioactive, or known radioactive.

705 (DOE/LLW-165) Low-level radioactive waste disposal facility fee schedules. Smith, P. EG and G Idaho, Inc., Idaho Falls, ID (United States); Rogers and Associates Engineering Corp., Salt Lake City, UT (United States). Apr 1993. 76p. Sponsored by USDOE, Washington, DC (United

States). DOE Contract AC07-76ID01570. Order Number DE93013744. Source: OSTI; NTIS; INIS; GPO Dep.

In the 1990's and beyond, new low-level radioactive waste (LLW) disposal facilities will be developed by States and compact regions. These disposal facilities will differ significantly from the existing facilities in a number of ways. One of these ways may be the fee schedule used to determine how much is charged each of the LLW generators to dispose of its wastes. This report reviews the general concept of fee schedules. There are an infinite number of combinations of the potential elements for a fee schedule, but the report focuses on four kinds of schedules: volume-based schedules, activity-based schedules, annual use fees, and cost allocation schedules. The choice of which elements to use and the structure of the schedule will be determined by the facility operator or its regulatory authority. This document is intended to assist them in understanding the choices available and the potential impacts of the schedule that they select.

706 (DOE/LLW-166) Sealed source and device removal and consolidation feasibility study: National Low-Level Waste Management Program. Ward, J.E. (Pacific Northwest Lab., Richland, WA (United States)); Carter, J.G.; Meyers, R.L. EG and G Idaho, Inc., Idaho Falls, ID (United States); Pacific Northwest Lab., Richland, WA (United States). Feb 1993. 109p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93013696. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this study is to assess the feasibility of removing Greater-Than-Class C (GTCC) sealed sources from their containment device and consolidating them for transport to a storage or disposal facility. A sealed source is a sealed capsule containing a radioactive material that is placed in a device providing radioactive containment. It is used in the medical, industrial, research, and food-processing communities for calibrating, measuring, gauging, controlling processes, and testing. This feasibility study addresses the key operational, safety, regulatory, and financial requirements of the removal/consolidation process. This report discusses the process to receive, handle, repack, and ship these sources to an interim or dedicated storage facility until a final disposal repository can be built and become operational (~ c. 2010). The study identifies operational and facility requirements to perform this work. Hanford, other DOE facilities, and private hot-cell facilities were evaluated to determine which facilities could perform this work. The personnel needed, design and engineering, facility preparation, process waste disposal requirements, and regulatory compliance were evaluated to determine the cost to perform this work. Cost requirements for items that will have to meet future changing regulatory requirements for transportation, transportation container design and engineering, and disposal were not included in this study. The cost associated with in-process consolidation of the sealed sources reported in this study may have not been modified for inflation and were based on 1992 dollars. This study shows that sealed source consolidation is possible with minimal personnel exposure, and would reduce the risk of radioactive releases to the environment. An initial pilot-scale operation could evaluate the possible methods to reduce the cost and consolidate sources.

707 (DOE/LLW-170) Economics of a small-volume low-level radioactive waste disposal facility. EG and G Idaho, Inc., Idaho Falls, ID (United States); Dames and

Moore, Denver, CO (United States). Apr 1993. 125p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93017395. Source: OSTI; NTIS; INIS; GPO Dep.

This report was prepared by the US Department of Energy National Low-Level Waste Management Program to present the results of a life-cycle cost analysis of a low-level radioactive waste disposal facility, including all support facilities, beginning in the preoperational phase and continuing through post-closure care. The disposal technology selected for this report is earth-covered concrete vaults, which use reinforced concrete vaults constructed above grade and an earth cover constructed at the end of the operational period for permanent closure. The report develops a design, cost estimate, and schedule for the base case and eight alternative scenarios involving changes in total disposal capacity, operating life, annual disposal rate, source of financing and long-term interest rates. The purpose of this analysis of alternatives is to determine the sensitivity of cost to changes in key analytical or technical parameters, thereby evaluating the influence of a broad range of conditions. The total estimated cost of each alternative is estimated and a unit disposal charge is developed.

708 (DOE/LLW-171) Characterization of decommissioned reactor internals: Monte Carlo analysis technique. Reid, B.D.; Love, E.F.; Luksic, A.T. EG and G Idaho, Inc., Idaho Falls, ID (United States). Mar 1993. 38p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93013740. Source: OSTI; NTIS; INIS; GPO Dep.

This study discusses computer analysis techniques for determining activation levels of irradiated reactor component hardware to yield data for the Department of Energy's Greater-Than-Class C Low-Level Radioactive Waste Program. The study recommends the Monte Carlo Neutron/Photon (MCNP) computer code as the best analysis tool for this application and compares the technique to direct sampling methodology. To implement the MCNP analysis, a computer model would be developed to reflect the geometry, material composition, and power history of an existing shutdown reactor. MCNP analysis would then be performed using the computer model, and the results would be validated by comparison to laboratory analysis results from samples taken from the shutdown reactor. The report estimates uncertainties for each step of the computational and laboratory analyses; the overall uncertainty of the MCNP results is projected to be $\pm 35\%$. The primary source of uncertainty is identified as the material composition of the components, and research is suggested to address that uncertainty.

709 (DOE/LLW-172) Greater-than-Class C Low-Level Radioactive Waste Program 1992 baseline strategy. EG and G Idaho, Inc., Idaho Falls, ID (United States). Feb 1993. 35p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93013738. Source: OSTI; NTIS; INIS; GPO Dep.

This baseline strategy document describes Department of Energy (DOE) goals, objectives, and strategy for fulfilling its responsibility to dispose of greater-than-Class C low-level radioactive waste (GTCC LLW) according to the requirements of Section 3(b) of the Low-Level Radioactive Waste Policy Amendments Act of 1985, Public Law 99-240. This document describes the baseline strategy being employed at the end of FY 1992. The strategy for fulfilling the above

responsibility consists of three tasks: interim storage of limited quantities of GTCC LLW at a currently operating DOE facility to eliminate a potential public health and safety threat; acceptance of GTCC LLW for storage in a DOE dedicated facility on an as-needed basis pending disposal; and disposal in a facility licensed by the Nuclear Regulatory Commission. The objectives, assumptions, and strategies for each of these tasks are presented in this plan.

710 (DOE/LLW-178) Greater-than-Class C low-level radioactive waste transportation regulations and requirements study: National Low-Level Waste Management Program. Tyacke, M.; Schmitt, R. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jul 1993. 131p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93018938. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this report is to identify the regulations and requirements for transporting greater-than-Class C (GTCC) low-level radioactive waste (LLW) and to identify planning activities that need to be accomplished in preparation for transporting GTCC LLW. The regulations and requirements for transporting hazardous materials, of which GTCC LLW is included, are complex and include several Federal agencies, state and local governments, and Indian tribes. This report is divided into five sections and three appendices. Section 1 introduces the report. Section 2 identifies and discusses the transportation regulations and requirements. The regulations and requirements are divided into Federal, state, local government, and Indian tribes subsections. This report does not identify the regulations or requirements of specific state, local government, and Indian tribes, since the storage, treatment, and disposal facility locations and transportation routes have not been specifically identified. Section 3 identifies the planning needed to ensure that all transportation activities are in compliance with the regulations and requirements. It is divided into (a) transportation packaging; (b) transportation operations; (c) system safety and risk analysis; (d) route selection; (e) emergency preparedness and response; and (f) safeguards and security. This section does not provide actual planning since the details of the Department of Energy (DOE) GTCC LLW Program have not been finalized, e.g., waste characterization and quantity, storage, treatment and disposal facility locations, and acceptance criteria. Sections 4 and 5 provide conclusions and referenced documents, respectively.

711 (DOE/LLW-181) 1992 state-by-state assessment of low-level radioactive wastes received at commercial disposal sites: National Low-Level Waste Management Program. Fuchs, R.L.; McDonald, S.D. EG and G Idaho, Inc., Idaho Falls, ID (United States). Low-Level Waste Management Program. Sep 1993. 134p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94002919. Source: OSTI; NTIS; INIS; GPO Dep.

Each year the National Low-Level Waste Management Program publishes a state-by-state assessment report. This report provides both national and state-specific disposal data on low-level radioactive waste commercially disposed in the United States. Data in this report are categorized according to disposal site, generator category, waste class, volumes, and radionuclide activity. Included in this report are tables showing the distribution of waste by state for 1992 and a comparison of waste volumes and radioactivity by state for 1988 through 1992; also included is a list of all commercial nuclear power reactors in the United States as of December

31, 1992. This report distinguishes between low-level radioactive waste shipped directly for disposal by generators and waste that was handled by an intermediary, a reporting change introduced in the 1988 state-by-state report.

712 (DOE/LLW-184) Greater-than-Class C low-level radioactive waste shipping package/container identification and requirements study: National Low-Level Waste Management Program. Tyacke, M. EG and G Idaho, Inc., Idaho Falls, ID (United States). Aug 1993. 454p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. (INEL/MISC-93087). Order Number DE94002937. Source: OSTI; NTIS; INIS; GPO Dep.

This report identifies a variety of shipping packages (also referred to as casks) and waste containers currently available or being developed that could be used for greater-than-Class C (GTCC) low-level waste (LLW). Since GTCC LLW varies greatly in size, shape, and activity levels, the casks and waste containers that could be used range in size from small, to accommodate a single sealed radiation source, to very large-capacity casks/canisters used to transport or dry-store highly radioactive spent fuel. In some cases, the waste containers may serve directly as shipping packages, while in other cases, the containers would need to be placed in a transport cask. For the purpose of this report, it is assumed that the generator is responsible for transporting the waste to a Department of Energy (DOE) storage, treatment, or disposal facility. Unless DOE establishes specific acceptance criteria, the receiving facility would need the capability to accept any of the casks and waste containers identified in this report. In identifying potential casks and waste containers, no consideration was given to their adequacy relative to handling, storage, treatment, and disposal. Those considerations must be addressed separately as the capabilities of the receiving facility and the handling requirements and operations are better understood.

713 (DOE/LLW-193) Material Not Categorized As Waste (MNCAW) data report: Radioactive Waste Technical Support Program. Casey, C.; Heath, B.A. EG and G Idaho, Inc., Idaho Falls, ID (United States). Nov 1992. 116p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94008513. Source: OSTI; NTIS; INIS; GPO Dep.

The Department of Energy (DOE), Headquarters, requested all DOE sites storing valuable materials to complete a questionnaire about each material that, if discarded, could be liable to regulation. The Radioactive Waste Technical Support Program entered completed questionnaires into a database and analyzed them for quantities and type of materials stored. This report discusses the data that TSP gathered. The report also discusses problems revealed by the questionnaires and future uses of the data. Appendices contain selected data about material reported.

714 (DOE/LLW-198) Identification of permit and waste acceptance criteria provisions requiring modification for acceptance of commercial mixed waste: National Low-Level Waste Management Program. EG and G Idaho, Inc., Idaho Falls, ID (United States); Ebasco Environmental (United States). Mar 1994. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94010709. Source: OSTI; NTIS; INIS; GPO Dep.

In October 1990, representatives of States and compact regions requested that the US Department of Energy (DOE) explore an agreement with host States and compact regions

under which DOE would accept commercial mixed low-level radioactive waste (LLW) at DOE's own treatment and disposal facilities. A program for DOE management of commercial mixed waste is made potentially more attractive in light of the low commercial mixed waste volumes, high regulatory burdens, public opposition to new disposal sites, and relatively high cost of constructing commercial disposal facilities. Several studies were identified as essential in determining the feasibility of DOE accepting commercial mixed waste for disposal. The purpose of this report is to identify any current or proposed waste acceptance criteria (WAC) or Resource Conservation and Recovery Act (RCRA) provisions that would have to be modified for commercial mixed waste acceptance at specified DOE facilities. Following the introduction, Section 2 of this report (a) provides a background summary of existing and proposed mixed waste disposal facilities at each DOE site, and (b) summarizes the status of any RCRA Part B permit and WAC provisions relating to the disposal of mixed waste, including provisions relating to acceptance of offsite waste. Section 3 provides overall conclusions regarding the current status and permit modifications that must be implemented in order to grant DOE sites authority under their permits to accept commercial mixed waste for disposal. Section 4 contains a list of references.

715 (DOE/MC/29107-94/C0331) Design for application of the DETOXSM wet oxidation process to mixed wastes. Bell, R.A.; Dhooge, P.M. Delphi Research, Inc., Albuquerque, NM (United States). [1994]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-92MC29107. (CONF-940225-92: Waste management '94, Tucson, AZ (United States), 27 Feb - 3 mar 1994). Order Number DE94009548. Source: OSTI; NTIS; INIS; GPO Dep.

Conceptual engineering has been performed for application of the DETOXSM wet oxidation process to treatment of specific mixed waste types. Chemical compositions, mass balances, energy balances, temperatures, pressures, and flows have been used to define design parameters for treatment units capable of destroying 5. Kg per hour of polychlorinated biphenyls and 25. Kg per hour of tributyl phosphate. Equipment for the units has been sized and materials of construction have been specified. Secondary waste streams have been defined. Environmental safety and health issues in design have been addressed. Capital and operating costs have been estimated based on the conceptual designs.

716 (DOE/MC/29107-3701) Development studies for a novel wet oxidation process. Dhooge, P.M.; Hakim, L.B. Delphi Research, Inc., Albuquerque, NM (United States). Jan 1994. 117p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-92MC29107. Order Number DE94004098. Source: OSTI; NTIS; INIS; GPO Dep.

A catalytic wet oxidation process (DETOX), which uses an acidic iron solution to oxidize organic compounds to carbon dioxide, water, and other simple products, was investigated as a potential method for the treatment of multicomponent hazardous and mixed wastes. The organic compounds picric acid, poly(vinyl chloride), tetrachlorothiophene, pentachloropyridine, Aroclor 1260 (a polychlorinated biphenyl), and hexachlorobenzene were oxidized in 125 ml reaction vessels. The metals arsenic, barium, beryllium, cadmium, cerium (as a surrogate for plutonium), chromium, lead, mercury, neodymium (as a surrogate for uranium), nickel, and

vanadium were tested in the DETOX solution. Barium, beryllium, cerium, chromium, mercury, neodymium, nickel, and vanadium were all found to be very soluble (>100 g/l) in the DETOX chloride-based solution. Arsenic, barium, cadmium, and lead solubilities were lower. Lead could be selectively precipitated from the DETOX solution. Chromium(VI) was reduced to relatively non-toxic chromium(III) by the solution. Six soils were contaminated with arsenic, barium, beryllium, chromium, lead, and neodymium oxides at approximately 0.1% by weight, and benzene, trichloroethene, mineral oil, and Aroclor 1260 at approximately 5% by weight total, and 5.g amounts treated with the DETOX solution in unstirred 125. ml reaction bombs. It is felt that soil treatment in a properly designed system is entirely possible despite incomplete oxidation of the less volatile organic materials in these unstirred tests.

717 (DOE/MC/29109-3356) Road Transportable Analytical Laboratory (RTAL) system: Quarterly technical report, September-November 1992. Engineering Computer Optecnomics, Inc., Annapolis, MD (United States). 15 Jan 1993. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-92MC29109. Order Number DE93041217. Source: OSTI; NTIS; GPO Dep.

Goal is development and demonstration of a mobile, field laboratory system for meeting DOE needs for rapid, accurate analysis of hazardous and radioactive contaminants in soil, ground water, and surface waters. Work during this period was carried out on tasks 1 and 2: information required for NEPA, and performance requirements.

718 (DOE/MC/29109-3392) Road Transportable Analytical Laboratory (RTAL) system: Quarterly technical report, December 1992-February 1993. Engineering Computer Optecnomics, Inc., Annapolis, MD (United States). 22 Mar 1993. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-92MC29109. Order Number DE93040019. Source: OSTI; NTIS; INIS; GPO Dep.

The goal of this contractual effort is the development and demonstration of a Road Transportable Analytical Laboratory (RTAL) system to meet the unique needs of the Department of Energy (DOE) for rapid, accurate analysis of a wide variety of hazardous and radioactive contaminants in soil, groundwater, and surface waters. This laboratory system will be designed to provide the field and laboratory analytical equipment necessary to detect and quantify radionuclides, organics, heavy metals and other inorganics, and explosive materials. The planned laboratory system will consist of a set of individual laboratory modules deployable independently or as an interconnected group to meet each DOE site's specific needs.

719 (DOE/MC/29109-3634) Road Transportable Analytical Laboratory system: Phase 1. Finger, S.M.; Keith, V.F.; Spertzel, R.O.; De Avila, J.C.; O'Donnell, M.; Vann, R.L. ECO, Inc., Annapolis, MD (United States). Sep 1993. 275p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-92MC29109. Order Number DE94004053. Source: OSTI; NTIS; INIS; GPO Dep.

This developmental effort clearly shows that a Road Transportable Analytical Laboratory System is a worthwhile and achievable goal. The RTAL is designed to fully analyze (radioanalytes, and organic and inorganic chemical analytes) 20 samples per day at the highest levels of quality assurance and quality control. It dramatically reduces the turnaround time for environmental sample analysis from 45 days (at a central commercial laboratory) to 1 day. At the

same time each RTAL system will save the DOE over \$12 million per year in sample analysis costs compared to the costs at a central commercial laboratory. If RTAL systems were used at the eight largest DOE facilities (at Hanford, Savannah River, Fernald, Oak Ridge, Idaho, Rocky Flats, Los Alamos, and the Nevada Test Site), the annual savings would be \$96,589,000. The DOE's internal study of sample analysis needs projects 130,000 environmental samples requiring analysis in FY 1994, clearly supporting the need for the RTAL system. The cost and time savings achievable with the RTAL system will accelerate and improve the efficiency of cleanup and remediation operations throughout the DOE complex.

720 (DOE/MC/29116-3606) Novel mass spectrometric instrument for gaseous and particulate characterization and monitoring: Technical progress report, July 1, 1993-September 30, 1993. Coggiola, M.J. SRI International, Menlo Park, CA (United States). Nov 1993. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-92MC29116. Order Number DE94005902. Source: OSTI; NTIS; GPO Dep.

The goals of the Office of Technology Development as outlined by the director of the Environmental Restoration and Waste Management Program (EM), Leo Duffy, in 1991 appropriations hearings include conducting an aggressive technology development program for waste management, waste minimization, waste treatment, storage and disposal of waste. This will be done through the development of more effective remediation technology to reduce occupational and public exposure. We are developing a method to monitor airborne emissions from the TSCA plant at Oak Ridge which will provide real-time, accurate, and inexpensive data on the emission of hazardous organic and inorganic chemicals in both gaseous and particulate form, and to assist DOE in maintaining its ambitious schedules and overcoming significant scientific limitations of its current monitoring technologies. In May 1988 under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Oak Ridge National Laboratory (ORNL) established a timetable remedial investigation/feasibility study, and a Federal Facility Agreement is being negotiated with the Environmental Protection Agency and the Tennessee Department of Health and Environment. As a result, work has begun on inactive waste sites at ORNL to excavate and isolate wastes in compliance with current standards. In addition, ORNL must comply with the Resource Conservation and Recovery Act (RCRA), which regulates generation, transportation, treatment, storage, and disposal of hazardous wastes and corrective action of releases to the environment of hazardous wastes from active facilities.

721 (DOE/METC/C-93/7063) Innovative technologies for recycling and reusing radioactively contaminated materials from DOE facilities. Bossart, S.J. (USDOE Morgantown Energy Technology Center, WV (United States)); Hyde, J. USDOE Morgantown Energy Technology Center, WV (United States). [1993]. 16p. Sponsored by USDOE, Washington, DC (United States). (CONF-930523-8: 18. National Association of Environmental Professionals (NAEP) annual conference on current and future priorities for environmental management, Raleigh, NC (United States), 24-26 May 1993). Order Number DE93015579. Source: OSTI; NTIS; INIS; GPO Dep.

Through award of ten contracts under the solicitation, DOE is continuing efforts to develop innovative technologies for decontamination and recycling or reusing of process

equipment, scrap metal, and concrete. These ten technologies are describe briefly in this report. There is great economic incentive for recycling or reusing materials generated during D&D of DOE's facilities. If successfully developed, these superior technologies will enable DOE to clean its facilities by 2019. These technologies will also generate a reusable or recyclable product, while achieving D&D in less time at lower cost with reduced health and safety risks to the workers, the public and the environment.

722 (DOE/METC/C-93/7098) Innovative technologies for recycling contaminated concrete and scrap metal. Bossart, S.J. (USDOE Morgantown Energy Technology Center, WV (United States)); Moore, J. USDOE Morgantown Energy Technology Center, WV (United States). [1993]. 13p. Sponsored by USDOE, Washington, DC (United States). (CONF-931095-4: Department of Energy environmental remediation conference, Augusta, GA (United States), 24-28 Oct 1993). Order Number DE93041131. Source: OSTI; NTIS; INIS; GPO Dep.

Decontamination and decommissioning of US DOE's surplus facilities will generate enormous quantities of concrete and scrap metal. A solicitation was issued, seeking innovative technologies for recycling and reusing these materials. Eight proposals were selected for award. If successfully developed, these technologies will enable DOE to clean its facilities by 2019.

723 (DOE/MWIP-2) Mixed Waste Integrated Program Interim evaluation report on thermal treatment technologies. Gillins, R.L. (Science Applications International Corp., Idaho Falls, ID (United States)); DeWitt, L.M.; Wollerman, A.L. Oak Ridge National Lab., TN (United States). Feb 1993. 173p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (ORNL/M-2728). Order Number DE93011397. Source: OSTI; NTIS; INIS; GPO Dep.

The Mixed Waste Integrated Program (MWIP) is one of several US Department of Energy (DOE) integrated programs established to organize and coordinate throughout the DOE complex the development of technologies for treatment of specific waste categories. The goal of the MWIP is to develop and deploy appropriate technologies for the treatment of DOE mixed low-level and alpha-contaminated wastes in order to bring all affected DOE installations and projects into compliance with environmental laws. Evaluation of treatment technologies by the MWIP will focus on meeting waste form performance requirements for disposal. Thermal treatment technologies were an early emphasis for the MWIP because thermal treatment is indicated (or mandated) for many of the hazardous constituents in DOE mixed waste and because these technologies have been widely investigated for these applications. An advisory group, the Thermal Treatment Working Group (TTWG), was formed during the program's infancy to assist the MWIP in evaluating and prioritizing thermal treatment technologies suitable for development. The results of the overall evaluation scoring indicate that the four highest-rated technologies were rotary kilns, slagging kilns, electric-arc furnaces, and plasma-arc furnaces. The four highest-rated technologies were all judged to be applicable on five of the six waste streams and are the only technologies in the evaluation with this distinction. Conclusions as to the superiority of one technology over others are not valid based on this preliminary study, although some general conclusions can be drawn.

724 (DOE/MWIP-3-Vol.1) Technical area status report for low-level mixed waste final waste forms: Volume 1. Mayberry, J.L. (Science Applications International Corp., Idaho Falls, ID (United States)); DeWitt, L.M.; Darnell, R. USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). Office of Technology Development; Science Applications International Corp., Idaho Falls, ID (United States); Final Waste Forms Working Group, Washington, DC (United States). Aug 1993. 123p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC01-92EW30030 ; AC05-84OR21400. (ORNL/M-2990/Vol.1). Order Number DE93040594. Source: OSTI; NTIS; INIS; GPO Dep.

The Final Waste Forms (FWF) Technical Area Status Report (TASR) Working Group, the Vitrification Working Group (WG), and the Performance Standards Working Group were established as subgroups to the FWF Technical Support Group (TSG). The FWF TASR WG is comprised of technical representatives from most of the major DOE sites, the Nuclear Regulatory Commission (NRC), the EPA Office of Solid Waste, and the EPA's Risk Reduction Engineering Laboratory (RREL). The primary activity of the FWF TASR Working Group was to investigate and report on the current status of FWFs for LLNM in this TASR. The FWF TASR Working Group determined the current status of the development of various waste forms described above by reviewing selected articles and technical reports, summarizing data, and establishing an initial set of FWF characteristics to be used in evaluating candidate FWFS; these characteristics are summarized in Section 2. After an initial review of available information, the FWF TASR Working Group chose to study the following groups of final waste forms: hydraulic cement, sulfur polymer cement, glass, ceramic, and organic binders. The organic binders included polyethylene, bitumen, vinyl ester styrene, epoxy, and urea formaldehyde. Section 3 provides a description of each final waste form. Based on the literature review, the gaps and deficiencies in information were summarized, and conclusions and recommendations were established. The information and data presented in this TASR are intended to assist the FWF Production and Assessment TSG in evaluating the Technical Task Plans (TTPs) submitted to DOE EM-50, and thus provide DOE with the necessary information for their FWF decision-making process. This FWF TASR will also assist the DOE and the MWIP in establishing the most acceptable final waste forms for the various LLMW streams stored at DOE facilities.

725 (DOE/MWIP-3-Vol.2) Technical area status report for low-level mixed waste final waste forms: Volume 2, Appendices. Mayberry, J.L. (Science Applications International Corp., Idaho Falls, ID (United States)); Huebner, T.L.; Ross, W.; Nakaoka, R.; Schumacher, R.; Cunnane, J.; Singh, D.; Darnell, R. BDM Corp., McLean, VA (United States); Science Applications International Corp., Idaho Falls, ID (United States); Pacific Northwest Lab., Richland, WA (United States); Los Alamos National Lab., NM (United States); Westinghouse Savannah River Co., Aiken, SC (United States); Argonne National Lab., IL (United States); EG and G Idaho, Inc., Idaho Falls, ID (United States); Westinghouse Hanford Co., Richland, WA (United States). Aug 1993. 305p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC01-92EW30030 ; AC05-84OR21400. (ORNL/M-2990/Vol.2). Order Number DE93040579. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents information on low-level mixed waste forms. The descriptions of the low-level mixed waste (LLMW) streams that are considered by the Mixed Waste Integrated

Program (MWIP) are given in Appendix A. This information was taken from descriptions generated by the Mixed Waste Treatment Program (MWTP). Appendix B provides a list of characteristic properties initially considered by the Final Waste Form (FWF) Working Group (WG). A description of facilities available to test the various FWFs discussed in Volume I of DOE/MWIP-3 are given in Appendix C. Appendix D provides a summary of numerous articles that were reviewed on testing of FWFS. Information that was collected by the tests on the characteristic properties considered in this report are documented in Appendix D. The articles reviewed are not a comprehensive list, but are provided to give an indication of the data that are available.

726 (DOE/MWIP-4) Technical area status report for waste destruction and stabilization. Dalton, J.D. (Science Applications International Corp., Idaho Falls, ID (United States)); Harris, T.L.; DeWitt, L.M. Oak Ridge National Lab., TN (United States); BDM Corp., McLean, VA (United States); Science Applications International Corp., Idaho Falls, ID (United States). Aug 1993. 214p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400 ; AC01-92EW30030. (ORNL/M-2984). Order Number DE93040334. Source: OSTI; NTIS; INIS; GPO Dep.

The Office of Environmental Restoration and Waste Management (EM) was established by the Department of Energy (DOE) to direct and coordinate waste management and site remediation programs/activities throughout the DOE complex. In order to successfully achieve the goal of properly managing waste and the cleanup of the DOE sites, the EM was divided into five organizations: the Office of Planning and Resource Management (EM-10); the Office of Environmental Quality Assurance and Resource Management (EM-20); the Office of Waste Operations (EM-30); the Office of Environmental Restoration (EM-40); and the Office of Technology and Development (EM-50). The mission of the Office of Technology Development (OTD) is to develop treatment technologies for DOE's operational and environmental restoration wastes where current treatment technologies are inadequate or not available. The Mixed Waste Integrated Program (MWIP) was created by OTD to assist in the development of treatment technologies for the DOE mixed low-level wastes (MLLW). The MWIP has established five Technical Support Groups (TSGs) whose purpose is to identify, evaluate, and develop treatment technologies within five general technical areas representing waste treatment functions from initial waste handling through generation of final waste forms. These TSGs are: (1) Front-End Waste Handling, (2) Physical/Chemical Treatment, (3) Waste Destruction and Stabilization, (4) Second-Stage Destruction and Offgas Treatment, and (5) Final Waste Forms. This report describes the functions of the Waste Destruction and Stabilization (WDS) group. Specifically, the following items are discussed: DOE waste stream identification; summary of previous efforts; summary of WDS treatment technologies; currently funded WDS activities; and recommendations for future activities.

727 (DOE/MWIP-8-Vol.1) Technical area status report for chemical/physical treatment: Volume 1. Brown, C.H. Jr. (Oak Ridge National Lab., TN (United States)); Schwinkendorf, W.E. Oak Ridge National Lab., TN (United States); BDM Federal, Inc., Arlington, VA (United States); USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). Office of Technology Development. Aug 1993. 91p. Sponsored by

USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400 ; AC01-92EW30030 ; AC01-93EW50512. (ORNL/M-3002/V1). Order Number DE93040903. Source: OSTI; NTIS; INIS; GPO Dep.

The Office of Environmental Restoration and Waste Management (EM) was established by the Department of Energy (DOE) to direct and coordinate waste management and site remediation programs and activities throughout the DOE Complex. The Mixed Waste Integrated Program (MWIP) was created by the DOE Office of Technology Development (OTD) to develop, deploy, and complete appropriate technologies for the treatment of an DOE low-level mixed waste (LLMW). The MWIP mission includes development of strategies related to enhanced waste form production, improvements to and testing of the EM-30 baseline flowsheet for mixed waste treatment, programmatic oversight for ongoing technical projects, and specific technical tasks related to the site specific Federal Facilities Compliance Agreement (FFCA). The MWIP has established five Technical Support Groups (TSGs) based on primary functional areas of the Mixed Waste Treatment Plant) identified by EM-30. These TSGs are: (1) Front-End Waste Handling, (2) Chemical/Physical Treatment, (3) Waste Destruction and Stabilization, (4) Second-stage Destruction and Offgas Treatment, and (5) Final Waste Forms. The focus of this document is the Chemical/Physical Treatment System (CPTS). The CPTS performs the required pretreatment and/or separations on the waste streams passing through the system for discharge to the environment or efficient downstream processing. Downstream processing can include all system components except Front-End Waste Handling. The primary separations to be considered by the CPTS are: (1) removal of suspended and dissolved solids from aqueous and liquid organic streams, (2) separation of water from organic liquids, (3) treatment of wet and dry solids, including separation into constituents as required, for subsequent thermal treatment and final form processing, (4) mercury removal and control, and (5) decontamination of equipment and waste classified as debris.

728 (DOE/MWIP-9) Mixed Waste Integrated Program: A technology assessment for mercury-containing mixed wastes. Perona, J.J.; Brown, C.H. Oak Ridge National Lab., TN (United States). Mar 1993. 51p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (ORNL/M-2965). Order Number DE93019953. Source: OSTI; NTIS; INIS; GPO Dep.

The treatment of mixed wastes must meet US Environmental Protection Agency (EPA) standards for chemically hazardous species and also must provide adequate control of the radioactive species. The US Department of Energy (DOE) Office of Technology Development established the Mixed Waste Integrated Program (MWIP) to develop mixed-waste treatment technology in support of the Mixed Low-Level Waste Program. Many DOE mixed-waste streams contain mercury. This report is an assessment of current state-of-the-art technologies for mercury separations from solids, liquids, and gases. A total of 19 technologies were assessed. This project is funded through the Chemical-Physical Technology Support Group of the MWIP.

729 (DOE/MWIP-10) Evaluation of nitrate destruction methods. Taylor, P.A. (Oak Ridge National Lab., TN (United States)); Kurath, D.E.; Guenther, R. Oak Ridge National Lab., TN (United States). 30 Mar 1993. 28p. Sponsored by USDOE, Washington, DC (United States). DOE

Contract AC05-84OR21400. (ORNL/M-2966). Order Number DE93019952. Source: OSTI; NTIS; INIS; GPO Dep.

A wide variety of high nitrate-concentration aqueous mixed [radioactive and Resource Conservation and Recovery Act (RCRA) hazardous] wastes are stored at various US Department of Energy (DOE) facilities. These wastes will ultimately be solidified for final disposal, although the waste acceptance criteria for the final waste form is still being determined. Because the nitrates in the wastes will normally increase the volume or reduce the integrity of all of the waste forms under consideration for final disposal, nitrate destruction before solidification of the waste will generally be beneficial. This report describes and evaluates various technologies that could be used to destroy the nitrates in the stored wastes. This work was funded by the Department of Energy's Office of Technology Development, through the Chemical/Physical Technology Support Group of the Mixed Waste Integrated Program. All the nitrate destruction technologies will require further development work before a facility could be designed and built to treat the majority of the stored wastes. Several of the technologies have particularly attractive features: the nitrate to ammonia and ceramic (NAC) process produces an insoluble waste form with a significant volume reduction, electrochemical reduction destroys nitrates without any chemical addition, and the hydrothermal process can simultaneously treat nitrates and organics in both acidic and alkaline wastes. These three technologies have been tested using lab-scale equipment and surrogate solutions. At their current state of development, it is not possible to predict which process will be the most beneficial for a particular waste stream.

730 (DOE/MWIP-11) Vitrification development plan for US Department of Energy mixed wastes. Peters, R. (Pacific Northwest Lab., Richland, WA (United States)); Lucerna, J.; Plodinec, M.J. USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). Office of Technology Development; Pacific Northwest Lab., Richland, WA (United States). Oct 1993. 95p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (ORNL/M-3258). Order Number DE94006308. Source: OSTI; NTIS; INIS; GPO Dep.

This document is a general plan for conducting vitrification development for application to mixed wastes owned by the US Department of Energy. The emphasis is a description and discussion of the data needs to proceed through various stages of development. These stages are (1) screening at a waste site to determine which streams should be vitrified, (2) waste characterization and analysis, (3) waste form development and treatability studies, (4) process engineering development, (5) flowsheet and technical specifications for treatment processes, and (6) integrated pilot-scale demonstration. Appendices provide sample test plans for various stages of the vitrification development process. This plan is directed at thermal treatments which produce waste glass. However, the study is still applicable to the broader realm of thermal treatment since it deals with issues such as off-gas characterization and waste characterization that are not necessarily specific to vitrification. The purpose is to provide those exploring or considering vitrification with information concerning the kinds of data that are needed, the way the data are obtained, and the way the data are used. This will provide guidance to those who need to prioritize data needs to fit schedules and budgets. Knowledge of data needs also permits managers and planners to estimate resource requirements for vitrification development.

731 (DOE/MWIP-13) Preliminary Hazards Analysis Plasma Hearth Process. Ayccock, M. (Science Applications International Corp., Pleasanton, CA (United States)); Cordes, D.; Russell, J.; TenBrook, W.; Yimbo, P. Oak Ridge National Lab., TN (United States); Science Applications International Corp., Pleasanton, CA (United States). Nov 1993. 110p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400 ; W-7405-ENG-48. (ORNL/M-3225; UCRL-CR-116222). Order Number DE94005359. Source: OSTI; NTIS; INIS; GPO Dep.

This Preliminary Hazards Analysis (PHA) for the Plasma Hearth Process (PHP) follows the requirements of United States Department of Energy (DOE) Order 5480.23 (DOE, 1992a), DOE Order 5480.21 (DOE, 1991d), DOE Order 5480.22 (DOE, 1992c), DOE Order 5481.1B (DOE, 1986), and the guidance provided in DOE Standards DOE-STD-1027-92 (DOE, 1992b). Consideration is given to fit proposed regulations published as 10 CFR 830 (DOE, 1993) and DOE Safety Guide SG 830.110 (DOE, 1992b). The purpose of performing a PRA is to establish an initial hazard categorization for a DOE nuclear facility and to identify those processes and structures which may have an impact on or be important to safety. The PHA is typically performed during and provides input to project conceptual design. The PRA then is followed by a Preliminary Safety Analysis Report (PSAR) performed during Title I and II design. This PSAR then leads to performance of the Final Safety Analysis Report performed during construction, testing, and acceptance and completed before routine operation. Radiological assessments indicate that a PHP facility, depending on the radioactive material inventory, may be an exempt, Category 3, or Category 2 facility. The calculated impacts would result in no significant impact to offsite personnel or the environment. Hazardous material assessments indicate that a PHP facility will be a Low Hazard facility having no significant impacts either onsite or offsite to personnel and the environment.

732 (DOE/MWIP-14) Multicriteria decision methodology for selecting technical alternatives in the Mixed Waste Integrated Program. Ferrada, J.J.; Berry, J.B. Oak Ridge National Lab., TN (United States). Nov 1993. 107p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (ORNL/M-3181). Order Number DE94003997. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy (DOE) Mixed Waste Integrated Program (MWIP) has as one of its tasks the identification of a decision methodology and key decision criteria for the selection methodology. The aim of a multicriteria analysis is to provide an instrument for a systematic evaluation of distinct alternative projects. Determination of this methodology will clarify (1) the factors used to evaluate these alternatives, (2) the evaluator's view of the importance of the factors, and (3) the relative value of each alternative. The selected methodology must consider the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) decision-making criteria for application to the analysis technology subsystems developed by the DOE Office of Technology Development. This report contains a compilation of several decision methodologies developed in various national laboratories, institutions, and universities. The purpose of these methodologies may vary, but the core of the decision attributes are very similar. Six approaches were briefly analyzed; from these six, in addition to recommendations made by the MWIP technical support group leaders and CERCLA, the final decision methodology was extracted. Slight variations are observed in the many

methodologies developed by different groups, but most of the analyzed methodologies address similar aspects for the most part. These common aspects were the core of the methodology suggested in this report for use within MWIP for the selection of technologies. The set of criteria compiled and developed for this report have been grouped in five categories: (1) process effectiveness, (2) developmental status, (3) life-cycle cost, (4) implementability, and (5) regulatory compliance.

733 (DOE/MWIP-15) Surrogate formulations for thermal treatment of low-level mixed waste: Part 1: Radiological surrogates. Stockdale, J.A.D. (Martin Marietta Energy Systems, Inc., Oak Ridge, TN (United States)); Bostick, W.D.; Hoffmann, D.P.; Lee, H.T. Oak Ridge K-25 Site, TN (United States); Oak Ridge Associated Universities, Inc., TN (United States). Jan 1994. 93p. Sponsored by US-DOE, Washington, DC (United States). DOE Contract AC05-84OT21400 ; AC05-76OR00033. Order Number DE94011598. Source: OSTI; NTIS; INIS; GPO Dep.

The evaluation and comparison of proposed thermal treatment systems for mixed wastes can be expedited by tests in which the radioactive components of the wastes are replaced by surrogate materials chosen to mimic, as far as is possible, the chemical and physical properties of the radioactive materials of concern. In this work, sponsored by the Mixed Waste Integrated Project of the US Department of Energy, the authors have examined reported experience with such surrogates and suggest a simplified standard list of materials for use in tests of thermal treatment systems. The chief radioactive nuclides of concern in the treatment of mixed wastes are ^{239}Pu , ^{238}U , ^{235}U , ^{137}Cs , ^{103}Ru , ^{99}Tc , and ^{90}Sr . These nuclides are largely by-products of uranium enrichment, reactor fuel reprocessing, and weapons program activities. Cs, Ru, and Sr all have stable isotopes that can be used as perfect surrogates for the radioactive forms. Technetium exists only in radioactive form, as do plutonium and uranium. If one wishes to preclude radioactive contamination of the thermal treatment system under trial burn, surrogate elements must be chosen for these three. For technetium, the authors suggest the use of natural ruthenium, and for both plutonium and uranium, they recommend cerium. The seven radionuclides listed can therefore be simulated by a surrogate package containing stable isotopes of ruthenium, strontium, cesium, and cerium.

734 (DOE/MWIP-19) Guideline for benchmarking thermal treatment systems for low-level mixed waste. Hoffman, D.P. (Martin Marietta Energy Systems, Inc., Oak Ridge, TN (United States)); Gibson, L.V. Jr.; Hermes, W.H.; Bastian, R.E.; Davis, W.T. Oak Ridge K-25 Site, TN (United States). Jan 1994. 89p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OT21400. Order Number DE94011932. Source: OSTI; NTIS; INIS; GPO Dep.

A process for benchmarking low-level mixed waste (LLMW) treatment technologies has been developed. When used in conjunction with the identification and preparation of surrogate waste mixtures, and with defined quality assurance and quality control procedures, the benchmarking process will effectively streamline the selection of treatment technologies being considered by the US Department of Energy (DOE) for LLMW cleanup and management. Following the quantitative template provided in the benchmarking process will greatly increase the technical information available for the decision-making process. The additional technical information will remove a large part of the uncertainty in the selection of treatment technologies. It is anticipated that the

use of the benchmarking process will minimize technology development costs and overall treatment costs. In addition, the benchmarking process will enhance development of the most promising LLMW treatment processes and aid in transferring the technology to the private sector. To instill inherent quality, the benchmarking process is based on defined criteria and a structured evaluation format, which are independent of any specific conventional treatment or emerging process technology. Five categories of benchmarking criteria have been developed for the evaluation: operation/design; personnel health and safety; economics; product quality; and environmental quality. This benchmarking document gives specific guidance on what information should be included and how it should be presented. A standard format for reporting is included in Appendix A and B of this document. Special considerations for LLMW are presented and included in each of the benchmarking categories.

735 (DOE/MWIP-25) Life cycle cost analysis for the Plasma Arc Furnace. Barnes-Smith, P. Los Alamos National Lab., NM (United States); International Technology Corp., Albuquerque, NM (United States). Mar 1994. 50p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (LA-UR-94-928). Order Number DE94012310. Source: OSTI; NTIS; GPO Dep.

This document is a draft version. The Mixed Waste Integrated Program requested that the Systems Analysis Group investigate the cost effectiveness of using the Plasma Arc Furnace (PAF) module in place of specified thermal and final forms treatment equipment in the baseline Mixed Waste Treatment Project (MWTP) study as performed by Bechtel Corporation, September 1992. The attached estimates are based on the process equipment and facilities cost data contained in the Bechtel study. The PAF process equipment and facilities cost data were developed using independent cost estimates for the equipment list provided by SAIC, Waste Management and Technology Division, in cooperation with the Pollution Prevention and Systems Analysis Group of the Oak Ridge National Laboratory, Chemical Technology Division. In order to develop the total life cycle cost estimate comparison for this study, it was necessary to use a common base for comparison. Although it was felt that the Bechtel MWTP study did not fully reflect the optimum size for the thermal and final forms treatment equipment, it was the best available data at the time.

736 (DOE/NBM-1100-Vol.2) US Department of Energy Interim mixed waste inventory report: Waste streams, treatment capacities and technologies: Volume 2, Site specific—California through Idaho. USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States); Sandia National Labs., Albuquerque, NM (United States); Brookhaven National Lab., Upton, NY (United States); EG and G Idaho, Inc., Idaho Falls, ID (United States). Apr 1993. 874p. Sponsored by US-DOE, Washington, DC (United States). DOE Contract AC04-76DP00789 ; AC06-76RL01830 ; AC07-76ID01570. AF-6871. Order Number DE93012097. Source: OSTI; NTIS; INIS; GPO Dep.

The Department of Energy (DOE) has prepared this report to provide an inventory of its mixed wastes and treatment capacities and technologies in response to Section 105(a) of the Federal Facility Compliance act (FFCA) of 1992 (Pub. L. No. 102-386). As required by the FFCA-1992, this report provide site-specific information on DOE's mixed waste streams and a general review of available and

planned treatment facilities for mixed wastes for the following sites: eight California facilities which are Energy Technology engineering Center, General Atomics, General Electric Vallecitos Nuclear Center, Lawrence Berkeley Laboratory, Lawrence Livermore National Laboratory, Laboratory for Energy-Related Health Research, Mare Island Naval Shipyard, and Sandia national Laboratories; Grand Junction Project Office; Rocky Flats Plant; Knolls Atomic Power Laboratory-Windsor Site; Pinellas Plant; Pearl Harbor Naval Shipyard; Argonne National Laboratory-West; and Idaho National Engineering Laboratory.

737 (DOE/NBM-1100-Vol.3) US Department of Energy Interim mixed waste inventory report: Waste streams, treatment capacities and technologies: Volume 3, Site specific—Illinois through New York. USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States); Sandia National Labs., Albuquerque, NM (United States); Brookhaven National Lab., Upton, NY (United States); EG and G Idaho, Inc., Idaho Falls, ID (United States). Apr 1993. 882p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789 ; AC06-76RL01830 ; AC07-76ID01570. AF-6871. Order Number DE93012098. Source: OSTI; NTIS; INIS; GPO Dep.

The Department of Energy (DOE) has prepared this report to provide an inventory of its mixed wastes and treatment capacities and technologies in response to Section 105(a) of the Federal Facility Compliance Act (FFCA) of 1992 (Pub. L. No. 102-386). As required by the FFCA-1992, this report provides site-specific information on DOE's mixed waste streams and a general review of available and planned treatment facilities for mixed wastes for the following sites: Argonne National Laboratory-East; Site A/plot M in Palos Forest Preserve, Illinois; Ames Laboratory; Paducah Gaseous Diffusion Plant; Portsmouth Naval Shipyard; Kansas City Plant; University of Missouri; Weldon Springs Site, St. Charles, Missouri; Nevada Test Site; Middlesex Sampling Plant, Middlesex, New Jersey; Princeton Plasma Physics Laboratory; LANL; Sandia national laboratory; Brookhaven National Laboratory; Colonie Interim Storage Site, Colonie, New York; Knolls Atomic Power Laboratory; Knolls Atomic Power Laboratory-Kesselring Site; and West Valley Demonstration Project.

738 (DOE/NBM-1100-Vol.4) US Department of Energy Interim mixed waste inventory report: Waste streams, treatment capacities and technologies: Volume 4, Site specific—Ohio through South Carolina. USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States); Sandia National Labs., Albuquerque, NM (United States); Brookhaven National Lab., Upton, NY (United States); EG and G Idaho, Inc., Idaho Falls, ID (United States). Apr 1993. 1044p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789 ; AC06-76RL01830 ; AC07-76ID01570. AF-6871. Order Number DE93012099. Source: OSTI; NTIS; INIS; GPO Dep.

The Department of Energy (DOE) has prepared this report to provide an inventory of its mixed wastes and treatment capacities and technologies in response to Section 105(a) of the Federal Facility Compliance Act (FFCA) of 1992 (Pub. L. No. 102-386). As required by the FFCA-1992, this report provides site-specific information on DOE's mixed waste streams and a general review of available and planned treatment facilities for mixed wastes at the following five

Ohio facilities: Battelle Columbus Laboratories; Fernald Environmental Management Project; Mound Plant; Portsmouth Gaseous Diffusion Plant; and RMI, Titanium Company.

739 (DOE/NBM-1100-Vol.6) US Department of Energy Interim mixed waste inventory report: Waste streams, treatment capacities and technologies: Volume 6, Appendices. USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States); Sandia National Labs., Albuquerque, NM (United States); Brookhaven National Lab., Upton, NY (United States); EG and G Idaho, Inc., Idaho Falls, ID (United States). Apr 1993. 402p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789 ; AC06-76RL01830 ; AC07-76ID01570. AF-6871. Order Number DE93012101. Source: OSTI; NTIS; INIS; GPO Dep.

This volume contains Appendix A—Federal Facility Compliance Act of 1992, Appendix B—Technology Development, and Appendix C—Other Materials. Appendix B supplies details concerning the technology development activities supported by DOE in the area of mixed waste management. Two parts of this appendix are important. The more important of the two is the collection of technology development summaries. There are 267 summaries collected from several sources, which are described. The second important part consists of tables which group technologies by one several attributes such as target site and cross-complex applicability as well as relationship to Resource Conservation Recovery Act Best Demonstrated Available Technologies (RCRA BDATs).

740 (DOE/NBM-1101) Technical program plan for the transitioning, decommissioning, and final disposition focus area. D and D Integrated Demonstration Technical Support Group (United States). Jan 1994. 301p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OT21400. Order Number DE94005597. Source: OSTI; NTIS; INIS; GPO Dep.

Hundreds of aging nuclear materials processing facilities within the Department of Energy's (DOE) Weapons Complex are now being shut down and deactivated. These facilities, situated throughout the United States, will require a monumental effort to clean up safely and with minimal environmental insult. Current cleanup technologies tend to be labor intensive and expensive, they produce an unacceptably large volume of waste, and they expose workers to radioactive and other hazardous substances. This document describes an emerging program designed to develop and demonstrate new technical approaches to the decontamination and decommissioning (D&D) program for DOE's nuclear materials processing facilities. Sponsored by the DOE Office of Technology Development within the Office of Environmental Restoration and Waste Management (EM), the program seeks to integrate the strengths of DOE's technical, managerial, and systems engineering capabilities with those of industry, universities, and other government agencies. Once developed, these technologies will help to provide US industry with a competitive edge in the worldwide market that exists for improved environmental restoration and D&D services.

741 (DOE/OR-01-1129-D1) Detailed leak detection test plan and schedule for the Oak Ridge National Laboratory LLLW active tanks: Waste Management and Environmental Restoration Programs. Douglas, D.G. (Vista Research, Inc., Mountain View, CA (United States)); Maresca, J.W. Jr. Oak Ridge National Lab., TN (United

States); Vista Research, Inc., Mountain View, CA (United States). Mar 1993. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (ORNL/ER/Sub-92-SK263/2-D1). Order Number DE93010327. Source: OSTI; NTIS; INIS; GPO Dep.

This document provides a detailed leak detection test plan and schedule for leak testing many of the tanks that comprise the active portion of the liquid low-level waste (LLLW) system at the Oak Ridge National Laboratory (ORNL). This plan was prepared in response to the requirements of the Federal Facility Agreement (FFA) between the US Department of Energy (DOE) and two other agencies, the US Environmental Protection Agency (EPA) and the Tennessee Department of Environment and Conservation (TDEC).

742 (DOE/OR-01-1135-D2) Federal Facility Agreement plans and schedules for liquid low-level radioactive waste tank systems at Oak Ridge National Laboratory, Oak Ridge, Tennessee. Oak Ridge National Lab., TN (United States). Jun 1993. 117p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400 ; AC05-76OR00001. (ES/ER-17-D1/R1). Order Number DE93016908. Source: OSTI; NTIS; INIS; GPO Dep.

The Superfund Amendments and Reauthorization Act of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) requires a Federal Facility Agreement (FFA) for federal facilities placed on the National Priorities List. The Oak Ridge Reservation was placed on that list on December 21, 1989, and the agreement was signed in November 1991 by the Department of Energy Oak Ridge Field Office (DOE-OR), the US Environmental Protection Agency (EPA)-Region IV, and the Tennessee Department of Environment and Conservation (TDEC). The effective date of the FFA was January 1, 1992. Section 9 and Appendix F of the agreement impose design and operating requirements on the Oak Ridge National Laboratory (ORNL) liquid low-level radioactive waste (LLLW) tank systems and identify several plans, schedules, and assessments that must be submitted to EPA/TDEC for review or approval. The initial issue of this document in March 1992 transmitted to EPA/TDEC those plans and schedules that were required within 60 to 90 days of the FFA effective date. The current revision of this document updates the plans, schedules, and strategy for achieving compliance with the FFA, and it summarizes the progress that has been made over the past year. Chapter 1 describes the history and operation of the ORNL LLLW System, the objectives of the FFA, the organization that has been established to bring the system into compliance, and the plans for achieving compliance. Chapters 2 through 7 of this report contain the updated plans and schedules for meeting FFA requirements. This document will continue to be periodically reassessed and refined to reflect newly developed information and progress.

743 (DOE/OR-01-1138-D1) Remediation schedule for inactive liquid low-level waste storage tanks at Oak Ridge National Laboratory, Oak Ridge, Tennessee. Oak Ridge National Lab., TN (United States); H and R Technical Associates, Inc., Oak Ridge, TN (United States). Mar 1993. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (ORNL/ER/Sub-90-LJ068/2). Order Number DE93010842. Source: OSTI; NTIS; INIS; GPO Dep.

This document, which contains the remediation schedules for the inactive liquid low-level waste (LLLW) tanks at Oak Ridge National Laboratory, was prepared as required by the

Federal Facility Agreement (FFA). It includes the current status, planned pre-Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) activities, and planned remediation dates for the tanks identified in the FFA as Category D (removed-from-service) tanks. The inactive tanks under consideration are located in four waste area groupings (WAGs): 1, 5, 8, and 9. The tank remediation strategy is to remove the liquid contents, stabilize each tank to the extent possible, and remediate each tank as part of the CERCLA process for the WAG or operable unit (OU) to which it belongs. Some tanks are in WAG/OUTs that have already begun the CERCLA process (WAG 1 Gunite and Associated Tanks OU, and WAG 5). Others are already empty (free of liquids) and stable, awaiting remediation as part of their WAG/OU. A number of others are currently being emptied and investigated to determine what, if any, interim corrective measures may be needed. The schedule for each WAG that contains any inactive LLLW tanks is shown in a figure, and the dates for specific activities are shown in table T. The current status of each tank and its planned pre-CERCLA activities are provided in an appendix.

744 (DOE/OR-01-1159-D1) Waste Characterization Data Manual for the inactive liquid low-level waste tank systems at Oak Ridge National Laboratory, Oak Ridge, Tennessee: Environmental Restoration Program. Oak Ridge National Lab., TN (United States); Bechtel National, Inc., Oak Ridge, TN (United States); CH2M Hill Southeast, Inc., Oak Ridge, TN (United States). Jun 1993. 186p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Contract 30B-99053C. (ORNL/ER-80). Order Number DE93016762. Source: OSTI; NTIS; INIS; GPO Dep.

This Waste Characterization Data Manual contains the results of an analysis of the contents of liquid low-level waste (LLLW) tanks that have been removed from service in accordance with the requirements of the Oak Ridge National Laboratory (ORNL) Federal Facility Agreement (FFA), Section IX.G.1. Section IX.G.1 of the FFA requires waste characterizations be conducted and provided to EPA and TDEC for all LLLW tanks that are removed from service. These waste characterizations shall include the results of sampling and analysis of the tank contents, including wastes, liquids, and sludges. This manual was first issued as ORNL/ER-80 in June 1992. The waste characterization data were extracted from ORNL reports that described tank sampling and analysis conducted in 1988 for 32 out-of-service tanks. This revision of the manual contains waste characterization data for 54 tanks, including the 32 tanks from the 1988 sampling campaign (Sects. 2.1 through 2.32) and the 22 additional tanks from a subsequent sampling campaign in 1992 and 1993 (Sects. 2.33 through 2.54). Data are presented from analyses of volatile organic compounds, semivolatile organic compounds, polychlorinated biphenyls (PCBs), pesticides, radiochemical compounds, and inorganic compounds. As additional data resulting from analyses of out-of-service tank samples become available, they will be added to this manual.

745 (DOE/OR-01-1167-D1) Detailed leak detection test plan and schedule for the Oak Ridge National Laboratory LLLW active pipelines: Environmental Restoration and Waste Management Programs. Douglas, D.G. (Vista Research, Inc., Mountain View, CA (United States)); Starr, J.W.; Juliano, T.M.; Maresca, J.W. Jr. Oak Ridge National Lab., TN (United States); Vista Research, Inc., Mountain View, CA (United States). Sep 1993. 71p.

Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (ORNL/ER-171-D1). Order Number DE94000424. Source: OSTI; NTIS; INIS; GPO Dep.

This document provides a detailed leak detection test plan and schedule for leak testing many of the pipelines that comprise the active portion of the liquid low-level waste (LLLW) system at the Oak Ridge National Laboratory (ORNL). This plan was prepared in response to the requirements of the Federal Facility Agreement (FFA) between the US Department of Energy (DOE) and two other agencies, the US Environmental Protection Agency (EPA) and the Tennessee Department of Environment and Conservation (TDEC). The LLLW system is an interconnected complex of tanks and pipelines. The FFA distinguishes four categories of tank and pipeline systems within this complex: new systems (Category A), doubly contained systems (Category B), singly contained systems (Category C), and inactive systems (Category D). The FFA specifically requires leak testing of the Category C systems. This plan and schedule addresses leak testing of the Category C pipelines and those doubly contained pipelines that do not fully meet the requirements for secondary containment as listed in the FFA.

746 (DOE/OR-01-1168-D1) Risk characterization data manual for Category D inactive liquid low-level waste tank systems at Oak Ridge National Laboratory, Oak Ridge, Tennessee. Oak Ridge National Lab., TN (United States). Jul 1993. 75p. Sponsored by US-DOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (ORNL/ER/Sub-90-LJ068/1-D1). Order Number DE93017755. Source: OSTI; NTIS; INIS; GPO Dep.

This manual reports the results of a risk characterization of Category D inactive liquid low-level radioactive waste (LLLW) underground storage tanks (USTs) at the Oak Ridge National Laboratory (ORNL). The risk characterization is required by the Federal Facility Agreement between the Department of Energy-Oak Ridge Operations Office, the Environmental Protection Agency-Region IV, and the Tennessee Department of Environment and Conservation. The intent of the risk characterization is to determine relative priorities for assessment and remediation. A total of 55 FFA Category D inactive LLLW tanks are discussed in this manual. Of the 39 tanks at ORNL that have been accepted into the Environmental Restoration (ER) Program, all have been sampled for preliminary characterization, except for 5 tanks that were found to be empty plus 1 that was found not to exist. The remaining 16 tanks are in the Waste Management (WM) Program. Twelve were sampled for preliminary characterization, and four were found empty. Each sampled tank was scored on a scale of 1 to 5 on the basis of three criteria: (1) leak characteristics, (2) location, and (3) toxicological characteristics of residual sludges and liquids. Each criterion was assigned a weighing factor based on perceived importance. The criterion score multiplied by the weighting factor equaled the tank's total score for that criterion. The three weighted criterion scores for each tank were then summed for a total score for that tank. When the scores for all tanks had been weighted and summed, the tanks were ranked in descending order on the basis of their total scores. The highest possible score for a tank is 30. The descending rank order represents the recommended priorities for evaluation: the higher the score, the higher the priority for evaluation. Of the 54 tanks sampled in the risk characterization, 23 tanks scored 16 or higher, 11 scored between 10 and 15, 5 scored between 4 and 9, and 15 scored 3 or less.

747 (DOE/OR-01-1168-D2) Risk characterization data manual for Category D inactive liquid low-level waste tank systems at Oak Ridge National Laboratory, Oak Ridge, Tennessee. USDOE Oak Ridge Operations Office, TN (United States); Oak Ridge National Lab., TN (United States). Sep 1993. 79p. Sponsored by US-DOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (ORNL/ER/Sub-90-LJ068/1-D2). Order Number DE94001658. Source: OSTI; NTIS; INIS; GPO Dep.

This manual reports the results of a risk characterization of Category D inactive liquid low-level radioactive waste (LLLW) underground storage tanks (USTs) at the Oak Ridge National Laboratory (ORNL). The risk characterization is required by the Federal Facility Agreement between the Department of Energy-Oak Ridge Operations Office, the Environmental Protection Agency-Region IV, and the Tennessee Department of Environment and Conservation. The intent of the risk characterization is to determine relative priorities for assessment and remediation. A total of 55 FFA Category D inactive LLLW tanks are discussed in this manual. Of the 39 tanks at ORNL that have been accepted into the Environmental Restoration (ER) Program, all have been sampled for preliminary characterization, except for 5 tanks that were found to be empty plus 1 that was found not to exist. The remaining 16 tanks are in the Waste Management (WM) Program. Twelve were sampled for preliminary characterization, and four were found empty. Each sampled tank was scored on a scale of 1 to 5 on the basis of three criteria: (1) leak characteristics, (2) location, and (3) toxicological characteristics of residual sludges and liquids. Each criterion was assigned a weighing factor based on perceived importance. The criterion score multiplied by the weighting factor equaled the tank's total score for that criterion. The three weighted criterion scores for each tank were then summed for a total score for that tank. When the scores for all tanks had been weighted and summed, the tanks were ranked in descending order on the basis of their total scores. The highest possible score for a tank is 30. The descending rank order represents the recommended priorities for evaluation: the higher the score, the higher the priority for evaluation. Of the 54 tanks sampled in the risk characterization, 23 tanks scored 16 or higher, 11 scored between 10 and 15, 5 scored between 4 and 9, and 15 scored 3 or less.

748 (DOE/OR-01-1169-D1) Postconstruction report for the mercury tanks interim action at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee. Voskuil, T.L. Martin Marietta Energy Systems, Inc., Oak Ridge, TN (United States). Sep 1993. 146p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OS21400. (Y/ER-93-D1). Order Number DE94002752. Source: OSTI; NTIS; INIS; GPO Dep.

Three underground concrete settling tanks (tanks 2101-U, 2104-U, and 2100-U) at the Y-12 Plant on the Oak Ridge Reservation in Oak Ridge, Tennessee, contained contaminated sludges contributing mercury to the Upper East Fork Poplar Creek (UEFPC). These tanks were cleaned out as an interim action under the Comprehensive Environmental Response, Compensation, and Liability Act as part of the Reduction of Mercury in Plant Effluent subproject. Cleaning out these tanks prevented the sludge that had settled in the bottom from resuspending and carrying mercury into UEFPC. Tanks 2104-U and 2100-U were returned to service and will continue to receive effluent from buildings 9201-4 and 9201-5. Tank 2101-U had been abandoned and its effluent redirected to Tank 2100-U during previous activities. This interim action permanently sealed Tank 2101-U from the

storm sewer system. Upon removal of materials and completion of cleanup, inspections determined that the project's cleanup criteria had been met. The structural integrity of the tanks was also inspected, and minor cracks identified in tanks 2101-U and 2104-U were repaired. This project is considered to have been completed successfully because it met its performance objectives as addressed in the Interim Record of Decision and the work plan: to remove the waste from the three storage tanks; to ensure that the tanks were cleaned to the levels specified; to return tanks 2100-U and 2104-U to service; to isolate Tank 2101-U permanently; and to manage the wastes in an appropriate fashion.

749 (DOE/OR-01-1173-D1) **Remedial Investigation Work Plan for Chestnut Ridge Operable Unit 1 (Chestnut Ridge Security Pits) at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee.** CDM Federal Programs Corp., Oak Ridge, TN (United States); Oak Ridge Y-12 Plant, TN (United States). Sep 1993. 486p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OS21400. (Y/ER-112-D1). Order Number DE94003336. Source: OSTI; NTIS; INIS; GPO Dep.

This Remedial Investigation (RI) Work Plan specifically addresses Chestnut Ridge Operable Unit 1, (OU1) which consists of the Chestnut Ridge Security Pits (CRSP). The CRSP are located ~800 ft southeast of the central portion of the Y-12 Plant atop Chestnut Ridge, which is bounded to the northwest by Bear Creek Valley and to the southeast by Bethel Valley. Operated from 1973 to 1988, the CRSP consisted of a series of trenches used for the disposal of classified hazardous and nonhazardous waste materials. Disposal of hazardous waste materials was discontinued in December 1984, while nonhazardous waste disposal ended on November 8, 1988. An RI is being conducted at this site in response to CERCLA regulations. The overall objectives of the RI are to collect data necessary to evaluate the nature and extent of contaminants of concern (COC), support an ecological risk assessment (ERA) and a human health risk assessment (HHRA), support the evaluation of remedial alternatives, and ultimately develop a Record of Decision for the site. The purpose of this Work Plan is to outline RI activities necessary to define the nature and extent of suspected contaminants at Chestnut Ridge OU1. Potential migration pathways also will be investigated. Data collected during the RI will be used to evaluate the overall risk posed to human health and the environment by OU1.

750 (DOE/OR-03-1150-D1) **Design demonstrations for the remaining 19 Category B tank systems at Oak Ridge National Laboratory, Oak Ridge, Tennessee.** Ebasco Services, Inc., Oak Ridge, TN (United States). Jun 1993. 293p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400 ; AC05-91OR21928. (ORNL/M-2810). Order Number DE93016909. Source: OSTI; NTIS; INIS; GPO Dep.

This document presents design demonstrations conducted of liquid low-level waste (LLLW) storage tank systems located at the Oak Ridge National Laboratory (ORNL). ORNL has conducted research in energy related fields since 1943. The facilities used to conduct the research include nuclear reactors, chemical pilot plants, research laboratories, radioisotope production laboratories, and support facilities. These facilities have produced a variety of radioactive and/or hazardous wastes that have been transported and stored through an extensive network of piping and tankage. Demonstration of the design of these tank systems has

been stipulated by the Federal Facility Agreement (FFA) between the EPA (United States Environmental Protection Agency)-Region IV; the Tennessee Department of Environment and Conservation (TDEC); and the DOE. The FFA establishes four categories of tank systems: Category A-New or Replacement Tank Systems with Secondary Containment; Category B-Existing Tank Systems with Secondary Containment; Category C-Existing Tank Systems Without Secondary Containment, and Category D-Existing Tank Systems Without Secondary Containment That are Removed from Service. This document provides a design demonstration of the secondary containment and ancillary equipment of 19 tank systems listed in the FFA as Category B. The design demonstration for each tank is presented in Section 2. The assessments assume that each tank system was constructed in accordance with the design drawings and construction specifications for that system unless specified otherwise. Each design demonstration addresses system conformance to the requirements of the FFA (Appendix F, Section C).

751 (DOE/OR-03-1195-D1) **Design demonstrations for Category B tank system piping at Oak Ridge National Laboratory, Oak Ridge, Tennessee.** Oak Ridge National Lab., TN (United States); Ebasco Services, Inc., Oak Ridge, TN (United States). Feb 1994. 466p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400 ; AC05-91OR21928. (ORNL/ER-193-D1). Order Number DE94009505. Source: OSTI; NTIS; INIS; GPO Dep.

Demonstration of the design of the tank systems described in this report is stipulated by the Federal Facility Agreement (FFA) between the U.S. Environmental Protection Agency-Region IV, the Tennessee Department of Environment and Conservation, and the U.S. Department of Energy. This report provides a design demonstration of the secondary containment and ancillary equipment of 30 piping systems listed in the FFA as Category B (i.e., existing tank systems with secondary containment). The design demonstrations were developed using information obtained from design drawings (as-built when available), construction specifications, and interviews with facility operators. Each design demonstration addresses system conformance to the requirements of the FFA (Appendix F, Section C). Deficiencies or restrictions regarding the ability to demonstrate that each of the containment systems conforms to FFA requirements are noted in the discussion of each piping system.

752 (DOE/OR/00033-T517) **Feasibility study for a plasma system to process mixed waste.** Phillips, K.A. Florida Univ., Gainesville, FL (United States). Dept. of Nuclear Engineering Sciences. 1992. 106p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-76OR00033. Order Number DE93005279. Source: OSTI; NTIS; INIS; GPO Dep.

The management of waste material that contains both hazardous and radioactive components, referred to as mixed waste, is hindered by a complex regulatory climate and a lack of treatment, storage, and disposal facilities. The objectives of this research were to examine the feasibility of a laboratory-scale plasma system to process this waste, specifically to destroy the hazardous component, and to recommend an approach to research in this area for researchers at the University of Florida. The destruction of the primary components of liquid scintillation waste - pseudocumene, toluene, and xylene - using a radio-frequency inductively coupled plasma was examined. The computer

code microCOMPACT-E was used to model the fluid dynamics and destruction reactions occurring in the plasma chamber. With a plasma temperature of 7000 K and an inlet velocity of 0.4 m/s or the organic material complete destruction of all three materials was achieved. A throughput of approximately 2×10^{-6} kg/s of scintillation material was predicted using the code. This value corresponds to a generator power of approximately 700 W. Based on the computer modeling results obtained and an examination of the regulatory requirements, it was determined that a laboratory-scale plasma system to process mixed waste is feasible. It was recommended that researchers at the University of Florida collaborate with a current research project in this field, providing radioactive waste, radiation, and shielding expertise. If independent research is to be undertaken, it is recommended that experimental work be begun.

753 (DOE/OR/00033-T558) Reliability analysis of common hazardous waste treatment processes. Waters, R.D. (Vanderbilt Univ., Nashville, TN (United States)). Oak Ridge Inst. for Science and Education, TN (United States); Vanderbilt Univ., Nashville, TN (United States). May 1993. 227p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-76OR00033. Order Number DE94000852. Source: OSTI; NTIS; INIS; GPO Dep.

Five hazardous waste treatment processes are analyzed probabilistically using Monte Carlo simulation to elucidate the relationships between process safety factors and reliability levels. The treatment processes evaluated are packed tower aeration, reverse osmosis, activated sludge, upflow anaerobic sludge blanket, and activated carbon adsorption.

754 (DOE/OR-1047-D1) Design demonstrations for Category B tank systems at Oak Ridge National Laboratory, Oak Ridge, Tennessee. Oak Ridge National Lab., TN (United States); Ebasco Services, Inc., Oak Ridge, TN (United States). Jul 1992. 242p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (ORNL/M-2265). Order Number DE92040322. Source: OSTI; NTIS; INIS; GPO Dep.

This document presents design demonstrations conducted of liquid low-level waste (LLLW) storage tank systems located at the Oak Ridge National Laboratory (ORNL). ORNL has conducted research in energy related fields since 1943. The facilities used to conduct the research include nuclear reactors, chemical pilot plants, research laboratories, radioisotope production laboratories, and support facilities. These facilities have produced a variety of radioactive and/or hazardous wastes. These wastes have been stored and transported through an extensive network of piping and tankage. Demonstration of the design of these tank systems has been stipulated by the Federal Facility Agreement (FFA) between the US Environmental Protection Agency (EPA) - Region IV; the Tennessee Department of Environment and Conservation (TDEC); and the DOE. The FFA establishes four categories of tanks. These are: Category A - New or Replacement Tank Systems with Secondary Containment; Category B - Existing Tank Systems with Secondary Containment; Category C - Existing Tank Systems without Secondary Containment; and Category D - Existing Tank Systems without Secondary Containment that are; Removed from Service. This document provides a design demonstration of the secondary containment and ancillary equipment of 11 tank systems listed in the FFA as Category "B." The design demonstration for each tank is presented in Section 2. The design demonstrations were

developed using information obtained from the design drawings (as-built when available), construction specifications, and interviews with facility operators. The assessments assume that each tank system was constructed in accordance with the design drawings and construction specifications for that system unless specified otherwise. Each design demonstration addresses system conformance to the requirements of the FFA (Appendix F, Subsection C).

755 (DOE/OR-1051) Decontamination and Decommissioning technology assessment. Martin Marietta Energy Systems, Inc., Oak Ridge, TN (United States). Mar 1993. 110p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OT21400. Order Number DE93010885. Source: OSTI; NTIS; INIS; GPO Dep.

Decontamination and Decommissioning (D&D) of the wide variety of Department of Energy (DOE) facilities is expected to be one of the most expensive programs ever undertaken by DOE. D&D activities can be accomplished using current techniques with potential total costs greater than \$50 billion and a significant impact on the environment. Focusing a fraction of this funding to develop better technologies could reduce costs by billions, reduce worker exposure through better protection, increase processing efficiencies, minimize wastes, and allow greater recycle of materials. D&D faces serious problems: disposition of large quantities of difficult-to-dispose-of materials, adequate worker and environmental protection, and regulatory hurdles. A major objective is to reuse and recycle as much material from D&D as is practical, both to conserve valuable raw materials and to minimize the amount of waste requiring disposal. For recycling with unrestricted release to be a viable alternative, a de minimus standard must be in place. The integrated demonstration (ID) proposed in this document will provide users the technology needed to meet the challenges of D&D. This technology will be better, safer, and faster than that which is currently available and will pay back the cost invested in it many times over. In an effort to find an alternative to disposal of materials, DOE has committed to a new initiative to support Environmental Restoration and Waste Management activities: recycle of all materials that are practical for reuse. Future opportunities to reuse many materials include Complex 21 and the Superconducting Supercollider and packaging and disposal systems for DOE waste materials. In cases where reuse or recycle of materials is impractical, disposal methodologies must be defined which provide reasonable, risk-based protection of human health and the environment and which are acceptable to the public and the affected states.

756 (DOE/OR-1054-D1) Phase 2 Sampling Plan for Chestnut Ridge Operable Unit 2 (Filled Coal Ash Pond/Upper McCoy Branch) at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee: Environmental Restoration Program. Oak Ridge Y-12 Plant, TN (United States); CDM Federal Programs Corp., Oak Ridge, TN (United States). Aug 1992. 272p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OS21400. (Y/ER-42-D1). Order Number DE92041271. Source: OSTI; NTIS; INIS; GPO Dep.

CDM Federal Programs Corporation (CDM Federal) was contracted by Martin Marietta Energy Systems, Inc. to prepare a Phase H Sampling Plan to describe field investigation work necessary to address regulatory agency review comments on the Remedial Investigation of Filled Coal Ash Pond (FCAP)/Upper McCoy Branch, Chestnut Ridge Operable Unit 2 at the Y-12 Plant, conducted by CH2M Hill in

1990. The scope and approach of the field investigation described in this plan specifically focus on deficiencies noted by the regulators in discussions at the comment resolution meeting of May 8, 1992, in Oak Ridge, Tennessee. This Phase II Sampling Plan includes a field sampling plan, a field and laboratory quality assurance project plan, a health and safety plan, a waste management plan, and appendixes providing an update to applicable or relevant and appropriate requirements for this site and field and laboratory testing methods and procedures. To address deficiencies noted by the regulators, the following activities will be conducted: Background surface soil and surface water/sediment samples will be collected based on statistical considerations for comparison to site data. Existing and new data to be collected will be used to support a human health risk assessment that includes the future homesteader scenario. Biological surveys, samples, and measurements will be collected/conducted to augment existing data and support an ecological risk assessment. Another round of groundwater sampling will be conducted, including on-site wells and the wells on Chestnut Ridge downgradient of the Security Pits. Borings will be completed in the FCAP to collect samples from below the surface depth to describe the chemical characteristics and volume of the ash. The volume of ash associated with sluice channel on Chestnut Ridge will be determined. Soil samples will be collected below the coal ash in the FCAP and adjacent to sluice channel to evaluate soil contamination and migration of contaminants.

757 (DOE/OR-1054-D2) Phase 2 Sampling Plan for Chestnut Ridge Operable Unit 2 (Filled Coal Ash Pond/Upper McCoy Branch) at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee: Environment Restoration Program. Oak Ridge Y-12 Plant, TN (United States); CDM Federal Programs Corp., Oak Ridge, TN (United States). Jan 1993. 268p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OS21400. (Y/ER-42-D2). Order Number DE93013202. Source: OSTI; NTIS; INIS; GPO Dep.

CDM Federal Programs Corporation (CDM Federal) was contracted by Energy Systems to prepare a Phase II Sampling Plan to describe the field investigation work necessary to address regulatory agency review comments on the Remedial Investigation of the Filled Coal Ash Pond (FCAP)/Upper McCoy Branch, Chestnut Ridge Operable Unit 2 at the Y-12 Plant, conducted by CH2M Hill in 1990. The scope and approach of the field investigation described in this plan specifically focus on deficiencies noted by the regulators in discussions at the comment resolution meeting of May 8, 1992, in Oak Ridge, Tennessee. This Phase II Sampling Plan includes a field sampling plan, a field and laboratory quality assurance project plan, a health and safety plan, a waste management plan, and appendixes providing an update to the applicable or relevant and appropriate requirements for this site and field and laboratory testing methods and procedures.

758 (DOE/RL-90-0041) Hanford land disposal restrictions plan for mixed wastes. USDOE Richland Operations Office, WA (United States). Oct 1990. 205p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91007156. Source: OSTI; NTIS; INIS; GPO Dep.

Since the early 1940s, the Hanford Site has been involved in the production and purification of nuclear defense materials. These production activities have resulted in the generation of large quantities of liquid and solid radioactive

mixed waste. This waste is subject to regulation under authority of both the Resource Conservation and Recovery Act of 1976 (RCRA) and the Atomic Energy Act. The State of Washington Department of Ecology (Ecology), the US Environmental Protection Agency (EPA), and the US Department of Energy (DOE) have entered into an agreement, the Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement) to bring Hanford Site Operations into compliance with dangerous waste regulations. The Tri-Party Agreement was amended to require development of the Hanford Land Disposal Restrictions Plan for Mixed Wastes (this plan) to comply with land disposal restrictions requirements for radioactive mixed waste. The Tri-Party Agreement requires, and the this plan provides, the following sections: Waste Characterization Plan, Storage Report, Treatment Report, Treatment Plan, Waste Minimization Plan, a schedule, depicting the events necessary to achieve full compliance with land disposal restriction requirements, and a process for establishing interim milestones. 34 refs., 28 figs., 35 tabs.

759 (DOE/RL-90-45) Hanford Federal Facility Agreement and Consent Order: Quarterly progress report for the period ending September 30, 1990. USDOE Richland Operations Office, WA (United States). Nov 1990. 81p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91007925. Source: OSTI; NTIS; GPO Dep.

This is the sixth quarterly report as required by the Hanford Federal Facility Agreement and Consent Order (Ecology et al. 1989), also known as the Tri-Party Agreement, established between the US Department of Energy, the US Environmental Protection Agency (EPA), and the Washington State Department of Ecology (Ecology). The Tri-Party Agreement sets the plan and schedule for achieving regulatory compliance and cleanup of waste sites at the Hanford Site. This report covers progress for the quarter that ended September 30, 1990. 32 refs., 1 fig.

760 (DOE/RL-93-11) 1993 report on Hanford Site land disposal restrictions for mixed wastes. Black, D. USDOE Richland Field Office, WA (United States). Apr 1993. 212p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93016353. Source: OSTI; NTIS; INIS; GPO Dep.

Since the early 1940s, the contractors at the Hanford Site have been involved in the production and purification of nuclear defense materials. These production activities have resulted in the generation of large quantities of liquid and solid radioactive mixed waste (RMW). This waste is subject to regulation under authority of both the Resource Conservation and Recovery Act of 1976²(RCRA) and Atomic Energy Act³. This report covers mixed waste only. Hazardous waste that is not contaminated with radionuclides is not addressed in this report. The Washington State Department of Ecology, US Environmental Protection Agency, and US Department of Energy have entered into an agreement, the Hanford Federal Facility Agreement and Consent Order¹ (commonly referred to as the Tri-Party Agreement) to bring the Hanford Site operations into compliance with dangerous waste regulations. The Tri-Party Agreement required development of the original land disposal restrictions (LDR) plan and its annual updates to comply with LDR requirements for RMW. This report is the third update of the plan first issued in 1990. The Tri-Party Agreement requires, and the baseline plan and annual update reports provide, the information that follows: Waste characterization information; storage data;

treatment information; waste reduction information; schedule; and progress.

761 (DOE/RL-93-15) Radioactive air emissions notice of construction for the Waste Receiving And Processing facility. USDOE Richland Field Office, WA (United States). Feb 1993. 42p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93016356. Source: OSTI; NTIS; INIS; GPO Dep.

The mission of the Waste Receiving And Processing (WRAP) Module 1 facility (also referred to as WRAP 1) includes: examining, assaying, characterizing, treating, and repackaging solid radioactive and mixed waste to enable permanent disposal of the wastes in accordance with all applicable regulations. The solid wastes to be handled in the WRAP 1 facility include low-level waste (LLW), transuranic (TRU) waste, TRU mixed wastes, and low-level mixed wastes (LLMW). Airborne releases from the WRAP 1 facility will be primarily in particulate forms (99.999 percent of total unabated emissions). The release of two volatilized radionuclides, tritium and carbon-14 will contribute less than 0.001 percent of the total unabated emissions. Table 2-1 lists the radionuclides which are anticipated to be emitted from WRAP 1 exhaust stack. The Clean Air Assessment Package 1988 (CAP-88) computer code (WHC 1991) was used to calculate effective dose equivalent (EDE) from WRAP 1 to the maximally exposed offsite individual (MEI), and thus demonstrate compliance with WAC 246-247. Table 4-1 shows the dose factors derived from the CAP-88 modeling and the EDE for each radionuclide. The source term (i.e., emissions after abatement in curies per year) are multiplied by the dose factors to obtain the EDE. The total projected EDE from controlled airborne radiological emissions to the offsite MEI is $1.31\text{E-}03$ mrem/year. The dose attributable to radiological emissions from WRAP 1 will, then, constitute 0.013 percent of the WAC 246-247 EDE regulatory limit of 10 mrem/year to the offsite MEI.

762 (DOE/RL-93-16) Application for approval to construct the Waste Receiving And Processing facility. USDOE Richland Field Office, WA (United States). Feb 1993. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93016355. Source: OSTI; NTIS; INIS; GPO Dep.

The following Application For Approval Of Construction is being submitted by the US Department of Energy, Richland Field Office pursuant to 40 CFR 61.07, "Application for Approval of Construction or Modification," for the Waste Receiving and Processing (WRAP) Module 1 facility (also referred to as WRAP 1). The WRAP 1 facility will be a new source of radioactive emissions to the atmosphere. The WRAP 1 facility will be housed in the new 2336-W Building, which will be located in the 200 West Area south of 23rd Street and west of Dayton Avenue. The 200 West Area is located within the boundary of the Hanford Site. The mission of the WRAP 1 facility is to examine, assay, characterize, treat, and repackaging solid radioactive and mixed waste to enable permanent disposal of the waste in accordance with all applicable regulations. The solid wastes to be handled in the WRAP 1 facility include low-level waste (LLW), Transuranic (TRU) waste, TRU mixed waste, and low-level mixed waste (LLMW). The WRAP 1 facility will only accept contact handled (CH) waste containers. CH waste is a waste category whose external surface dose rate does not exceed 200 mrem/h. These containers have a surface dose rate of less than 200 mrem/h.

763 (DOE/RL-93-76) Hanford Federal Facility state of Washington leased land. USDOE Richland Operations Office, WA (United States). Nov 1993. 531p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94007991. Source: OSTI; NTIS; INIS; GPO Dep.

This report was prepared to provide information concerning past solid and hazardous waste management practices for all leased land at the US DOE Hanford Reservation. This report contains sections including land description; land usage; ground water, air and soil monitoring data; and land uses after 1963. Numerous appendices are included which provide documentation of lease agreements and amendments, environmental assessments, and site surveys.

764 (DOE/RL-94-10-Vol.1-Pt.1) Hanford Site annual dangerous waste report: Volume 1, Part 1, Generator dangerous waste report dangerous waste: Calendar Year 1993. USDOE Richland Field Office, WA (United States). [1993]. 532p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94012311. Source: OSTI; NTIS; GPO Dep.

This report contains information on hazardous wastes at the Hanford Site. Information consists of shipment date, physical state, chemical nature, weight, waste description, and waste designation.

765 (DOE/RL-94-10-Vol.1-Pt.2) Hanford Site annual dangerous waste report: Volume 1, Part 2, Generator dangerous waste report dangerous waste: Calendar Year 1993. USDOE Richland Field Office, WA (United States). [1993]. 533p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94012312. Source: OSTI; NTIS; GPO Dep.

This report contains information on hazardous wastes at the Hanford Site. Information consists of shipment date, physical state, chemical nature, weight, waste description, and waste designation.

766 (DOE/RL-94-10-Vol.2) Hanford Site annual dangerous waste report: Volume 2, Generator dangerous waste report radioactive mixed waste: Calendar Year 1993. USDOE Richland Field Office, WA (United States). [1993]. 507p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94012313. Source: OSTI; NTIS; GPO Dep.

This report contains information on radioactive mixed wastes at the Hanford Site. Information consists of shipment date, physical state, chemical nature, weight, waste description, and waste designation.

767 (DOE/RL-94-10-Vol.3-Pt.1) Hanford Site annual dangerous waste report: Volume 3, Part 1, Waste management facility report dangerous waste: Calendar Year 1993. USDOE Richland Field Office, WA (United States). [1993]. 356p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94012314. Source: OSTI; NTIS; GPO Dep.

This report contains information on hazardous wastes at the Hanford Site. Information consists of shipment date, physical state, chemical nature, waste description, handling method and containment vessel, waste number, waste designation, and amount of waste.

768 (DOE/RL-94-10-Vol.3-Pt.2) Hanford Site annual dangerous waste report: Volume 3, Part 2, Waste management facility report dangerous waste: Calendar Year 1993. USDOE Richland Field Office, WA (United States). [1993]. 316p. Sponsored by USDOE, Washington, DC

(United States). Order Number DE94012315. Source: OSTI; NTIS; GPO Dep.

This report contains information on hazardous wastes at the Hanford Site. Information consists of shipment date, physical state, chemical nature, waste description, handling method and containment vessel, waste number, waste designation, and amount of waste.

769 (DOE/RL-94-10-Vol.4) Hanford site annual dangerous waste report: Volume 4, Waste management facility report radioactive mixed waste: Calendar Year 1993. USDOE Richland Field Office, WA (United States). [1993]. 342p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94012316. Source: OSTI; NTIS; GPO Dep.

This report contains information on hazardous waste at the Hanford site. Information consists of shipment date, physical state, chemical nature, waste description, handling method and containment vessel, waste number, waste designation, and amount of waste.

770 (DOE/RL-94-10-Vol.5) Hanford Site annual dangerous waste report: Volume 5, Supplement waste minimization report: Calendar Year 1993. USDOE Richland Field Office, WA (United States). [1993]. 13p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94012317. Source: OSTI; NTIS; GPO Dep.

This report contains procedures by which generated wastes were minimized or eliminated.

771 (DOE/RL-94-15) National emission standards for hazardous air pollutants application for approval to stabilize the 105N Basin. USDOE Richland Operations Office, WA (United States). [1994]. 104p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94010338. Source: OSTI; NTIS; INIS; GPO Dep.

The 105N Basin (basin) Stabilization will place the basin in a radiologically and environmentally safe condition so that it can be decommissioned at a later date. The basin stabilization objectives are to inspect for Special Nuclear Material (SNM) (i.e., fuel assemblies and fuel pieces), remove the water from the basin and associated pits, and stabilize the basin surface. The stabilization will involve removal of basin hardware, removal of basin sediments, draining of basin water, and cleaning and stabilizing basin surfaces-to prevent resuspension of radioactive emissions to the air. These activities will be conducted in accordance with all applicable regulations. The basin is in the 105N Building, which is located in the 100N Area. The 100N Area is located in the Northern portion of the Hanford Site approximately 35 miles northwest of the city of Richland, Washington. The basin is a reinforced unlined concrete structure 150 feet long, 50 feet wide, and 24 feet deep. The basin is segregated into seven areas sharing a common pool of water; the Discharge/Viewing ("D") Pit, the fuel segregation pit (including a water tunnel that connects the "D" pit and segregation pit), two storage basins designated as North Basin and South Basin, two cask load-out pits, and a fuel examination area. The North Basin floor is entirely covered and the South Basin is partly covered by a modular array of cubicles formed by boron concrete posts and boron concrete panels.

772 (DOE/RL/11946-1-Vol.3) Preliminary design for the Waste Receiving And Processing Facility Module 1: Volume 3, Outline specifications. United Engineers and Constructors, Inc., Englewood, CO (United States). Western Operations. Mar 1992. 513p. Sponsored by USDOE,

Washington, DC (United States). DOE Contract AC06-91RL11946. Order Number DE92015017. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents specifications related to the buildings and equipment of the wrap facility. The facility will retrieve, process, and certify transuranic, mixed, and low-level radioactive wastes for disposal. (CBS)

773 (DOE/RL/11946-1-Vol.4) Waste Receiving and Processing Facility, Module 1: Volume 4, Project cost estimate. United Engineers and Constructors, Inc., Englewood, CO (United States). Western Operations. Mar 1992. 160p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-91RL11946. Order Number DE92015018. Source: OSTI; NTIS; INIS; GPO Dep.

This Report for the Waste Receiving and Processing (WRAP) Module 1 facility provides the Preliminary Design project cost estimate and the project construction schedule. The WRAP facility will retrieve and process transuranic, mixed, and low-level radioactive wastes for certification/preparation for disposal.

774 (DOE/RL/11946-1-Vol.5) Waste Receiving and Processing Facility, Module 1: Volume 5, Engineering studies. United Engineers and Constructors, Inc., Englewood, CO (United States). Western Operations. Mar 1992. 1188p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-91RL11946. Order Number DE92015019. Source: OSTI; NTIS; INIS; GPO Dep.

The WRAP facility at Hanford will retrieve, process, certify transuranic, mixed, and low level radioactive wastes for disposal/either on-site or at the WIPP. The Conceptual Design Report for the Waste Receiving And Processing Facility, Module 1 (WRAP 1), established the technical benchmark. The UE&C Engineering Proposal/Work Plan proposed twenty Evaluation/Optimization Engineering Studies to evaluate design alternatives and critically examine functional performance requirements prior to commencement of Preliminary Design. Of these twenty studies, one has been eliminated as unnecessary (The Use of Scintered Metal Filters) due mainly to the lack of National Standards and to the fact that standard HEPA type filters are totally adequate for WRAP application. This report presents an executive summary of the remaining nineteen studies.

775 (DOE/RL/11946-1-Vol.6) Waste Receiving and Processing Facility, Module 1: Volume 6, Engineering assessments. United Engineers and Constructors, Inc., Englewood, CO (United States). Western Operations. Mar 1992. 949p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-91RL11946. Order Number DE92015020. Source: OSTI; NTIS; INIS; GPO Dep.

This report evaluates the ability of the WRAP Module 1 Facility to achieve the required material throughput by developing a time and motion simulation model of the facility using the WITNESS Simulation Program. Analysis of the simulation model indicated that the required throughput of 6825 drums per year based on working 5.5 hours in the Shipping & Receiving and Waste Process areas and 7 hours in the NDA/NDE area for 175 days a year, as stated in the Functional Design Criteria (FDC) Rev. 1 and Supplemental Design Requirements Document (SDRD) Rev. 1, can be achieved.

776 (DOE/RL/11946-1-Vol.7) Waste Receiving and Processing Facility, Module 1: Volume 7, Project design criteria. United Engineers and Constructors, Inc., Englewood, CO (United States). Western Operations. Mar 1992.

247p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-91RL11946. Order Number DE92015021. Source: OSTI; NTIS; INIS; GPO Dep.

This Project Design Criteria document for the WRAP facility at the Hanford Site is presented within a systems format. The WRAP Module 1 facility has been categorized into eight (8) engineering systems for design purposes. These systems include: receiving, shipping and storage, nondestructive assay/nondestructive examination (NDA/NDE), waste process, internal transportation, building, heating ventilation and air conditioning (HVAC), process control, and utilities. Within each system section of this document, the system-specific requirements are identified. The scope of the system is defined, the design goals are identified and the functional requirements are detailed.

777 (DOE/RL/11946-2-Vol.1) **Conceptual design for the Waste Receiving and Processing facility Module 2A: Conceptual Design Report: Volume 1.** United Engineers and Constructors, Inc., Englewood, CO (United States). Western Operations. Jul 1992. 231p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-91RL11946. Order Number DE92019841. Source: OSTI; NTIS; INIS; GPO Dep.

Engineering drawings for this project are identified as CAPE-3035. Inquiries may be directed to: Office of Scientific and Technical Information, P.O. Box 62, Oak Ridge, TN 37831.

This is a Conceptual Design Report (CDR) for the Waste Receiving and Processing (WRAP) Module 2A facility at Hanford Reservation. The mission of the WRAP Module 2A facility is to receive, process, package, certify, and ship for permanent burial at the Hanford site disposal facilities those contact handled (CH) low-level radioactive mixed wastes (LLMW) that: (1) are currently in retrievable storage at the Hanford Central Waste Complex (HCWC) awaiting a treatment capability to permit permanent disposal compliant with the Land Disposal Restrictions and; (2) are forecasted to be generated over the next 30 years. The primary sources of waste to be treated at WRAP Module 2A include the currently stored waste from the 183-H solar basin evaporators, secondary solids from the future Hanford site liquid effluent treatment facilities, thermal treatment facility ash, other WRAP modules, and other, miscellaneous waste from storage and onsite/offsite waste generators consisting of compactible and non-compactable solids, contaminated soils, and metals. This volume, Volume 1 provides a narrative of the project background, objective and justification. A description of the WRAP 2A mission, operations and project scope is also included. Significant project requirements such as security, health, safety, decontamination and decommissioning, maintenance, data processing, and quality are outlined. Environmental compliance issues and regulatory permits are identified, and a preliminary safety evaluation is provided.

778 (DOE/RL/11946-2-Vol.2) **Conceptual design for the Waste Receiving And Processing facility Module 2A: Volume 2, Project cost estimate.** United Engineers and Constructors, Inc., Englewood, CO (United States). Western Operations. Jul 1992. 156p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-91RL11946. Order Number DE92019842. Source: OSTI; NTIS; INIS; GPO Dep.

Engineering drawings for this project are identified as CAPE-3035. Inquiries may be directed to: Office of Scientific and Technical Information, P.O. Box 62, Oak Ridge, TN 37831.

This Conceptual Design Report (CDR) for the Waste Receiving and Processing (WRAP) Module 2A facility. The mission of the WRAP Module 2A facility is to receive, process, package, certify, and ship for permanent burial at the Hanford site disposal facilities those contact handled (CH) low-level radioactive mixed wastes (LLMW) that: (1) are currently in retrievable storage at the Hanford Central Waste Complex (HCWC) awaiting a treatment capability to permit permanent disposal compliant with the Land Disposal Restrictions and; (2) are forecasted to be generated over the next 30 years. This volume provides the detailed cost estimate for the WRAP 2A facility. Included in this volume is the project construction schedule.

779 (DOE/RL/11946-2-Vol.3) **Conceptual design for the Waste Receiving and Processing facility Module 2A: Outline specifications: Volume 3.** United Engineers and Constructors, Inc., Englewood, CO (United States). Western Operations. Jul 1992. 1206p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-91RL11946. Order Number DE92019843. Source: OSTI; NTIS; INIS; GPO Dep.

Engineering drawings for this project are identified as CAPE-3035. Inquiries may be directed to: Office of Scientific and Technical Information, P.O. Box 62, Oak Ridge, TN 37831.

This is part of a Conceptual Design Report (CDR) for the Waste Receiving and Processing (WRAP) Module 2A facility at the Hanford Reservation. The mission of the facility is to receive, process, package, certify, and ship for permanent burial at the Hanford site disposal facilities those contact handled (CH) low-level radioactive mixed wastes (LLMW) that: (1) are currently in retrievable storage at the Hanford Central Waste Complex (HCWC) awaiting a treatment capability to permit permanent disposal compliant with the Land Disposal Restrictions and; (2) are forecasted to be generated over the next 30 years. The primary sources of waste to be treated include the currently stored waste from the 183-H solar basin evaporators, secondary solids from the future Hanford site liquid effluent treatment facilities, thermal treatment facility ash, other WRAP modules, and other miscellaneous waste from storage and onsite/offsite waste generators consisting of compactible and non-compactable solids, contaminated soils, and metals. This volume, Volume III is a compilation of the outline specifications that will form the basis for development of the Title design construction specifications. This volume contains abbreviated CSI outline specifications for equipment as well as non-equipment related construction and material items. For process and mechanical equipment, data sheets are provided with the specifications which indicate the equipment overall design parameters. This volume also includes a major equipment list.

780 (DOE/RL/11946-2-Vol.5) **Conceptual design for the Waste Receiving and Processing facility Module 2A: System descriptions: Volume 5.** United Engineers and Constructors, Inc., Englewood, CO (United States). Western Operations. Jul 1992. 196p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-91RL11946. Order Number DE92019844. Source: OSTI; NTIS; INIS; GPO Dep.

Engineering drawings for this project are identified as CAPE-3035. Inquiries may be directed to: Office of Scientific and Technical Information, P.O. Box 62, Oak Ridge, TN 37831.

This is part of a Conceptual Design Report (CDR) for the Waste Receiving and Processing (WRAP) Module 2A facility at Hanford Reservation. The mission of the WRAP Module 2A facility is to receive, process, package, certify, and ship for permanent burial at the Hanford site disposal facilities those contact handled (CH) low-level radioactive mixed wastes (LLMW) that: (1) are currently in retrievable storage at the Hanford Central Waste Complex (HCWC) awaiting a treatment capability to permit permanent disposal compliant with the Land Disposal Restrictions and; (2) are forecasted to be generated over the next 30 years. The primary sources of waste to be treated at WRAP Module 2A include the currently stored waste from the 183-H solar basin evaporators, secondary solids from the future Hanford site liquid effluent treatment facilities, thermal treatment facility ash, other WRAP modules, and other miscellaneous waste from storage and onsite/offsite waste generators consisting of compactible and non-compactible solids, contaminated soils, and metals. This volume, Volume V, provides a comprehensive conceptual design level narrative description of the process, utility, ventilation, and plant control systems. The feeds and throughputs, design requirements, and basis for process selection are provided, as appropriate. Key DOE/WHC criteria and reference drawings are delineated.

781 (DOE/RL/11946-T1-Vol.1) Waste Receiving and Processing Facility Module 2A: Advanced Conceptual Design Report: Volume 1. United Engineers and Constructors, Inc., Englewood, CO (United States). Western Operations. Mar 1994. 271p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-91RL11946. Order Number DE94012831. Source: OSTI; NTIS; GPO Dep.

Engineering drawings for this project are identified as CAPE-3079. Inquiries may be directed to: Office of Scientific and Technical Information, P.O. Box 62, Oak Ridge, TN 37831.

This ACDR was performed following completion of the Conceptual Design Report in July 1992; the work encompassed August 1992 to January 1994. Mission of the WRAP Module 2A facility is to receive, process, package, certify, and ship for permanent burial at the Hanford site disposal facilities the Category 1 and 3 contact handled low-level radioactive mixed wastes that are currently in retrievable storage at Hanford and are forecast to be generated over the next 30 years by Hanford, and waste to be shipped to Hanford from about DOE sites. This volume provides an introduction to the ACDR process and the scope of the task along with a project summary of the facility, treatment technologies, cost, and schedule. Major areas of departure from the CDR are highlighted. Descriptions of the facility layout and operations are included.

782 (DOE/RL/11946-T1-Vol.2) Waste Receiving and Processing Facility Module 2A: Advanced Conceptual Design Report: Volume 2. United Engineers and Constructors, Inc., Englewood, CO (United States). Western Operations. Mar 1994. 152p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-91RL11946. Order Number DE94012832. Source: OSTI; NTIS; GPO Dep.

Engineering drawings for this project are identified as CAPE-3079. Inquiries may be directed to: Office of Scientific and Technical Information, P.O. Box 62, Oak Ridge, TN 37831.

This volume presents the Total Estimated Cost (TEC) for the WRAP (Waste Receiving and Processing) 2A facility.

The TEC is \$81.9 million, including an overall project contingency of 25% and escalation of 13%, based on a 1997 construction midpoint. (The mission of WRAP 2A is to receive, process, package, certify, and ship for permanent burial at the Hanford site disposal facilities the Category 1 and 3 contact handled low-level radioactive mixed wastes that are currently in retrievable storage, and are forecast to be generated over the next 30 years by Hanford, and waste to be shipped to Hanford site from about 20 DOE sites.)

783 (DOE/RL/11946-T1-Vol.3A) Waste Receiving and Processing Facility Module 2A: Advanced Conceptual Design Report: Volume 3A. United Engineers and Constructors, Inc., Englewood, CO (United States). Western Operations. Mar 1994. 1266p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-91RL11946. Order Number DE94012833. Source: OSTI; NTIS; GPO Dep.

Engineering drawings for this project are identified as CAPE-3079. Inquiries may be directed to: Office of Scientific and Technical Information, P.O. Box 62, Oak Ridge, TN 37831.

Objective of this document is to provide descriptions of all WRAP 2A feed streams, including physical and chemical attributes, and describe the pathway that was used to select data for volume estimates. WRAP 2A is being designed for nonthermal treatment of contact-handled mixed low-level waste Category 1 and 3. It is based on immobilization and encapsulation treatment using grout or polymer.

784 (DOE/RL/11946-T1-Vol.3B) Waste Receiving and Processing Facility Module 2A: Advanced Conceptual Design Report: Volume 3B. United Engineers and Constructors, Inc., Englewood, CO (United States). Western Operations. Mar 1994. 564p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-91RL11946. Order Number DE94012834. Source: OSTI; NTIS; GPO Dep.

Engineering drawings for this project are identified as CAPE-3079. Inquiries may be directed to: Office of Scientific and Technical Information, P.O. Box 62, Oak Ridge, TN 37831.

This volume consists of the following sections: WRAP 2A value engineering assessment, resolution of value engineering assessment actions (white paper), HAZOP studies for identifying major safety and operability problems, and time and motion simulation.

785 (EGG-2656) Public acceptability of the use of gamma rays from spent nuclear fuel as a hazardous waste treatment process. Mincher, B.J.; Wells, R.P.; Reilly, H.J. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jan 1992. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92016826. Source: OSTI; NTIS; INIS; GPO Dep.

Three methods were used to estimate public reaction to the use of gamma irradiation of hazardous wastes as a hazardous waste treatment process. The gamma source of interest is spent nuclear fuel. The first method is Benefit-Risk Decision Making, where the benefits of the proposed technology are compared to its risks. The second analysis compares the proposed technology to the other, currently used nuclear technologies and estimates public reaction based on that comparison. The third analysis is called Analysis of Public Consent, and is based on the professional methods of the Institute for Participatory Management and Planning. The conclusion of all three methods is that the

proposed technology should not result in negative public reaction sufficient to prevent implementation.

786 (EGG-CIET-11061) **GIS analysis of the siting criteria for the Mixed and Low-Level Waste Treatment Facility and the Idaho Waste Processing Facility.** Hoskinson, R.L. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jan 1994. 40p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94008520. Source: OSTI; NTIS; GPO Dep.

This report summarizes a study conducted using the Arc/Info® geographic information system (GIS) to analyze the criteria used for site selection for the Mixed and Low-Level Waste Treatment Facility (MLLWTF) and the Idaho Waste Processing Facility (IWPF). The purpose of the analyses was to determine, based on predefined criteria, the areas on the INEL that best satisfied the criteria. The coverages used in this study were produced by importing the AutoCAD files that produced the maps for a pre site selection draft report into the GIS. The files were then converted to Arc/Info® GIS format. The initial analysis was made by considering all of the criteria as having equal importance in determining the areas of the INEL that would best satisfy the requirements. Another analysis emphasized four of the criteria as "must" criteria which had to be satisfied. Additional analyses considered other criteria that were considered for, but not included in the predefined criteria. This GIS analysis of the siting criteria for the IWPF and MLLWTF provides a logical, repeatable, and defensible approach to the determination of candidate locations for the facilities. The results of the analyses support the location of the Candidate Locations.

787 (EGG-LLW-11140) **Estimating costs of low-level radioactive waste disposal alternatives for the Commonwealth of Massachusetts.** EG and G Idaho, Inc., Idaho Falls, ID (United States). Feb 1994. 84p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94010778. Source: OSTI; NTIS; GPO Dep.

This report was prepared for the Commonwealth of Massachusetts by the Idaho National Engineering Laboratory, National Low-Level Waste Management Program. It presents planning life-cycle cost (PLCC) estimates for four sizes of in-state low-level radioactive waste (LLRW) disposal facilities. These PLCC estimates include preoperational and operational expenditures, all support facilities, materials, labor, closure costs, and long-term institutional care and monitoring costs. It is intended that this report be used as a broad decision making tool for evaluating one of the several complex factors that must be examined when deciding between various LLRW management options - relative costs. Because the underlying assumptions of these analyses will change as the Board decides how it will manage Massachusetts's waste and the specific characteristics any disposal facility will have, the results of this study are not absolute and should only be used to compare the relative costs of the options presented. The disposal technology selected for this analysis is aboveground earth-mounded vaults. These vaults are reinforced concrete structures where low-level waste is emplaced and later covered with a multi-layered earthen cap. The "base case" PLCC estimate was derived from a preliminary feasibility design developed for the Illinois Low-Level Radioactive Waste Disposal Facility. This PLCC report describes facility operations and details the procedure used to develop the base case PLCC estimate for each facility component and size. Sensitivity analyses were performed on the base case PLCC estimate

by varying several factors to determine their influences upon the unit disposal costs. The report presents the results of the sensitivity analyses for the five most significant cost factors.

788 (EGG-M-91394) **Cryofracture as a tool for pre-processing retrieved buried and stored transuranic waste.** Loomis, G.G. (EG and G Idaho, Inc., Idaho Falls, ID (United States)); Winberg, M.R.; Ancho, M.L.; Osborne, D. EG and G Idaho, Inc., Idaho Falls, ID (United States). [1992]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (CONF-920307-84: Waste management '92, Tucson, AZ (United States), 1-5 Mar 1992). Order Number DE92017842. Source: OSTI; NTIS; INIS; GPO Dep.

This paper summarizes important features of an experimental demonstration of applying the Cryofracture process to size-reduce retrieved buried and stored transuranic-contaminated wastes. By size reducing retrieved buried and stored waste, treatment technologies such as thermal treatment can be expedited. Additionally, size reduction of the waste can decrease the amount of storage space required by reducing the volume requirements of storage containers. A demonstration program was performed at the Cryofracture facility by Nuclear Remedial Technologies for the Idaho National Engineering Laboratory. Cryofracture is a size-reducing process whereby objects are frozen to liquid nitrogen temperatures and crushed in a large hydraulic press. Materials at cryogenic temperatures have low ductility and are easily size-reduced by fracturing. Six 55-gallon drums and six 2 x 2 x 8 ft boxes containing simulated waste with tracers were subjected to the Cryofracture process. Data was obtained on (a) cool-down time, (b) yield strength of the containers, (c) size distribution of the waste before and after the Cryofracture process, (d) volume reduction of the waste, and (e) sampling of air and surface dusts for spread of tracers to evaluate potential contamination spread. The Cryofracture process was compared to conventional shredders and detailed cost estimates were established for construction of a Cryofracture facility at the Idaho National Engineering Laboratory.

789 (EGG-M-91416) **Radiological and hazardous material measurement system.** Karvinen, J.R. EG and G Idaho, Inc., Idaho Falls, ID (United States). [1992]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. (CONF-920307-82: Waste management '92, Tucson, AZ (United States), 1-5 Mar 1992). Order Number DE92017857. Source: OSTI; NTIS; INIS; GPO Dep.

Existing nuclear waste assay systems do not have the measurement threshold or volume production rate capabilities required for a meaningful remediation of the significant amounts of nuclear waste at many of the DOE facilities. The conceptual design of the Radiological and Hazardous Material Measurement System, (RHMMS) was in response to engineering requirements for the remediation of uncharacterized buried nuclear waste in the Radioactive Waste Management Complex (RWMC) at the Idaho National Engineering Laboratory (INEL). The RHMMS is an integrated, multi-measurement processor with projected capabilities of measuring fissile and fertile materials to threshold levels below 10 nCi/g, at a volume production rate approaching 300 barrel equivalents per day. The processor also has the waste refinement capability of removing material which exceeds transuranic (TRU) levels from the bulk waste material. This paper addresses only the development of the measurement systems required for characterizing the waste.

790 (EGG-M-91423) **BWID System Design Study.** O'Brien, M.C.; Rudin, M.J.; Morrison, J.L.; Richardson, J.G. EG and G Idaho, Inc., Idaho Falls, ID (United States). [1991]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. (CONF-920307-85: Waste management '92, Tucson, AZ (United States), 1-5 Mar 1992). Order Number DE92017899. Source: OSTI; NTIS; INIS; GPO Dep.

The mission of the Buried Waste Integrated Demonstration (BWID) System Design Study is to identify and evaluate technology process options for the cradle-to-grave remediation of Transuranic (TRU)-Contaminated Waste Pits and Trenches buried at the Idaho National Engineering Laboratory (INEL). Emphasis is placed upon evaluating system configuration options and associated functional and operational requirements for retrieving and treating the buried wastes. A Performance-Based Technology Selection Filter was developed to evaluate the identified remediation systems and their enabling technologies based upon system requirements and quantification of technical Comprehensive Environmental Response, Compensation, and Liability (CERCLA) balancing criteria. Remediation systems will also be evaluated with respect to regulatory and institutional acceptance and cost-effectiveness.

791 (EGG-M-91476) **An overview of commercial low-level radioactive waste disposal technology.** Plummer, T.L.; Morreale, B.J. EG and G Idaho, Inc., Idaho Falls, ID (United States). [1991]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. (CONF-9109305-1: Conference on low level radioactive waste management and disposal, Petersburg, VA (United States), 26 Sep 1991). Order Number DE92003301. Source: OSTI; NTIS; INIS; GPO Dep.

The primary objective of low-level radioactive (LLW) waste management is to safely dispose of LLW while protecting the health of the public and the quality of the environment. LLW in the United States is generated through both Department of Energy (DOE) and commercial activities. In this paper, waste from commercial activities will be referred to as "commercial LLW." The DOE waste will not be discussed in this paper. Commercial LLW is waste that is generated by Nuclear Regulatory Commission (NRC) designated licensees or Agreement States. Commercial LLW is generated by nuclear power reactors, hospitals, universities, and manufacturers. This paper will give an overview of the current disposal technologies planned by selected States' for disposing of their LLW and the processes by which those selections were made. 3 refs.

792 (EGG-M-91481) **In situ vitrification on buried waste.** Bates, S.O. EG and G Idaho, Inc., Idaho Falls, ID (United States). [1992]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (CONF-920307-83: Waste management '92, Tucson, AZ (United States), 1-5 Mar 1992). Order Number DE92017840. Source: OSTI; NTIS; INIS; GPO Dep.

In situ vitrification (ISV) is being evaluated as a remedial treatment technology for buried mixed and transuranic (TRU) wastes at the Subsurface Disposal Area (SDA) at Idaho National Engineering Laboratory (INEL) and can be related to buried wastes at other Department of Energy (DOE) sites. There are numerous locations around the DOE Complex where wastes were buried in the ground or stored for future burial. The Buried Waste Program (BWP) is conducting a comprehensive Environmental Response,

Compensation, and Liability Act (CERCLA) remedial investigation/feasibility study (RI/FS) for the Department of Energy - Field Office Idaho (DOE-ID). As part of the RI/FS, an ISV scoping study on the treatability of the SDA mixed low-level and mixed TRU waste is being performed for applicability to remediation of the waste at the Radioactive Waste Management Complex (RWMC). The ISV project being conducted at the INEL by EG&G Idaho, Inc. consists of a treatability investigation to collect data to satisfy nine CERCLA criteria with regards to the SDA. This treatability investigation involves a series of experiments and related efforts to study the feasibility of ISV for remediation of mixed and TRU waste disposed of at the SDA.

793 (EGG-M-91495) **Gamma-ray decomposition of PCBs.** Mincher, B.J.; Meikrantz, D.H.; Arbon, R.E.; Murphy, R.J. EG and G Idaho, Inc., Idaho Falls, ID (United States). [1991]. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. (CONF-9110277-1: Florida environmental chemistry conference, Palm Coast, FL (United States), 30 Oct - 1 Nov 1991). Order Number DE92003319. Source: OSTI; NTIS; INIS; GPO Dep.

This program is the Idaho National Engineering Laboratory (INEL) component of a joint collaborative effort with Lawrence Livermore National Laboratory (LLNL). The purpose of this effort is to demonstrate a viable process for breaking down hazardous halogenated organic wastes to simpler, non-hazardous wastes using high energy ionizing radiation. The INEL effort focuses on the use of spent reactor fuel gamma radiation sources to decompose complex wastes such as PCBs. At LLNL, halogenated solvents such as carbon tetrachloride and trichloroethylene are being studied using accelerator radiation sources. The INEL irradiation experiments concentrated on a single PCB congener so that a limited set of decomposition reactions could be studied. The congener 2, 2', 3, 3', 4, 5', 6, 6'-octachlorobiphenyl was examined following exposure to various gamma doses at the Advanced Test Reactor (ATR) spent fuel pool. The decomposition rates and products in several solvents are discussed. 7 refs., 13 figs., 1 tab.

794 (EGG-M-92051) **ISOCELL™ proof-of-concept for retrieval of wastes and contaminated soil.** Chatwin, T.D. (EG and G Idaho, Inc., Idaho Falls, ID (United States)); Krieg, R.K. EG and G Idaho, Inc., Idaho Falls, ID (United States). [1992]. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. (CONF-920459-3: Federal environmental restoration conference and exhibition, Washington, DC (United States), 15-17 Apr 1992). Order Number DE92017843. Source: OSTI; NTIS; INIS; GPO Dep.

ISOCELL™ cryogenic technology is designed to immobilize buried hazardous, radioactive, and mixed waste and contaminated soil by creating a block of frozen waste and soil that can be safely retrieved, stored, transported, and treated with a minimum of dust or aerosol production. A "proof-of-concept" test of the ISOCELL process was conducted in clean soil by RKK, Ltd., for the Idaho National Engineering Laboratory (INEL). Results indicate ISOCELL technology successfully froze moist soil into a solid block capable of being lifted and retrieved. Test conditions were compared to characteristics of possible buried waste sites in the INEL.

795 (EGG-M-92097) **Report of results of the vapor vacuum extraction test at the Radioactive Waste Management Complex (RWMC) on the Idaho National**

Engineering Laboratory (INEL) in the state of Idaho. Chatwin, T.D.; Miyasaki, D.H.; Sisson, J.B.; Sondrup, A.J. EG and G Idaho, Inc., Idaho Falls, ID (United States). [1992]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. (CONF-9202121-1: 18. environmental symposium and exhibition, Alexandria, VA (United States), 24-27 Feb 1992). Order Number DE92017920. Source: OSTI; NTIS; INIS; GPO Dep.

A test-scale vapor vacuum extraction (VVE) system was installed and operated at the Radioactive Waste Management Complex (RWMC) on the Idaho National Engineering Laboratory (INEL), which is west of Idaho Falls, Idaho and is managed by the US Department of Energy Idaho Field Office. The system was constructed for the purpose of demonstrating the feasibility of VVE or vapor venting technology to abate a volatile organic compound (VOC) plume located in the vadose zone below the subsurface disposal area at the complex. To date, the system has been operated for two periods, a two-week test and a four-month test. The purpose of the two-week test was to determine what would be extracted from the borehole and to verify the design of the system to handle what would be extracted.

796 (EGG-M-92121) Implementation of the buried waste integrated demonstration. Kostelnik, K.M.; Merrill, S.K. EG and G Idaho, Inc., Idaho Falls, ID (United States). [1992]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. (CONF-920851-79: Spectrum '92: nuclear and hazardous waste management international topical meeting, Boise, ID (United States), 23-27 Aug 1992). Order Number DE92019762. Source: OSTI; NTIS; INIS; GPO Dep.

The Department of Energy (DOE), Office of Technology Development (OTD) has initiated the Buried Waste Integrated Demonstration (BWID) to resolve technological deficiencies associated with the remediation of radioactive and hazardous buried waste. The BWID mission is to identify, demonstrate, and transfer innovative technologies for the remediation of DOE buried waste. To accomplish the mission, BWID is using a systems approach which supports the development of a suite of advanced and innovative technologies for the effective and efficient remediation of buried waste. This systems approach includes technologies for the entire remediation cycle. Specifically, BWID sponsors technology development in the following technology categories: site and waste characterization, retrieval, pre-processing, ex situ treatment, packaging, transportation, storage, disposal, and post-disposal monitoring.

797 (EGG-M-92226) Thermal processing systems for TRU mixed waste. Eddy, T.L.; Raivo, B.D.; Anderson, G.L. EG and G Idaho, Inc., Idaho Falls, ID (United States). [1992]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. (CONF-920851-61: Spectrum '92: nuclear and hazardous waste management international topical meeting, Boise, ID (United States), 23-27 Aug 1992). Order Number DE92018016. Source: OSTI; NTIS; INIS; GPO Dep.

This paper presents preliminary ex situ thermal processing system concepts and related processing considerations for remediation of transuranic (TRU)-contaminated wastes (TRUW) buried at the Radioactive Waste Management Complex (RWMC) of the Idaho National Engineering Laboratory (INEL). Anticipated waste stream components and problems are considered. Thermal processing conditions required to obtain a high-integrity, low-leachability glass/

ceramic final waste form are considered. Five practical thermal process system designs are compared. Thermal processing of mixed waste and soils with essentially no pre-sorting and using incineration followed by high temperature melting is recommended. Applied research and development necessary for demonstration is also recommended.

798 (EGG-M-92301) Gamma radiolysis of chlorinated hydrocarbons. Arbon, R.E.; Mincher, B.J.; Meikrantz, D.H. EG and G Idaho, Inc., Idaho Falls, ID (United States). [1992]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. (CONF-920851-59: Spectrum '92: nuclear and hazardous waste management international topical meeting, Boise, ID (United States), 23-27 Aug 1992). Order Number DE92018028. Source: OSTI; NTIS; GPO Dep.

This program is the Idaho National Engineering Laboratory (INEL) component of a joint collaborative effort with Lawrence Livermore National Laboratory (LLNL). The purpose of this effort is to demonstrate a viable process for breaking down hazardous halogenated organic wastes to simpler, non-hazardous waste using high energy ionizing radiation. The INEL effort focuses on the use of spent reactor fuel gamma radiation sources to decompose complex wastes such as PCBs. At LLNL, halogenated solvents such as carbon tetrachloride and trichloroethylene are being studied using accelerator radiation sources. The INEL irradiation experiments concentrated on a single PCB congener so that a limited set of decomposition reactions could be studied. The congener 2,2', 3,3',4,5',6,6' - octachlorobiphenyl was examined following exposure to various gamma doses at the Advanced Test Reactor (ATR) spent fuel pool. The decomposition rates and products in several solvents are discussed. 3 refs.

799 (EGG-M-92308) Calibration of Far West Technology (FWT-60) radiachromic dye dosimeters. Mincher, B.J.; Zaidi, M.K. EG and G Idaho, Inc., Idaho Falls, ID (United States). [1992]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. (CONF-920702-1: 10. international conference on solid state dosimetry, Washington, DC (United States), 13-17 Jul 1992). Order Number DE92018014. Source: OSTI; NTIS; INIS; GPO Dep.

Radiachromic dye dosimetry was used to measure kilogray doses absorbed by various liquid samples during gamma-ray exposure in a spent nuclear fuel pool. The source of nuclear fuel was the Advanced Test Reactor (ATR) at the Idaho National Engineering Laboratory (INEL). Calibrations were performed using a ⁶⁰Co source and were run on bare dosimeters, as well as on dosimeters which mocked to simulate the samples. These dosimeters were prepared as a dye-impregnated nylon film and are commercially available. When exposed to gamma-ray doses of 0.5 to 200 kGy, a color change occurs which has an optical density proportional to absorbed dose. The difference in the calibration curves demonstrated the importance of irradiation of dosimeters under conditions as close to the actual samples as possible. Since these dosimeters could not be immersed directly in the organic solutions of interest, they were sandwiched between layers of lucite and stainless steel. This simulated the conditions inside an irradiated sample and provides a practical method of measuring absorbed doses. The reproducibility of measurements using the radiachromic dye dosimeters is also shown. 10 refs.

800 (EGG-M-92342) An overview of In situ waste treatment technologies. Walker, S.; Hyde, R.A.; Piper, R.B.; Roy, M.W. EG and G Idaho, Inc., Idaho Falls, ID (United States). [1992]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. (CONF-920851-57: Spectrum '92: nuclear and hazardous waste management international topical meeting, Boise, ID (United States), 23-27 Aug 1992). Order Number DE92018012. Source: OSTI; NTIS; INIS; GPO Dep.

In situ technologies are becoming an attractive remedial alternative for eliminating environmental problems. In situ treatments typically reduce risks and costs associated with retrieving, packaging, and storing or disposing waste and are generally preferred over ex situ treatments. Each in situ technology has specific applications, and, in order to provide the most economical and practical solution to a waste problem, these applications must be understood. This paper presents an overview of thirty different in situ remedial technologies for buried wastes or contaminated soil areas. The objective of this paper is to familiarize those involved in waste remediation activities with available and emerging in situ technologies so that they may consider these options in the remediation of hazardous and/or radioactive waste sites. Several types of in situ technologies are discussed, including biological treatments, containment technologies, physical/chemical treatments, solidification/stabilization technologies, and thermal treatments. Each category of in situ technology is briefly examined in this paper. Specific treatments belonging to these categories are also reviewed. Much of the information on in situ treatment technologies in this paper was obtained directly from vendors and universities and this information has not been verified.

801 (EGG-M-92586) A new probe for In situ TDR moisture measurement. Yokuda, E. (EG and G Idaho, Inc., Idaho Falls, ID (United States)); Smith, R. EG and G Idaho, Inc., Idaho Falls, ID (United States). [1993]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. (CONF-930561-5: 39. international instrumentation symposium, Albuquerque, NM (United States), 2-6 May 1993). Order Number DE93013681. Source: OSTI; NTIS; INIS; GPO Dep.

This paper explains the development of a new Time Domain Reflectometry (TDR) probe which can be inserted through waste and soil to a depth of 14 feet with minimal labor and minimal soil disturbance. TDR has been used for 10 years as a method for measuring soil moisture contents. Conventional TDR probes are 30 centimeters long and therefore are difficult to insert at depths below a few feet. Recently, a probe has been developed which can be inserted to depths of 14 feet with the use of a vibratory drill. Quality objectives for the instrument, preliminary data, and suggestions for future developments are presented.

802 (EGG-M-92597) Three-dimensional model of heat transport during In Situ Vitrification with melting and cool down. Hawkes, G.L. EG and G Idaho, Inc., Idaho Falls, ID (United States). [1993]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. (CONF-930830-24: National conference and exposition on heat transfer, Atlanta, GA (United States), 8-11 Aug 1993). Order Number DE93016556. Source: OSTI; NTIS; INIS; GPO Dep.

A potential technology for permanent remediation of buried wastes is the In Situ Vitrification (ISV) process. This process uses electrical resistance heating to melt waste and contaminated soil in place to produce a durable, glasslike

material that encapsulates and immobilizes buried wastes. The magnitude of the resulting electrical resistance heating is sufficient to cause soil melting. As the molten region grows, surface heat losses cause the soil near the surface to re solidify. This paper presents numerical results obtained by considering heat transport and melting when solving the conservation of mass and energy equations using finite element methods. A local heat source is calculated by solving the electric field equation and calculating a Joule Heat source term. The model considered is a three-dimensional model of the electrodes and surrounding soil. Also included in the model is subsidence; where the surface of the melted soil subsides due to the change in density when the soil melts. A power vs. time profile is implemented for typical ISV experiments. The model agrees well with experimental data for melt volume and melt shape.

803 (EGG-M-92598) Rapid geophysical surveyor. Roybal, L.G.; Carpenter, G.S.; Josten, N.E. EG and G Idaho, Inc., Idaho Falls, ID (United States). [1993]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. (CONF-9304109-5: SAGEEP '93: symposium on the application of geophysics to environmental and engineering problems, San Diego, CA (United States), 18-21 Apr 1993). Order Number DE93016637. Source: OSTI; NTIS; INIS; GPO Dep.

The Rapid Geophysical Surveyor (RGS) is a system designed to rapidly and economically collect closely-spaced geophysical data used for characterization of Department of Energy (DOE) waste sites. Geophysical surveys of waste sites are an important first step in the remediation and closure of these sites; especially older sites where historical records are inaccurate and survey benchmarks have changed due to refinements in coordinate controls and datum changes. Closely-spaced data are required to adequately differentiate pits, trenches, and soil vault rows whose edges may be only a few feet from each other. A prototype vehicle designed to collect magnetic field data was built at the Idaho National Engineering Laboratory (INEL) during the summer of 1992. The RGS was one of several projects funded by the Buried Waste Integrated Demonstration (BWID) program. This vehicle was demonstrated at the Subsurface Disposal Area (SDA) within the Radioactive Waste Management Complex (RWMC) on the INEL in September of 1992. Magnetic data were collected over two areas in the SDA, with a total survey area of about 1.7 acres. Data were collected at a nominal density of 2 1/2 inches along survey lines spaced 1 foot apart. Over 350,000 data points were collected over a 6 day period corresponding to about 185 man-days using conventional ground survey techniques. This report documents the design and demonstration of the RGS concept including the presentation of magnetic data collected at the SDA. The surveys were able to show pit and trench boundaries and determine details of their spatial orientation never before achieved.

804 (EGG-M-92605) Mechanisms of contaminant migration from grouted waste. Magnuson, S.O. (EG and G Idaho, Inc., Idaho Falls, ID (United States)); Yu, A.D. EG and G Idaho, Inc., Idaho Falls, ID (United States); Westinghouse Savannah River Co., Aiken, SC (United States). [1992]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570 ; AC09-89SR18035. (CONF-921137-11: 14. low-level radioactive waste management conference, Phoenix, AZ (United States), 18-20 Nov 1992). Order Number DE93005192. Source: OSTI; NTIS; INIS; GPO Dep.

Low-level radioactive decontaminated salt solution is generated at the Savannah River Site (SRS) from the In-Tank Precipitation process. The solution is mixed with cement, slag, and fly ash, to form a grout, termed "Saltstone", that will be disposed in concrete vaults at the Saltstone Disposal Facility (SDF) [1]. Of the contaminants in the Saltstone, the greatest concern to SRS is the potential release of nitrate to the groundwater because of the high initial nitrate concentration (0.25 g/cm^3) in the Saltstone and the low Safe Drinking Water Act (SDWA) maximum contaminant level (MCL) of 44 mg/L. The SDF is designed to allow a slow, controlled release over thousands of years. This paper addresses a modeling study of nitrate migration from intact non-degraded concrete vaults in the unsaturated zone for the Radiological Performance Assessment (PA) of the SRS Saltstone Disposal Facility [3]. The PA addresses the performance requirements mandated by DOE Order 5820.2A [4].

805 (EGG-M-92644) Hazardous waste shipment data collection from DOE sites. Page, L.A. (Idaho National Engineering Lab., Idaho Falls, ID (United States)); Kirkpatrick, T.D.; Stevens, L. EG and G Idaho, Inc., Idaho Falls, ID (United States). [1992]. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. (CONF-921137-12: 14. low-level radioactive waste management conference, Phoenix, AZ (United States), 18-20 Nov 1992). Order Number DE93005190. Source: OSTI; NTIS; INIS; GPO Dep.

Past practices at the US Department of Energy (DOE) sites for offsite release of hazardous waste are being reviewed to determine if radioactively contaminated hazardous wastes were released to commercial treatment, storage, and disposal facilities. Records indicating the presence of radioactivity in waste shipped to and treated at a commercial incineration facility led to a ban on offsite hazardous waste shipments and investigation of past practices for offsite release of hazardous waste from the DOE sites. A House of Representatives Interior and Insular Affairs Committee oversight hearing on potentially contaminated waste shipments to commercial facilities concluded that the main issue was the lack of a uniform national standard to govern disposal of mixed waste.

806 (EGG-M-92702) Processing results of 1800 gallons of mercury and radioactively contaminated mixed waste rinse solution. Thiesen, B.P. EG and G Idaho, Inc., Idaho Falls, ID (United States). [1993]. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. (CONF-930873-11: 2. international mixed waste symposium, Baltimore, MD (United States), 17-20 Aug 1993). Order Number DE93013668. Source: OSTI; NTIS; INIS; GPO Dep.

Mercury-contaminated rinse solution was successfully treated at the Idaho National Engineering Laboratory. This waste was generated during the decontamination of the Heat Transfer Reactor Experiment 3 reactor shield tank. Approximately 6.8 m^3 ($1,800 \text{ pi}$) of waste was generated and placed into 33 drums. Each drum contained precipitated sludge material ranging from 2–5 cm in depth, with the average depth of about 6 cm. The pH of each drum varied from 3–11. The bulk liquid waste had a mercury level of 7.0 mg/l, which exceeded the Resource Conservation and Recovery Act limit of 0.2 mg/l. The average liquid bulk radioactivity was about 2.1 pCi/mL while the average sludge contamination was about 13,800 pCi/g. Treatment of the waste required separation of the liquid from the sludge, filtration, pH adjustment, and ion exchange. The resulting solution

after treatment had mercury levels at 0.0186 mg/l and radioactivity of 0.282 pCi/mL.

807 (EGG-M-92714) Unsteady-state VOC transport in vented waste drums. Liekhus, K.J.; Gresham, G.L.; Peterson, E.S.; Rae, C.; Hotz, N.J.; Connolly, M.J. EG and G Idaho, Inc., Idaho Falls, ID (United States). [1993]. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. (CONF-930873-27: 2. international mixed waste symposium, Baltimore, MD (United States), 17-20 Aug 1993). Order Number DE93018941. Source: OSTI; NTIS; GPO Dep.

A model of unsteady-state volatile organic compound (VOC) transport in a vented waste drum has been developed. Model predictions of the VOC concentration in the innermost layer of confinement and the drum headspace are compared to measurements in lab-scale simulated waste drums.

808 (EGG-M-93135) Pit 9 project: A private sector initiative. Macdonald, D.W. (USDOE Idaho Field Office, Idaho Falls, ID (United States)); Hughes, F.P.; Burton, B.N. EG and G Idaho, Inc., Idaho Falls, ID (United States). [1993]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. (CONF-930873-7: 2. international mixed waste symposium, Baltimore, MD (United States), 17-20 Aug 1993). Order Number DE93013677. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses the Pit 9 Comprehensive Demonstration which is intended to demonstrate a cost-effective approach to remediate an Idaho National Engineering Laboratory (INEL) waste disposal pit through a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Interim Action. The remediation will include additional requirements, if needed, to provide high confidence that only minor additional work would be necessary to accomplish the final closure as part of the overall final closure strategy for the INEL's Subsurface Disposal Area (SDA).

809 (EGG-M-93176) Vapor vacuum extraction treatability study at the Idaho National Engineering Laboratory. Herd, M.D. (EG and G Idaho, Inc., Idaho Falls, ID (United States)); Matthern, G.; Michael, D.L.; Spang, N.; Downs, W.; Weidner, J.; Cleary, P. EG and G Idaho, Inc., Idaho Falls, ID (United States). [1993]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. (CONF-9305196-1: Center for applied development of environmental technology conference, Idaho Falls, ID (United States), 11-14 May 1993). Order Number DE93013660. Source: OSTI; NTIS; INIS; GPO Dep.

During the 1960s and early 1970s, barreled mixed waste containing volatile organic compounds (VOCs) and radioactive waste was buried at the Subsurface Disposal Area (SDA) at the Idaho National Engineering Laboratory (INEL) Radioactive Waste Management Complex (RWMC). Over time, some of the barrels have deteriorated allowing, VOC vapors to be released into the vadose zone. The primary VOC contaminants of concern are CCl_4 and trichloroethylene; however, chloroform, tetrachloroethylene, and 1,1,1-trichloroethane have also been detected. Vapor Vacuum Extraction (VVE) is one alternative being considered for remediation of the RWMC SDA vadose zone. A proposed pilot-scale treatability study (TS) will provide operation and maintenance costs for the design of the potential scale-up of the system.

810 (EGG-ME-10522) Feasibility study for an additional HEPA filter leaching system in NWCF. Willis, W.D.

EG and G Idaho, Inc., Idaho Falls, ID (United States). Nov 1992. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93007145. Source: OSTI; NTIS; INIS; GPO Dep.

This report documents the feasibility of installing a second high-efficiency particulate air (HEPA) filter leaching system in the New Waste Calcining Facility at the Idaho Chemical Processing Plant (ICPP). A large spent filter backlog already exists at the ICPP, and it has been uncertain whether the existing HEPA filter leaching system will have a throughput rate sufficient to work off the existing backlog in a timely manner. Three areas within the New Waste Calcining Facility (NWCF) have been identified as possible locations for a second filter leaching system. This report examines the suitability of each location, identifies modifications that would be necessary to install a filter leaching system at each location, examines the impact of modifying each location, and discusses recent efforts to estimate filter throughput using the existing filter leaching system. Based on all available information, installation of a second filter leaching system is not recommended at the present time.

811 (EGG-MS-9879) Technical assessment of processes to enable recycling of low-level contaminated metal waste. Reimann, G.A. EG and G Idaho, Inc., Idaho Falls, ID (United States). Oct 1991. 62p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92010488. Source: OSTI; NTIS; INIS; GPO Dep.

Accumulations of metal waste exhibiting low levels of radioactivity (LLCMW) have become a national burden, both financially and environmentally. Much of this metal could be considered as a resource. The Department of Energy was assigned the task of inventorying and classifying LLCMW, identifying potential applications, and applying and/or developing the technology necessary to enable recycling. One application for recycled LLCMW is high-quality canisters for permanent repository storage of high-level waste (HLW). As many as 80,000 canisters will be needed by 2035. Much of the technology needed to decontaminate LLCMW has already been developed, but no integrated process has been described, even on a pilot scale, for recycling LLCMW into HLW canisters. This report reviews practices for removal of radionuclides and for producing low carbon stainless steel. Contaminants that readily form oxides may be reduced to below de minimis levels and combined with a slag. Most of the radioactivity remaining in the ingot is concentrated in the inclusions. Radionuclides that chemically resemble the elements that comprise stainless steel can not be removed effectively. Slag compositions, current melting practices, and canister fabrication techniques were reviewed.

812 (EGG-MS-10613) Thermodynamics of gas-metal-slag equilibria for applications in in situ and ex situ vitrification melts. Miller, R.L.; Reimann, G.A. EG and G Idaho, Inc., Idaho Falls, ID (United States). May 1993. 51p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93016480. Source: OSTI; NTIS; INIS; GPO Dep.

An equilibrium thermodynamic model for melting mixed waste was evaluated using the STEPSOL computer code. STEPSOL uses free energy minimization techniques to predict equilibrium composition from input species and user selected species in the output. The model assumes equilibrium between gas, slag, and metallic phases. Input for the model was developed using compositional data from Pit 9 of

the Subsurface Disposal Area at the Idaho National Engineering Laboratory. Thermodynamic data were primarily from compilations published by the US Government. The results of model evaluation indicate that the amount of plutonium chloride or plutonium oxyhydroxide that would be evaporated into the vapor phase would be minor. Relatively more uranium chloride and uranium oxyhydroxide would be vaporized. However, a hazards analysis was not part of the present task. Minor amounts of plutonium and uranium would be reduced to the metallic state, but these amounts should alloy with the iron-chromium-nickel metallic phase. The vast majority of the plutonium and uranium are in the slag phase as oxides. Results of the calculations show that silica and silicates dominate the products and that the system is very reducing. The major gases are carbon monoxide and hydrogen, with lesser amounts of carbon dioxide and water. High vapor pressure metals are considered but were not analyzed using STEPSOL. STEPSOL does not make predictions of distribution of species between phases.

813 (EGG-MS-10617) TSA waste stream and final waste form composition. Grandy, J.D.; Eddy, T.L.; Anderson, G.L. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jan 1993. 33p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93013742. Source: OSTI; NTIS; INIS; GPO Dep.

A final vitrified waste form composition, based upon the chemical compositions of the input waste streams, is recommended for the transuranic-contaminated waste stored at the Transuranic Storage Area of the Radioactive Waste Management Complex at the Idaho National Engineering Laboratory. The quantities of waste are large with a considerable uncertainty in the distribution of various waste materials. It is therefore impractical to mix the input waste streams into an "average" transuranic-contaminated waste. As a result, waste stream input to a melter could vary widely in composition, with the potential of affecting the composition and properties of the final waste form. This work examines the extent of the variation in the input waste streams, as well as the final waste form under conditions of adding different amounts of soil. Five prominent Rocky Flats Plant 740 waste streams are considered, as well as nonspecial metals and the "average" transuranic-contaminated waste streams. The metals waste stream is the most extreme variation and results indicate that if an average of approximately 60 wt% of the mixture is soil, the final waste form will be predominantly silica, alumina, alkaline earth oxides, and iron oxide. This composition will have consistent properties in the final waste form, including high leach resistance, irrespective of the variation in waste stream. For other waste streams, much less or no soil could be required to yield a leach resistant waste form but with varying properties.

814 (EGG-MS-10642) Improving iron-enriched basalt with additions of ZrO_2 and TiO_2 . Reimann, G.A.; Kong, P.C. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jun 1993. 39p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94002809. Source: OSTI; NTIS; INIS; GPO Dep.

The iron-enriched basalt (IEB) waste form, developed at the Idaho National Engineering Laboratory a decade ago, was modified to IEB4 by adding sufficient ZrO_2 and TiO_2 to develop crystals of zirconolite upon cooling, in addition to the crystals that normally form in a cooling basalt. Zirconolite ($CaZrTi_2O_7$) is an extremely leach-resistant mineral with a strong affinity for actinides. Zirconolite crystals containing uranium and thorium have been found that have endured

more than 2 billion years of natural processes. On this basis, zirconolite was considered to be an ideal host crystal for the actinides contained in transuranic (TRU)-contaminated wastes. Crystals of zirconolite were developed in laboratory melts of IEB4 that contained 5% each of ZrO_2 and TiO_2 and that were slow-cooled in the 1200–1000°C range. When actinide surrogates were added to IEB4, these oxides were incorporated into the crystals of zirconolite rather than precipitating in the residual glass phase. Zirconolite crystals developed in IEB4 should stabilize and immobilize the dilute TRUs in heterogeneous, buried low-level wastes as effectively as this same phase does in the various formulations of Synroc used for the more concentrated TRUs encountered in high-level wastes. Synroc requires hot-pressing equipment, while IEB4 precipitates zirconolite from a cooling basaltic melt.

815 (EGG-MS-10646) Bench-scale arc melter for R&D in thermal treatment of mixed wastes. Kong, P.C.; Grandy, J.D.; Watkins, A.D.; Eddy, T.L.; Anderson, G.L. EG and G Idaho, Inc., Idaho Falls, ID (United States). May 1993. 150p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93016484. Source: OSTI; NTIS; INIS; GPO Dep.

A small dc arc melter was designed and constructed to run bench-scale investigations on various aspects of development for high-temperature (1,500–1,800°C) processing of simulated transuranic-contaminated waste and soil located at the Radioactive Waste Management Complex (RWMC). Several recent system design and treatment studies have shown that high-temperature melting is the preferred treatment. The small arc melter is needed to establish techniques and procedures (with surrogates) prior to using a similar melter with the transuranic-contaminated wastes in appropriate facilities at the site. This report documents the design and construction, starting and heating procedures, and tests evaluating the melter's ability to process several waste types stored at the RWMC. It is found that a thin graphite strip provides reliable starting with initial high current capability for partially melting the soil/waste mixture. The heating procedure includes (1) the initial high current-low voltage mode, (2) a low current-high voltage mode that commences after some slag has formed and arcing dominates over the receding graphite conduction path, and (3) a predominantly Joule heating mode during which the current can be increased within the limits to maintain relatively quiescent operation. Several experiments involving the melting of simulated wastes are discussed. Energy balance, slag temperature, and electrode wear measurements are presented. Recommendations for further refinements to enhance its processing capabilities are identified. Future studies anticipated with the arc melter include waste form processing development; dissolution, retention, volatilization, and collection for transuranic and low-level radionuclides, as well as high vapor pressure metals; electrode material development to minimize corrosion and erosion; refractory corrosion and/or skull formation effects; crucible or melter geometry; metal oxidation; and melt reduction/oxidation (redox) conditions.

816 (EGG-MS-10657) Property and process correlations for iron-enriched basalt waste forms. Grandy, J.D.; Eddy, T.L.; Anderson, G.L. EG and G Idaho, Inc., Idaho Falls, ID (United States). Feb 1993. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93016595. Source: OSTI; NTIS; INIS; GPO Dep.

Correlations of thermodynamic properties and process parameters of high-temperature slag for a range of compositions of iron-enriched basalt are presented. The quantification of the properties of this complex mixture can assist in the design and monitoring of high-temperature melting systems for the treatment of radioactive and hazardous wastes at the Idaho National Engineering Laboratory. The buried and stored wastes at the INEL Radioactive Waste Management Complex have a similar composition to iron-enriched basalt after oxidation of organics. The properties correlated are the viscosity, electrical conductivity, refractory corrosion, and recrystallization temperature. The correlations are expressed as a function of input waste-soil mixture composition, alkali concentration, and slag temperature. An application to determine the effect of alkali flux on slag temperature, leach rate, and volume reduction is presented. Though the correlations are for mixtures of soil and waste with average transuranic-contaminated waste compositions, it appears that good approximations for other waste streams and glass-ceramic waste forms can be obtained because of similarities in composition.

817 (EGG-NRP-10991) High energy decomposition of halogenated hydrocarbons FY93 final report. Mincher, B.J.; Arbon, R.E.; Meikrantz, D.H. EG and G Idaho, Inc., Idaho Falls, ID (United States). Sep 1993. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94010797. Source: OSTI; NTIS; GPO Dep.

The purpose of this program is to demonstrate a viable process for the decomposition of hazardous organochlorine compounds to nonhazardous products. This process has applicability to the treatment of mixed wastes containing both chlorinated hydrocarbons and radioactive constituents. The organics may be decomposed leaving only the radioactive constituents in the waste. Further, the use of spent nuclear fuel as a gamma-ray source presents a potentially cost effective energy source and elegantly allows the fuel to be considered a resource rather than a liability. During FY93 more than 400 samples were irradiated with fission product gamma-rays. Many of these samples were individual PCB congeners dissolved in isopropanol. These samples were studied to gain an understanding of the mechanism and kinetics of, and to provide a mass balance for, the PCB radiolysis reaction. In addition to research findings this report also contains a summary of efforts expended on technology transfer, professional publications and conference presentations.

818 (EGG-PHY-10446) High energy decomposition of halogenated hydrocarbons: FY 1992 final report. Mincher, B.J.; Arbon, R.E.; Meikrantz, D.H. EG and G Idaho, Inc., Idaho Falls, ID (United States). Sep 1992. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93005268. Source: OSTI; NTIS; INIS; GPO Dep.

This program is the INEL component of a joint collaborative effort with Lawrence Livermore National Laboratory (LLNL). Purpose is to demonstrate a viable process for breaking down hazardous halogenated organic wastes to simpler, nonhazardous wastes using high energy ionizing radiation. The INEL effort focuses on the use of spent reactor fuel gamma radiation sources to decompose complex wastes such as PCBs. Work in FY92 expanded upon that reported for FY91. During FY91 it was reported that PCBs were susceptible to radiolytic decomposition in alcoholic solution, but that only a small percentage of decomposition

products could be accounted for. It was shown that decomposition was more efficient in methanol than in isopropanol and that the presence of a copper-zinc couple catalyst did not affect the reaction rate. Major goals of FY92 work were to determine the reaction mechanism, to identify further reaction products, and to select a more appropriate catalyst. Described in this report are results of mechanism specific experiments, mass balance studies, transformer oil irradiations, the use of hydrogen peroxide as a potential catalyst, and the irradiation of pure PCB crystals in the absence of diluent.

819 (EGG-WM-9857) Analysis of the low-level waste radionuclide inventory for the Radioactive Waste Management Complex performance assessment. Plan-sky, L.E.; Hoiland, S.A. EG and G Idaho, Inc., Idaho Falls, ID (United States). Feb 1992. 226p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012374. Source: OSTI; NTIS; INIS; GPO Dep.

This report summarizes the results of a study to improve the estimates of the radionuclides in the low-level radioactive waste (LLW) inventory which is buried in the Idaho National Engineering Laboratory (INEL) Radioactive Waste Management Complex (RWMC) Subsurface Disposal Area (SDA). The work is done to support the RWMC draft performance assessment (PA). Improved radionuclide inventory estimates are provided for the INEL LLW generators. Engineering, environmental assessment or other research areas may find use for the information in this report. It may also serve as a LLW inventory baseline for data quality assurance. The individual INEL LLW generators, their history and their activities are also described in detail.

820 (EGG-WM-10109) Full-scale tests of sulfur polymer cement and non-radioactive waste in heated and unheated prototypical containers. Darnell, G.R.; Aldrich, W.C.; Logan, J.A. EG and G Idaho, Inc., Idaho Falls, ID (United States). Feb 1992. 74p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012369. Source: OSTI; NTIS; GPO Dep.

Sulfur polymer cement has been demonstrated to be superior to portland cement in the stabilization of numerous troublesome low-level radioactive wastes, notably mixed waste fly ash, which contains heavy metals. EG&G Idaho, Inc. conducted full-scale, waste-stabilization tests with a mixture of sulfur polymer cement and nonradioactive incinerator ash poured over simulated steel and ash wastes. The container used to contain the simulated waste for the pour was a thin-walled, rectangular, steel container with no appendages. The variable in the tests was that one container and its contents were at 65°F (18°C) at the beginning of the pour, while the other was preheated to 275°F (135°C) and was insulated before the pour. The primary goal was to determine the procedures and equipment deemed operationally acceptable and capable of providing the best probability of passing the only remaining governmental test for sulfur polymer cement, the Nuclear Regulatory Commission's full-scale test. The secondary goal was to analyze the ability of the molten cement and ash mixture to fill different size pipes and thus eliminate voids in the resultant 24 ft³ monolith.

821 (EGG-WM-10146) Recommendations of treatment technologies for radioactively contaminated lead at the Idaho National Engineering Laboratory. Neupauer, R.M.; Zukauskas, J.F. EG and G Idaho, Inc., Idaho Falls, ID

(United States). Mar 1992. 172p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92017992. Source: OSTI; NTIS; INIS; GPO Dep.

Approximately one million pounds of radioactively contaminated lead are currently stored at the Idaho National Engineering Laboratory (INEL) and must be treated according to the Resource Conservation and Recovery Act. This excess lead exists in various forms, including brick, sheet, shot, wool, blankets, steel-jacketed casks, scrap, and miscellaneous solids. Several lead treatment technologies were evaluated based on effectiveness, applicability, feasibility, availability of equipment and materials, health and safety, generation of secondary waste streams, cost, and flexibility. Emphasis is given in this report to those treatment technologies that yield recyclable lead products. Methods that treat lead for storage and disposal were also investigated. Specific treatment technologies for decontaminating the excess lead at the INEL are recommended. The proposed treatment for lead brick, sheet, shot, blankets, and scrap is a series of surface decontamination techniques followed by melt-refining, if necessary. The recommended series of treatments for lead casks begins with removing and macroencapsulating the steel jackets, followed by size reducing and melt-refining the lead. Macroencapsulation is the proposed treatment for miscellaneous lead solids. Recycling lead that has been successfully decontaminated and macroencapsulating or stabilizing the treatment residuals is also recommended.

822 (EGG-WM-10496) Treatability study of aqueous, land disposal restricted mixed wastes. Haefner, D.R. EG and G Idaho, Inc., Idaho Falls, ID (United States). Dec 1992. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93016369. Source: OSTI; NTIS; INIS; GPO Dep.

Treatment studies have been completed on two aqueous waste streams at the Mixed Waste Storage Facility that are classified as land disposal restricted. Both wastes had mercury and lead as characteristic hazardous constituents. Samples from one of these wastes, composed of mercury and lead sulfide particles along with dissolved mercury and lead, was successfully treated by decanting, filtering, and ion exchanging. The effluent water had an average level of 0.003 and 0.025 mg/L of mercury and lead, respectively. These values are well below the targeted RCRA limits of 0.2 mg/L mercury and 5.0 mg/L lead. An acidic stream, containing the same hazardous metals, was also successfully treated using a treatment process of precipitation, filtering, and then ion exchange. Treatment of another waste was not completely successful, presumably because of the interference of a chelating agent.

823 (EGG-WM-10533) Treatability study for the bench-scale solidification of nonincinerable LDR low-level mixed waste. Gering, K.L. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jan 1993. 106p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93012189. Source: OSTI; NTIS; INIS; GPO Dep.

The focus of this report is the solidification of nonincinerable, land disposal restricted (LDR) low-level mixed waste generated at the Idaho National Engineering Laboratory. Benchscale solidification was performed on samples of this mixed waste, which was done under a Resource Conservation and Recovery Act treatability study. Waste forms

included liquids, sludges, and solids, and treatment techniques included the use of conventional Portland cement and sulphur polymer cement (SPC). A total of 113 monoliths were made under the experimental design matrix for this study; 8 of these were "blank" monoliths (contained no waste). Thus, 105 monoliths were used to solidify 21.6 kg of mixed waste; 92 were made with Portland cement systems, and 13 were made with SPC. Recipes for all monoliths are given, and suggested recipes (as based on the minimized leaching of toxic components) are summarized. In most cases, the results presented herein indicate that solidification was successful in immobilizing toxic metals, thereby transforming low-level mixed waste into low-level nonhazardous waste. The ultimate goal of this project is to use appropriate solidification techniques, as described in the literature, to transform low-level mixed waste to low-level nonhazardous waste by satisfying pertinent disposal requirements for this waste. Disposal requirements consider the toxicity characteristic leaching procedure tests, a free liquids test, and radiological analyses. This work is meaningful in that it will provide a basis for the disposal of waste that is currently categorized as LDR low-level mixed waste.

824 (EGG-WM-10630) Processing results of 1,800 gallons of mercury and radioactively contaminated mixed waste rinse solution. Thiesen, B.P. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jan 1993. 147p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93012166. Source: OSTI; NTIS; INIS; GPO Dep.

The mercury-contaminated rinse solution (INEL waste ID# 123; File 8 waste) was successfully treated at the Idaho National Engineering Laboratory (INEL). This waste was generated during the decontamination of the Heat Transfer Reactor Experiment 3 (HTRE-3) reactor shield tank. Approximately 1,800 gal of waste was generated and was placed into 33 drums. Each drum contained precipitated sludge material ranging from 1-10 in. in depth, with the average depth of about 2.5 in. The pH of each drum varied from 3-11. The bulk liquid waste had a mercury level of 7.0 mg/l, which exceeded the Resource Conservation and Recovery Act (RCRA) limit of 0.2 mg/l. The average liquid bulk radioactivity was about 2.1 pCi/ml, while the average sludge contamination was about 13,800 pCi/g. Treatment of the waste required separation of the liquid from the sludge, filtration, pH adjustment, and ion exchange. Because of difficulties in processing, three trials were required to reduce the mercury levels to below the RCRA limit. In the first trial, insufficient filtration of the waste allowed solid particulate produced during pH adjustment to enter into the ion exchange columns and ultimately the waste storage tank. In the second trial, the waste was filtered down to 0.1 μ to remove all solid mercury compounds. However, before filtration could take place, a solid mercury complex dissolved and mercury levels exceeded the RCRA limit after filtration. In the third trial, the waste was filtered through 0.3-A filters and then passed through the S-920 resin to remove the dissolved mercury. The resulting solution had mercury levels at 0.0186 mg/l and radioactivity of 0.282 pCi/ml. This solution was disposed of at the TAN warm waste pond, TAN782, TSF-10.

825 (EGG-WM-10728) A preliminary evaluation of alternatives for disposal of INEL low-level waste and low-level mixed waste. Smith, T.H.; Roesener, W.S.; Jorgenson-Waters, M.J. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jul 1993. 433p. Sponsored by USDOE,

Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94002899. Source: OSTI; NTIS; INIS; GPO Dep.

The Mixed and Low-Level Waste Disposal Facility (MLL-WDF) project was established in 1992 by the US Department of Energy Idaho Operations Office to provide enhanced disposal capabilities for Idaho National Engineering Laboratory (INEL) low-level mixed waste and low-level waste. This Preliminary Evaluation of Alternatives for Disposal of INEL Low-Level Waste and Low-Level Mixed Waste identifies and evaluates on a preliminary, overview basis the alternatives for disposal of that waste. Five disposal alternatives, ranging from of no-action to constructing and operating the MLL-WDF, are identified and evaluated. Several subalternatives are formulated within the MLLWDF alternative. The subalternatives involve various disposal technologies as well as various scenarios related to the waste volumes and waste forms to be received for disposal. The evaluations include qualitative comparisons of the projected isolation performance for each alternative, and facility, health and safety, environmental, institutional, schedule, and rough order-of-magnitude life-cycle cost comparisons. The performance of each alternative is evaluated against lists of "musts" and "wants." Also included is a discussion of other key considerations for decisionmaking. The analysis of results indicated further study is necessary to obtain the best estimate of long-term future waste volume and characteristics from the INEL Environmental Restoration activities and the expanded INEL Decontamination and Decommissioning Program.

826 (EGG-WM-10823) Modeling VOC transport in simulated waste drums. Liekhus, K.J.; Gresham, G.L.; Peterson, E.S.; Rae, C.; Hotz, N.J.; Connolly, M.J. EG and G Idaho, Inc., Idaho Falls, ID (United States). Idaho National Engineering Lab. Jun 1993. 133p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94002810. Source: OSTI; NTIS; INIS; GPO Dep.

A volatile organic compound (VOC) transport model has been developed to describe unsteady-state VOC permeation and diffusion within a waste drum. Model equations account for three primary mechanisms for VOC transport from a void volume within the drum. These mechanisms are VOC permeation across a polymer boundary, VOC diffusion across an opening in a volume boundary, and VOC solubilization in a polymer boundary. A series of lab-scale experiments was performed in which the VOC concentration was measured in simulated waste drums under different conditions. A lab-scale simulated waste drum consisted of a sized-down 55-gal metal drum containing a modified rigid polyethylene drum liner. Four polyethylene bags were sealed inside a large polyethylene bag, supported by a wire cage, and placed inside the drum liner. The small bags were filled with VOC-air gas mixture and the VOC concentration was measured throughout the drum over a period of time. Test variables included the type of VOC-air gas mixtures introduced into the small bags, the small bag closure type, and the presence or absence of a variable external heat source. Model results were calculated for those trials where the VOC permeability had been measured. Permeabilities for five VOCs [methylene chloride, 1,1,2-trichloro-1,2,2-trifluoroethane (Freon-113), 1,1,1-trichloroethane, carbon tetrachloride, and trichloroethylene] were measured across a polyethylene bag. Comparison of model and experimental results of VOC concentration as a function of time indicate that model accurately accounts for significant VOC transport mechanisms in a lab-scale waste drum.

827 (EGG-WM-10823-Rev.1) **Modeling unsteady-state VOC transport in simulated waste drums: Revision 1.** Liekhus, K.J.; Gresham, G.L.; Peterson, E.S.; Rae, C.; Hotz, N.J.; Connolly, M.J. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jan 1994. 133p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94008521. Source: OSTI; NTIS; INIS; GPO Dep.

This report is a revision of an EG&G Idaho informal report originally titled Modeling VOC Transport in Simulated Waste Drums. A volatile organic compound (VOC) transport model has been developed to describe unsteady-state VOC permeation and diffusion within a waste drum. Model equations account for three primary mechanisms for VOC transport from a void volume within the drum. These mechanisms are VOC permeation across a polymer boundary, VOC diffusion across an opening in a volume boundary, and VOC solubilization in a polymer boundary. A series of lab-scale experiments was performed in which the VOC concentration was measured in simulated waste drums under different conditions. A lab-scale simulated waste drum consisted of a sized-down 55-gal metal drum containing a modified rigid polyethylene drum liner. Four polyethylene bags were sealed inside a large polyethylene bag, supported by a wire cage, and placed inside the drum liner. The small bags were filled with VOC-air gas mixture and the VOC concentration was measured throughout the drum over a period of time. Test variables included the type of VOC-air gas mixtures introduced into the small bags, the small bag closure type, and the presence or absence of a variable external heat source. Model results were calculated for those trials where the permeability had been measured.

828 (EGG-WM-11179) **Decision analysis for INEL hazardous waste storage.** Page, L.A.; Roach, J.A. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jan 1994. 47p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94010765. Source: OSTI; NTIS; INIS; GPO Dep.

In mid-November 1993, the Idaho National Engineering Laboratory (INEL) Waste Reduction Operations Complex (WROC) Manager requested that the INEL Hazardous Waste Type Manager perform a decision analysis to determine whether or not a new Hazardous Waste Storage Facility (HWSF) was needed to store INEL hazardous waste (HW). In response to this request, a team was formed to perform a decision analysis for recommending the best configuration for storage of INEL HW. Personnel who participated in the decision analysis are listed in Appendix B. The results of the analysis indicate that the existing HWSF is not the best configuration for storage of INEL HW. The analysis detailed in Appendix C concludes that the best HW storage configuration would be to modify and use a portion of the Waste Experimental Reduction Facility (WERF) Waste Storage Building (WWSB), PBF-623 (Alternative 3). This facility was constructed in 1991 to serve as a waste staging facility for WERF incineration. The modifications include an extension of the current Room 105 across the south end of the WWSB and installing heating, ventilation, and bay curbing, which would provide approximately 1,600 ft² of isolated HW storage area. Negotiations with the State to discuss aisle space requirements along with modifications to WWSB operating procedures are also necessary. The process to begin utilizing the WWSB for HW storage includes planned closure of the HWSF, modification to the WWSB, and relocation of the HW inventory. The cost to modify the WWSB

can be funded by a reallocation of funding currently identified to correct HWSF deficiencies.

829 (EGG-WM-11205) **VOC transport in vented drums containing simulated waste sludge.** Liekhus, K.J.; Gresham, G.L.; Rae, C.; Connolly, M.J. EG and G Idaho, Inc., Idaho Falls, ID (United States). Feb 1994. 53p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94010764. Source: OSTI; NTIS; GPO Dep.

A model is developed to estimate the volatile organic compound (VOC) concentration in the headspace of the innermost layer of confinement in a lab-scale vented waste drum containing simulated waste sludge. The VOC transport model estimates the concentration using the measured VOC concentration beneath the drum lid and model parameters defined or estimated from process knowledge of drum contents and waste drum configuration. Model parameters include the VOC diffusion characteristic across the filter vent, VOC diffusivity in air, size of opening in the drum liner lid, the type and number of layers of polymer bags surrounding the waste, VOC permeability across the polymer, and the permeable surface area of the polymer bags. Comparison of model and experimental results indicates that the model can accurately estimate VOC concentration in the headspace of the innermost layer of confinement. The model may be useful in estimating the VOC concentration in actual waste drums.

830 (EGG-WMO-10244-App.A) **Mixed and Low-Level Waste Treatment Facility project: Appendix A, Environmental and regulatory planning and documentation: Draft.** EG and G Idaho, Inc., Idaho Falls, ID (United States). Apr 1992. 135p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92019852. Source: OSTI; NTIS; INIS; GPO Dep.

Mixed and low-level wastes generated at the Idaho National Engineering Laboratory (INEL) are required to be managed according to applicable State and Federal regulations, and Department of Energy Orders that provide for the protection of human health and the environment. The Mixed and Low-Level Waste Treatment Facility Project was chartered in 1991, by the Department of Energy to provide treatment capability for these mixed and low-level waste streams. The first project task consisted of conducting engineering studies to identify the waste streams, their potential treatment strategies, and the requirements that would be imposed on the waste streams and the facilities used to process them. This report, Appendix A, Environmental & Regulatory Planning & Documentation, identifies the regulatory requirements that would be imposed on the operation or construction of a facility designed to process the INEL's waste streams. These requirements are contained in five reports that discuss the following topics: (1) an environmental compliance plan and schedule, (2) National Environmental Policy Act requirements, (3) preliminary siting requirements, (4) regulatory justification for the project, and (5) health and safety criteria.

831 (EGG-WMO-10244-App.B-Pt.1) **Mixed and Low-Level Treatment Facility Project: Appendix B, Waste stream engineering files, Part 1, Mixed waste streams.** EG and G Idaho, Inc., Idaho Falls, ID (United States). Apr 1992. 253p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92019853. Source: OSTI; NTIS; INIS; GPO Dep.

This appendix contains the mixed and low-level waste engineering design files (EDFS) documenting each low-level and mixed waste stream investigated during preengineering studies for Mixed and Low-Level Waste Treatment Facility Project. The EDFs provide background information on mixed and low-level waste generated at the Idaho National Engineering Laboratory. They identify, characterize, and provide treatment strategies for the waste streams. Mixed waste is waste containing both radioactive and hazardous components as defined by the Atomic Energy Act and the Resource Conservation and Recovery Act, respectively. Low-level waste is waste that contains radioactivity and is not classified as high-level waste, transuranic waste, spent nuclear fuel, or 11e(2) byproduct material as defined by DOE 5820.2A. Test specimens of fissionable material irradiated for research and development only, and not for the production of power or plutonium, may be classified as low-level waste, provided the concentration of transuranic is less than 100 nCi/g. This appendix is a tool that clarifies presentation format for the EDFs. The EDFs contain waste stream characterization data and potential treatment strategies that will facilitate system tradeoff studies and conceptual design development. A total of 43 mixed waste and 55 low-level waste EDFs are provided.

832 (EGG-WMO-10244-App.B-Pt.2) Mixed and Low-Level Waste Treatment Facility Project: Appendix B, Waste stream engineering files: Part 2, Low-level waste streams. EG and G Idaho, Inc., Idaho Falls, ID (United States). Apr 1992. 269p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92019854. Source: OSTI; NTIS; INIS; GPO Dep.

Mixed and low-level wastes generated at the Idaho National Engineering Laboratory (INEL) are required to be managed according to applicable State and Federal regulations, and Department of Energy Orders that provide for the protection of human health and the environment. The Mixed and Low-Level Waste Treatment Facility Project was chartered in 1991, by the Department of Energy to provide treatment capability for these mixed and low-level waste streams. The first project task consisted of conducting engineering studies to identify the waste streams, their potential treatment strategies, and the requirements that would be imposed on the waste streams and the facilities used to process them. This report documents those studies so the project can continue with an evaluation of programmatic options, system tradeoff studies, and the conceptual design phase of the project. This report, appendix B, comprises the engineering design files for this project study. The engineering design files document each waste stream, its characteristics, and identified treatment strategies.

833 (EGG-WMO-10244-Pt.1) Mixed and low-level waste treatment project: Appendix C, Health and safety criteria for the mixed and low-level waste treatment facility at the Idaho National Engineering Laboratory: Part 1, Waste streams and treatment technologies. Neupauer, R.M.; Thurmond, S.M. EG and G Idaho, Inc., Idaho Falls, ID (United States). Sep 1992. 260p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93007637. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes health and safety concerns associated with the Mixed and Low-level Waste Treatment Facility at the Idaho National Engineering Laboratory. Various hazards are described such as fire, electrical, explosions,

reactivity, temperature, and radiation hazards, as well as the potential for accidental spills, exposure to toxic materials, and other general safety concerns.

834 (EGG-WMO-10244-Pt.2) Mixed and low-level waste treatment project: Appendix C, Health and safety criteria for the mixed and low-level waste treatment facility at the Idaho National Engineering Laboratory: Part 2, Chemical constituents. Neupauer, R.M.; Thurmond, S.M. EG and G Idaho, Inc., Idaho Falls, ID (United States). Sep 1992. 543p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93007636. Source: OSTI; NTIS; INIS; GPO Dep.

This report contains health and safety information relating to the chemicals that have been identified in the mixed waste streams at the Waste Treatment Facility at the Idaho National Engineering Laboratory. Information is summarized in two summary sections—one for health considerations and one for safety considerations. Detailed health and safety information is presented in material safety data sheets (MSDSs) for each chemical.

835 (EGG-WMO-10244-Vol.1-Vol.2) Mixed and Low-Level Waste Treatment Facility project: Executive summary: Volume 1, Program summary information; Volume 2, Waste stream technical summary: Draft. EG and G Idaho, Inc., Idaho Falls, ID (United States). Apr 1992. 91p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92019612. Source: OSTI; NTIS; INIS; GPO Dep.

Mixed and low-level wastes generated at the Idaho National Engineering Laboratory (INEL) are required to be managed according to applicable State and Federal regulations, and Department of Energy Orders that provide for the protection of human health and the environment. The Mixed and Low-Level Waste Treatment Facility Project was chartered in 1991, by the Department of Energy to provide treatment capability for these mixed and low-level waste streams. The first project task consisted of conducting engineering studies to identify the waste streams, their potential treatment strategies, and the requirements that would be imposed on the waste streams and the facilities used to process them. The engineering studies, initiated in July 1991, identified 37 mixed waste streams, and 55 low-level waste streams. This report documents the waste stream information and potential treatment strategies, as well as the regulatory requirements for the Department of Energy-owned treatment facility option. The total report comprises three volumes and two appendices. This report consists of Volume 1, which explains the overall program mission, the guiding assumptions for the engineering studies, and summarizes the waste stream and regulatory information, and Volume 2, the Waste Stream Technical Summary which encompasses the studies conducted to identify the INEL's waste streams and their potential treatment strategies.

836 (EGG-WMO-10244-Vol.3) Mixed and low-level waste treatment facility project: Volume 3, Waste treatment technologies (Draft). EG and G Idaho, Inc., Idaho Falls, ID (United States). Apr 1992. 244p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92019851. Source: OSTI; NTIS; INIS; GPO Dep.

The technology information provided in this report is only the first step toward the identification and selection of process systems that may be recommended for a proposed mixed and low-level waste treatment facility. More specific

information on each technology will be required to conduct the system and equipment tradeoff studies that will follow these preengineering studies. For example, capacity, maintainability, reliability, cost, applicability to specific waste streams, and technology availability must be further defined. This report does not currently contain all needed information; however, all major technologies considered to be potentially applicable to the treatment of mixed and low-level waste are identified and described herein. Future reports will seek to improve the depth of information on technologies.

837 (EGG-WTD-9194) In situ vitrification laboratory-scale test work plan. Nagata, P.K.; Smith, N.L. EG and G Idaho, Inc., Idaho Falls, ID (United States). May 1991. 38p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92003267. Source: OSTI; NTIS; INIS; GPO Dep.

The Buried Waste Program was established in October 1987 to accelerate the studies needed to develop a long-term management plan for the buried mixed waste at the Radioactive Waste Management Complex at Idaho Engineering Laboratory. The In Situ Vitrification Project is being conducted in a Comprehensive Environmental Response, Compensation, and Liability Act feasibility study format to identify methods for the long-term management of mixed buried waste. To support the overall feasibility study, the situ vitrification treatability investigations are proceeding along the three parallel paths: laboratory-scale tests, intermediate field tests, and field tests. Laboratory-scale tests are being performed to provide data to mathematical modeling efforts, which, in turn, will support design of the field tests and to the health and safety risk assessment. This laboratory-scale test work plan provides overall testing program direction to meet the current goals and objectives of the in situ vitrification treatability investigation. 12 refs., 1 fig., 7 tabs.

838 (EGG-WTD-9214) Summary of in situ vitrification modeling and analysis accomplishments for fiscal year 1991. Slater, C.E. EG and G Idaho, Inc., Idaho Falls, ID (United States). Nov 1991. 32p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92013100. Source: OSTI; NTIS; GPO Dep.

The in situ vitrification (ISV) modeling activities encompass a variety of both modeling development efforts and analysis applications in support of the ISV project. The model development effort is directed toward modifying or developing a set of computer codes to simulate the ISV process. These codes are used to perform safety and environmental hazards analyses, assist in experimental test planning and design, assist in equipment design and development of operating procedures, and provide enhanced understanding of the ISV process. This report presents a summary description of the accomplishments in Fiscal Year 1991 for both the model development and analysis areas. Brief descriptions of the models that were developed and the more important conclusions from the analytical studies are presented.

839 (EGG-WTD-9520) Test plan for ISV laboratory-pyrolysis testing. McAtee, R.E. EG and G Idaho, Inc., Idaho Falls, ID (United States). Sep 1991. 156p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012515. Source: OSTI; NTIS; GPO Dep.

The objective of the laboratory-pyrolysis studies is to obtain information on the high temperature (< 1200°C)

degradation and alteration of organic chemicals and materials similar to those found in the Radioactive Waste Management Complex, Pit 9. This test plan describes experimental procedures, sampling and analysis strategy, sampling procedures, sample control, and document management. It addresses safety issues in the experimental apparatus and procedures, personal training, and hazardous waste disposal. Finally, it describes the data quality objectives using the EPA tiered approach to treatability studies to define where research/scoping tests fit into these studies and the EPA analytical levels required for the tests.

840 (EGG-WTD-9684) The production of low-energy neutrons for the RHMS. Nieschmidt, E.B. EG and G Idaho, Inc., Idaho Falls, ID (United States). Aug 1991. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92003307. Source: OSTI; NTIS; INIS; GPO Dep.

Neutron interrogation is used in both the active neutron measurement cell for the identification of fissile materials and in the hazardous material cell for the capture gamma identification of the hazardous elements in waste. The use of radiological neutron sources and neutron generators, using the deuterium/tritium or deuterium/deuterium reactions for neutron production, results in the production of high energy neutrons. For most materials the high absorption cross sections are in the neutron thermal energy range. The moderation of the high energy neutrons to provide a high ratio thermal/epithermal spectrum is difficult. The effort herein reported seeks to find methods of producing neutrons at much lower energy levels, preferably below 200 KeV. 1 ref., 2 tabs.

841 (EGG-WTD-9723) Gamma analysis for transuranic waste assay. Johnson, L.O. EG and G Idaho, Inc., Idaho Falls, ID (United States). Aug 1991. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92003303. Source: OSTI; NTIS; INIS; GPO Dep.

Passive gamma analysis is one of the key technologies for the identification of transuranic elements in waste material. The techniques use high purity germanium detectors for the detection of the gamma photons. The detected signals are then analyzed in multi-channel gamma spectrometers to determine the photon energies. These photon energies are generally unique to the nuclide that produced the gamma rays and can, therefore, be used as an identifier of the nuclides present. This report is a discussion of methods used to calibrate the measurement systems and for the analysis of the data. 3 tabs.

842 (EGG-WTD-9935) High energy decomposition of halogenated hydrocarbons: Final report, FY 91. Mincher, B.J.; Meikrantz, D.H.; Arbon, R.E.; Murphy, R.J. EG and G Idaho, Inc., Idaho Falls, ID (United States). Oct 1991. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92003302. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this effort is to demonstrate a viable process for breaking down hazardous halogenated organic wastes to simpler, non-hazardous wastes using high energy ionizing radiation. The INEL effort focuses on the use of spent reactor fuel gamma radiation sources to decompose complex wastes such as PCBs. The INEL irradiation experiments concentrated on a single PCB congener so that a limited set of decomposition reactions could be studied. The congener 1, 2', 3, 3', 4, 5', 6, 6' - octachlorobiphenyl was

examined followed exposure to various gamma doses at the ATR spent fuel pool. The decomposition rates and products in several solvents are discussed. 7 refs., 5 figs., 3 tabs.

843 (EGG-WTD-10036) Assessment of selected furnace technologies for RWMC waste. Batdorf, J. (Science Applications International Corp., Idaho Falls, ID (United States)); Gillins, R.; Anderson, G.L. EG and G Idaho, Inc., Idaho Falls, ID (United States). Mar 1992. 63p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012512. Source: OSTI; NTIS; INIS; GPO Dep.

This report provides a description and initial evaluation of five selected thermal treatment (furnace) technologies, in support of earlier thermal technologies scoping work for application to the Idaho National Engineering Laboratory Radioactive Waste Management Complex (RWMC) buried wastes. The cyclone furnace, molten salt processor, microwave melter, ausmelt (fuel fired lance) furnace, and molten metal processor technologies are evaluated. A system description and brief development history are provided. The state of development of each technology is assessed, relative to treatment of RWMC buried waste.

844 (EGG-WTD-10037) Experience base for Radioactive Waste Thermal Processing Systems: A preliminary survey. Mayberry, J. (Science Applications International Corp., Idaho Falls, ID (United States)); Geimer, R.; Gillins, R.; Steverson, E.M.; Dalton, D.; Anderson, G.L. EG and G Idaho, Inc., Idaho Falls, ID (United States). Apr 1992. 93p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92017990. Source: OSTI; NTIS; INIS; GPO Dep.

In the process of considering thermal technologies for potential treatment of the Idaho National Engineering Laboratory mixed transuranic contaminated wastes, a preliminary survey of the experience base available from Radioactive Waste Thermal Processing Systems is reported. A list of known commercial radioactive waste facilities in the United States and some international thermal treatment facilities are provided. Survey focus is upon the US Department of Energy thermal treatment facilities. A brief facility description and a preliminary summary of facility status, and problems experienced is provided for a selected subset of the DOE facilities.

845 (EGG-WTD-10056) Summary of INEL research on the Iron-enriched basalt waste form. Reimann, G.A.; Grandy, J.D.; Eddy, T.L.; Anderson, G.L. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jan 1992. 59p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012510. Source: OSTI; NTIS; INIS; GPO Dep.

This report summarizes the knowledge base on the iron-enriched basalt (IEB) waste form developed at the Idaho National Engineering Laboratory (INEL) during 1979-1982. The results presented discuss the applicability of IEB in converting retrieved transuranic (TRU) waste from INEL's Radioactive Waste Management Complex (RWMC) into a vitreous/ceramic (glassy/rock) stable waste form suitable for permanent disposal in an appropriate repository, such as the Waste Isolation Pilot Plant (WIPP) in New Mexico. Borosilicate glass (BSG), the approved high-level waste form, appears unsuited for this application. Melting the average waste-soil mix from the RWMC produces the IEB composition and attempting to convert IEB to the BSG composition would require additions of substantial B_2O_3 , Na, and SiO_2

(glass frit). IEB requires processing temperatures of 1400 to 1600°C, depending upon the waste composition. Production of the IEB waste form, using Joule heated melters, has proved difficult in the past because of electrode and refractory corrosion problems associated with the high temperature melts. Higher temperature electric melters (arc and plasma) are available to produce this final waste form. Past research focused on extensive slag property measurements, waste form leachability tests, mechanical, composition, and microstructure evaluations, as well as a host of experiments to improve production of the waste form. Past INEL studies indicated that the IEB glass-ceramic is a material that will accommodate and stabilize a wide range of heterogeneous waste materials, including long lived radionuclides and scrap metals, while maintaining a superior level of chemical and physical performance characteristics. Controlled cooling of the molten IEB and subsequent heat treatment will produce a glass-ceramic waste form with superior leach resistance.

846 (EGG-WTD-10058) Thermal processing system concepts and considerations for RWMC buried waste. Eddy, T.L.; Kong, P.C.; Raivo, B.D.; Anderson, G.L. EG and G Idaho, Inc., Idaho Falls, ID (United States). Feb 1992. 157p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92018049. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents a preliminary determination of ex situ thermal processing system concepts and related processing considerations for application to remediation of transuranic (TRU)-contaminated buried wastes (TRUW) at the Radioactive Waste Management Complex (RWMC) of the Idaho National Engineering Laboratory (INEL). Beginning with top-level thermal treatment concepts and requirements identified in a previous Preliminary Systems Design Study (SDS), a more detailed consideration of the waste materials thermal processing problem is provided. Anticipated waste stream elements and problem characteristics are identified and considered. Final waste form performance criteria, requirements, and options are examined within the context of providing a high-integrity, low-leachability glass/ceramic, final waste form material. Thermal processing conditions required and capability of key systems components (equipment) to provide these material process conditions are considered. Information from closely related companion study reports on melter technology development needs assessment and INEL Iron-Enriched Basalt (IEB) research are considered. Five potentially practicable thermal process system design configuration concepts are defined and compared. A scenario for thermal processing of a mixed waste and soils stream with essentially no complex presorting and using a series process of incineration and high temperature melting is recommended. Recommendations for applied research and development necessary to further detail and demonstrate the final waste form, required thermal processes, and melter process equipment are provided.

847 (EGG-WTD-10254) Alpha low-level stored waste systems design study. Feizollahi, F. (Morrison Knudson Corp., San Francisco, CA (United States). Environmental Services Div.); Teheranian, B.; Quapp, W.J. EG and G Idaho, Inc., Idaho Falls, ID (United States). Aug 1992. 257p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93001932. Source: OSTI; NTIS; INIS; GPO Dep.

The Stored Waste System Design Study (SWSDS), commissioned by the Waste Technology Development Department at the Idaho National Engineering Laboratory

(INEL), examines relative life-cycle costs associated with three system concepts for processing the alpha low-level waste (alpha-LLW) stored at the Radioactive Waste Management Complex's Transuranic Storage Area at the INEL. The three system concepts are incineration/melting; thermal treatment/solidification; and sort, treat, and repackage. The SWSDS identifies system functional and operational requirements and assesses implementability; effectiveness; cost; and demonstration, testing, and evaluation (DT&E) requirements for each of the three concepts.

848 (EGG-WTD-10443) Waste Management Facilities Cost Information Report. Feizollahi, F.; Shropshire, D. EG and G Idaho, Inc., Idaho Falls, ID (United States). Oct 1992. 184p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93016371. Source: OSTI; NTIS; INIS; GPO Dep.

The Waste Management Facility Cost Information (WM-FCI) Report, commissioned by the US Department of Energy (DOE), develops planning life-cycle cost (PLCC) estimates for treatment, storage, and disposal facilities. This report contains PLCC estimates versus capacity for 26 different facility cost modules. A procedure to guide DOE and its contractor personnel in the use of estimating data is also provided. Estimates in the report apply to five distinctive waste streams: low-level waste, low-level mixed waste, alpha contaminated low-level waste, alpha contaminated low-level mixed waste, and transuranic waste. The report addresses five different treatment types: incineration, metal/melting and recovery, shredder/compaction, solidification, and vitrification. Data in this report allows the user to develop PLCC estimates for various waste management options.

849 (EGG-WTD-10935) Field test of the Rapid Transuranic Monitoring Laboratory. McIsaac, C.V.; Sill, C.W.; Gehrke, R.J.; Killian, E.W.; Watts, K.D.; Amaro, C.R. EG and G Idaho, Inc., Idaho Falls, ID (United States). Dec 1993. 103p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94008512. Source: OSTI; NTIS; GPO Dep.

A field test of the Rapid Transuranic Monitoring Laboratory (RTML) developed at the Idaho National Engineering Laboratory (INEL) was conducted as part of a demonstration sponsored by the Buried Waste Integrated Demonstration (BWID). The RTML is a mobile, field-deployable laboratory developed for use at buried radioactive waste remediation sites to allow onsite preparation and analysis of soil, smear, and air filter samples for alpha and gamma-emitting contaminants. Analytical instruments installed in the RTML include an extended range, germanium photon analysis spectrometer with an automatic sample changer, two large-area ionization chamber alpha spectrometers, and four alpha continuous air monitors. The performance of the RTML was tested at the Test Reactor Area and Cold Test Pit near the Radioactive Waste Management Complex at the INEL. Objectives, experimental procedures, and an evaluation of the performance of the RTML are presented.

850 (ES/ER-17-D1) Federal Facility Agreement plans and schedules for liquid low-level radioactive waste tank systems at Oak Ridge National Laboratory, Oak Ridge, Tennessee: Environmental Restoration Program. Oak Ridge National Lab., TN (United States). Mar 1992. 99p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92008499. Source: OSTI; NTIS; INIS; GPO Dep.

Although the Federal Facility Agreement (FFA) addresses the entire Oak Ridge Reservation, specific requirements are set forth for the liquid low-level radioactive waste (LLLW) storage tanks and their associated piping and equipment, tank systems, at ORNL. The stated objective of the FFA as it relates to these tank systems is to ensure that structural integrity, containment and detection of releases, and source control are maintained pending final remedial action at the site. The FFA requires that leaking LLLW tank systems be immediately removed from service. It also requires the LLLW tank systems that do not meet the design and performance requirements established for secondary containment and leak detection be either upgraded or replaced. The FFA establishes a procedural framework for implementing the environmental laws. For the LLLW tank systems, this framework requires the specified plans and schedules be submitted to EPA and TDEC for approval within 60 days, or in some cases, within 90 days, of the effective date of the agreement.

851 (ES/ER/TM-41) Characterization summary report for pond waste commercial disposal project: Environmental Restoration Program. Barkenbus, B.D.; Grumski, J.T.; Sams, T.L. Oak Ridge National Lab., TN (United States). Aug 1992. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93000554. Source: OSTI; NTIS; GPO Dep.

This report is prepared to summarize information on the existing sampling and analysis results for the K-1407B and K-1407C ponds holding basins for wastes received from the Oak Ridge K-25 Plant. The purpose of the document is to compare the existing data to commercial disposal facility criteria so that off-site disposal options for pond waste drums can be examined. There are ~45,795 drums of stabilized sludge and ~31,954 drums of raw sludge at the Oak Ridge K-25 Site. There have been corrosion and storage problems associated with these drums. The US Department of Energy would like to transport all waste drums that meet regulatory requirements to a commercial disposal facility. This report describes waste characterization and classifications.

852 (ES/ER/TM-54) Systems Engineering Plan and project record Configuration Management Plan for the Mixed Waste Disposal Initiative. Bryan, W.E.; Oakley, L.B. Martin Marietta Energy Systems, Inc., Oak Ridge, TN (United States). Apr 1993. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400 ; AC05-76OR00001. Order Number DE93012076. Source: OSTI; NTIS; INIS; GPO Dep.

This document summarizes the systems engineering assessment that was performed for the Mixed Waste Disposal Initiative (MWDI) Project to determine what types of documentation are required for the success of the project. The report also identifies the documents that will make up the MWDI Project Record and describes the Configuration Management Plan describes the responsibilities and process for making changes to project documentation.

853 (ES/ER/TM-55) An innovative approach to multimedia waste reduction: Measuring performance for environmental cleanup projects. Phifer, B.E. Jr. (Oak Ridge K-25 Site, TN (United States)); George, S.M. Oak Ridge K-25 Site, TN (United States); Weston (Roy F.), Inc., Oak Ridge, TN (United States). Apr 1993. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract

AC05-84OR21400. Order Number DE93011693. Source: OSTI; NTIS; INIS; GPO Dep.

One of the greatest challenges we now face in environmental cleanup is measuring the progress of minimizing multimedia transfer releases and achieving waste reduction. Briefly, multimedia transfer refers to the air, land, and water where pollution is not controlled, concentrated, and moved from one medium to another. An example of multimedia transfer would be heavy metals in wastewater sludges moved from water to land disposal. Over \$2 billion has been budgeted for environmental restoration site cleanups by the Department of Energy (DOE) for FY 1994. Unless we reduce the huge waste volumes projected to be generated in the near future, then we will devote more and more resources to the management and disposal of these wastes. To meet this challenge, the Martin Marietta Energy Systems, Inc., Oak Ridge Environmental Restoration (ER) Program has explored the value of a multimedia approach by designing an innovative Pollution Prevention Life-Cycle Model. The model consists of several fundamental elements (Fig. 1) and addresses the two major objectives of data gathering and establishing performance measures. Because the majority of projects are in the remedial investigation phase, the focus is on the prevention of unnecessary generation of investigation-derived waste and multimedia transfers at the source. A state-of-the-art tool developed to support the life-cycle model for meeting these objectives is the Numerical Scoring System (NSS), which is a computerized, user-friendly data base system for information management, designed to measure the effectiveness of pollution prevention activities in each phase of the ER Program. This report contains a discussion of the development of the Pollution Prevention Life-Cycle Model and the role the NSS will play in the pollution prevention programs in the remedial investigation phase of the ER Program at facilities managed by Energy Systems for DOE.

854 (ES/ER/TM-101) Norfolk Southern boxcar blocking/bracing plan for the mixed waste disposal initiative project: Environmental Restoration Program. Seigler, R.S. Oak Ridge K-25 Site, TN (United States). Jan 1994. 42p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94007919. Source: OSTI; NTIS; GPO Dep.

The US Department of Energy's (DOE) Environmental Restoration and Waste Management programs will dispose of mixed waste no longer deemed useful. This project is one of the initial activities used to help meet this goal. The project will transport the ~46,000 drums of existing stabilized mixed waste located at the Oak Ridge K-25 Site and presently stored in the K-31 and K-33 buildings to an off-site commercially licensed and permitted mixed waste disposal facility. Shipping and disposal of all ~46,000 pond waste drums (~1,000,000 ft³ or 55,000 tons) is scheduled to occur over a period of ~5-10 years. The first shipment of stabilized pond waste should transpire some time during the second quarter of FY 1994. Martin Marietta Energy Systems, Inc., proposes to line each of the Norfolk Southern boxcars with a prefabricated, white, 15-mm low-density polyethylene (LDPE) liner material. To avoid damaging the bottom of the polyethylene floor liner, a minimum .5 in. plywood will be nailed to the boxcars' nailable metal floor. At the end of the Mixed Waste Disposal Initiative (MWDI) Project workers at the Envirocare facility will dismantle and dispose of all the polyethylene liner and plywood materials. Envirocare of Utah, Inc., located in Clive, Utah, will perform a health physics survey and

chemically and radiologically decontaminate, if necessary, each of the rail boxcars prior to them being released back to Energy Systems. Energy Systems will also perform a health physics survey and chemically and radiologically decontaminate, if necessary, each of the rail boxcars prior to them being released back to Norfolk Southern Railroad.

855 (FEMP-2288) Management and disposition of off-site laboratory-generated mixed/low level waste. Fisher, D.L. Westinghouse Environmental Management Co. of Ohio, Cincinnati, OH (United States). Fernald Environmental Management Project. Oct 1993. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-92OR21972. (CONF-931095-51: Department of Energy environmental remediation conference, Augusta, GA (United States), 24-28 Oct 1993). Order Number DE94002547. Source: OSTI; NTIS; INIS; GPO Dep.

The Fernald Environmental Management Project (FEMP) is the first Department of Energy (DOE) site to take back mixed and low level waste generated at commercial laboratories from chemical analyses and treatability studies on samples taken from the site. This paper discusses the steps addressed and the issues resolved in order to initiate the task of taking back mixed/low level waste. Such issues included regulatory, waste management and contractual issues.

856 (INEL/MISC-91107) DOE LLW classification rationale. Flores, A.Y. Idaho National Engineering Lab., Idaho Falls, ID (United States). 16 Sep 1991. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012222. Source: OSTI; NTIS; INIS; GPO Dep.

This report was about the rationale which the US Department of Energy had with low-level radioactive waste (LLW) classification. It is based on the Nuclear Regulatory Commission's classification system. DOE site operators met to review the qualifications and characteristics of the classification systems. They evaluated performance objectives, developed waste classification tables, and compiled dose limits on the waste. A goal of the LLW classification system was to allow each disposal site the freedom to develop limits to radionuclide inventories and concentrations according to its own site-specific characteristics. This goal was achieved with the adoption of a performance objectives system based on a performance assessment, with site-specific environmental conditions and engineered disposal systems.

857 (INEL/MISC-92065) Pennsylvania Source Term Tracking System: National Low-Level Waste Management Program. EG and G Idaho, Inc., Idaho Falls, ID (United States). Aug 1992. 76p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93001935. Source: OSTI; NTIS; INIS; GPO Dep.

The Pennsylvania Source Term Tracking System tabulates surveys received from radioactive waste generators in the Commonwealth of radioactive waste is collected each quarter from generators using the Low-Level Radioactive Waste Management Quarterly Report Form (hereafter called the survey) and then entered into the tracking system data base. This personal computer-based tracking system can generate 12 types of tracking reports. The first four sections of this reference manual supply complete instructions for installing and setting up the tracking system on a PC. Section 5 presents instructions for entering quarterly survey data,

and Section 6 discusses generating reports. The appendix includes samples of each report.

858 (IS-M-705) Purification of waste uranium for recycle. Lograsso, T.A. (Ames Lab., IA (United States)); Delaney, D.W.; Parker, G.W.; Mailen, J.C. Ames Lab., IA (United States). [1992]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-82; AC05-84OR21400. (CONF-920851-5: Spectrum '92: nuclear and hazardous waste management international topical meeting, Boise, ID (United States), 23-27 Aug 1992). Order Number DE92013562. Source: OSTI; NTIS; INIS; GPO Dep.

This paper describes two separate efforts being conducted at Ames Laboratory and Oak Ridge National Laboratory (ORNL) to apply existing metal refining techniques to the purification of U scrap. ORNL is examining pyrometallurgical methods for the purification of "hottops" from the Vacuum Arc Remelt (VAR) operation. The initial effort was to determine promising approaches by examining the literature. This was followed by the development of a preliminary flowsheet and the design of equipment to test the flowsheet. Small-scale equipment was then constructed and evaluated, modifications were made, and an initial test of the flowsheet was conducted. It is expected that the methods developed in these small-scale tests, if promising, will be further developed for use at Y-12 for production scale purification of U-Nb scrap.

859 (K/HWP-1) Thermal treatment technology study and data base for Department of Energy mixed waste. Gillins, R.L. (Science Applications International Corp., Idaho Falls, ID (USA)); Steverson, E.M.; Balo, K.A. Oak Ridge K-25 Site, TN (United States). [1991]. 12p. Sponsored by USDOE, Washington, DC (USA). DOE Contract AC05-84OT21400. (CONF-910270-42: Waste management '91, Tucson, AZ (United States), 24 Feb - 1 mar 1991). Order Number DE91011429. Source: OSTI; NTIS; INIS; GPO Dep.

The Department of Energy (DOE) has a wide variety of waste streams that must be treated to meet various regulations before final disposal. One category of technologies for treating many of these waste streams is thermal treatment. A study of known thermal treatment technologies was conducted to aid DOE in the development of strategies to meet its waste management needs. The study was specifically addressed to mixed waste, but it is also applicable to hazardous and radioactive wastes. The data collected in the study, along with other waste management data, are being included in a comprehensive data base that DOE is developing. 3 refs., 1 fig.

860 (K/TCO-1080) Solidification of waste sludges using microwave heating. Del Cul, G.D. (Oak Ridge K-25 Site, TN (United States)); Bostick, W.D.; Adamski, R.E.; Slover, W.A.; Osborne, P.E.; Fellows, R.L.; White, T.L. Oak Ridge K-25 Site, TN (United States). [1994]. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OT21400. (CONF-940528-2: Incineration conference: 13th international symposium on thermal treatment technologies, Houston, TX (United States), 9-13 May 1994). Order Number DE94011050. Source: OSTI; NTIS; GPO Dep.

A laboratory-scale microwave heating system is used to demonstrate the feasibility of drying and then solidifying surrogate and authentic waste water treatment residuals. Depending upon the glass formers present in (or added to) the sludge sample, the resultant waste form is a brick-like

ceramic, a stone-like monolith, or an amorphous glass. Compared to the original wet sludge slurry, the refractory, high-density waste forms represent a large volume reduction (often by a factor of 5 to 10) and show enhanced leach resistance for regulated metals. As described in the text, microwave waste processing is perceived as offering numerous advantages over conventional thermal treatment technology.

861 (LA-12216-MS) Design and operational parameters of transportable supercritical water oxidation waste destruction unit. McFarland, R.D.; Brewer, G.R.; Rofer, C.K. Los Alamos National Lab., NM (United States). Dec 1991. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE92004341. Source: OSTI; NTIS; INIS; GPO Dep.

Supercritical water oxidation (SCWO) is the destruction of hazardous waste by oxidation in the presence of water at temperatures and pressures above its critical point. A 1 gal/h SCWO waste destruction unit (WDU) has been designed, built, and operated at Los Alamos National Laboratory. This unit is transportable and is intended to demonstrate the SCWO technology on wastes at Department of Energy sites. This report describes the design of the WDU and the preliminary testing phase leading to demonstration.

862 (LA-12221-MS) Preliminary cost comparison of advanced oxidation processes. Kidman, R.B.; Tsuji, K.S. Los Alamos National Lab., NM (United States). Jun 1992. 34p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE92015975. Source: OSTI; NTIS; GPO Dep.

Los Alamos National Laboratory is engaged in technical efforts to assess, improve, and optimize the electron-beam and supercritical-water-oxidation waste treatment technologies. Detailed economic analyses will ultimately play a key role in final evaluations. As a first step, this study gathers together first approximation estimates of the costs of various advanced oxidation processes and compares them with the costs of various conventional technologies.

863 (LA-12667-MS) Future radioactive liquid waste streams study. Rey, A.S. Los Alamos National Lab., NM (United States). Nov 1993. 66p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE94001837. Source: OSTI; NTIS; INIS; GPO Dep.

This study provides design planning information for the Radioactive Liquid Waste Treatment Facility (RLWTF). Predictions of estimated quantities of Radioactive Liquid Waste (RLW) and radioactivity levels of RLW to be generated are provided. This information will help assure that the new treatment facility is designed with the capacity to treat generated RLW during the years of operation. The proposed startup date for the RLWTF is estimated to be between 2002 and 2005, and the life span of the facility is estimated to be 40 years. The policies and requirements driving the replacement of the current RLW treatment facility are reviewed. Historical and current status of RLW generation at Los Alamos National Laboratory are provided. Laboratory Managers were interviewed to obtain their insights into future RLW activities at Los Alamos that might affect the amount of RLW generated at the Lab. Interviews, trends, and investigation data are analyzed and used to create scenarios. These scenarios form the basis for the predictions of future RLW generation and the level of RLW treatment capacity which will be needed at LANL.

864 (LA-SUB-92-9-Pt.11) Assessment of LANL liquid waste management documentation. Danna, J.G. (Rogers and Associates Engineering Corp., Salt Lake City, UT (United States)); Jennrich, E.A.; Lund, D.M.; Davis, K.D.; Hoevenmeyer, S.S. Los Alamos National Lab., NM (United States); Rogers and Associates Engineering Corp., Salt Lake City, UT (United States); Wastren, Inc., Idaho Falls, ID (United States). Apr 1991. 67p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (RAE-8915/6-12). Order Number DE93001287. Source: OSTI; NTIS; INIS; GPO Dep.

The objective of this report is to determine the present status of operations of the Liquid Waste Section of The Waste Management Group (HSE-7) at Los Alamos National Laboratory (LANL) with respect to preparation and maintenance of necessary criteria, plans and procedures. Particular areas where these documents are not presently in existence or being fully implemented will be identified. The requirements being assessed in this report, for the Liquid Waste Section, are: Waste acceptance criteria, Waste acceptance procedures, Waste certification program plan, Waste certification procedures, Waste characterization program, Waste characterization procedures, Training procedures, and Recordkeeping procedures.

865 (LA-SUB-93-92) Recommendations for future low-level and mixed waste management practices at Los Alamos National Laboratory. Jennrich, E.A. (Rogers and Associates Engineering Corp., Salt Lake City, UT (United States)); Klein, R.B.; Murphy, E.S.; Shuman, R.; Hickman, W.W.; Rutz, A.C.; Uhl, D.L. Los Alamos National Lab., NM (United States); Rogers and Associates Engineering Corp., Salt Lake City, UT (United States); Wastren, Inc., Idaho Falls, ID (United States). 27 Apr 1989. 164p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (RAE-8915-1). Order Number DE93008679. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes recommendations concerning the management of low-level radioactive wastes and mixtures at Los Alamos National Laboratory. Performance assessments, characterization, site disposal design, shipment, and storage are discussed.

866 (LA-UR-91-1552) Oxidative degradation of trichloroethylene adsorbed on active carbons: Use of microwave energy. Varma, R.; Nandi, S.P. Los Alamos National Lab., NM (United States). [1991]. 8p. Sponsored by USDOE, Washington, DC (USA). DOE Contract W-7405-ENG-36. (CONF-910430-12: 93. annual meeting and exposition of the American Ceramic Society (ACerS), Cincinnati, OH (United States), 28 Apr - 2 May 1991). Order Number DE91013656. Source: OSTI; NTIS; GPO Dep.

Chlorinated hydrocarbon compounds (CHCl), such as chlorinated alkanes/alkenes, benzene and biphenyl etc, represent an important fraction of the industrial hazardous wastes produced. Trichloroethylene (TCE) can be removed from waste streams by adsorption on active carbons. The primary objective of the present work was to study the detoxification in air-stream of TCE adsorbed on different types of active carbons using in situ microwave heating. A secondary objective was to examine the regeneration of used carbons from the effects of repeated cyclic operations (adsorption- detoxification). The experimental study has shown that trichloroethylene adsorbed on active carbon can be oxidatively degraded in presence of microwave radiation. Energy can be transferred efficiently to the reaction sites without losing heat to the surrounding vessel. One of

the decomposition product of trichloroethylene is free chlorine which is held very strongly on active carbon. Hydrochloric acid on the other hand seems to be less strongly held and appears in large concentration in the exit gas. Production of free chlorine can be avoided by using chloro-hydrocarbon mixed with sufficient internal hydrogen. This is also expected to minimize the problem of carbon regeneration encountered in this study. The results obtained from studies on the oxidative degradation of TCE under microwave radiation are promising in a number of respects: (1) the detoxification of TCE adsorbed on active carbon can be conducted at moderate (<400°C) temperatures, and (2) the used carbon bed can be regenerated. A patent on the process has been issued. 9 refs., 2 figs., 2 tabs.

867 (LA-UR-91-2408) Integrated unit operations within the Advanced Testing Line for Actinide Separations (ATLAS). Schreiber, S.B.; Yarbrow, S.L.; Pope, N.G.; Day, R.S. Los Alamos National Lab., NM (United States). [1991]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-910852-8: Summer national meeting of the American Institute of Chemical Engineers (AIChE), Pittsburgh, PA (United States), 20-22 Aug 1991). Order Number DE91016009. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The Advanced Testing Line for Actinide Separations (ATLAS) is currently in the initial phases of start up at the Los Alamos National Laboratory Plutonium Facility at TA-55. This integrated pilot plant operation, housed in six interconnected gloveboxes, encompasses all the major unit operations currently used for the nitrate aqueous processing of actinide scrap. These include: dissolution, anion exchange, precipitations (oxalates and peroxides), calcination, and evaporation for waste treatment. The Line uses a distributed process control scheme based on a PC network running a process control software package and PID controllers for equipment operation and data logging. On-line and in-line analytical support provides near real time results for both the actinide and impurity content of the various streams which are used to optimize process efficiency. Integrating all of the major aqueous unit operations, along with the process control and the analytic support, is a first for the industry. It will be used in optimizing process efficiency to minimize waste generation. 1 fig.

868 (LA-UR-91-2409) Homogeneous precipitations for separations and waste treatment. Yarbrow, S.L.; Schreiber, S.B.; Dunn, S.L. Los Alamos National Lab., NM (United States). [1991]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-910852-9: Summer national meeting of the American Institute of Chemical Engineers (AIChE), Pittsburgh, PA (United States), 20-22 Aug 1991). Order Number DE91016008. Source: OSTI; NTIS (US Sales Only); GPO Dep.

At the Los Alamos National Laboratory Plutonium Facility at TA-55, many different unit operations are used to separate and recover plutonium and other actinides. Among these operations, precipitation is very important because it can concentrate the actinides from dilute solutions. Also, depending on the precipitating anion, it can be selective. Traditionally, the precipitating agent is added slowly to the solution, however, this has the disadvantage that localized "excesses" of precipitant will be present and cause smaller particles to form that occlude impurities and are harder to filter. We have been investigating an alternative method of precipitation where the precipitating anion is generated

through a chemical reaction "in situ." This has the advantage of forming larger particles. Also, the reaction can be carefully controlled to provide the optimum precipitation conditions. 2 refs., 4 tabs.

869 (LA-UR-91-2976) **Addressing mixed waste in plutonium processing.** Christensen, D.C. (Los Alamos National Lab., NM (United States)); Sohn, C.L.; Reid, R.A. Los Alamos National Lab., NM (United States). [1991]. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9110227-1: American Chemical Society annual meeting, Atlanta, GA (United States), 1-3 Oct 1991). Order Number DE92000213. Source: OSTI; NTIS; INIS; GPO Dep.

The overall goal is the minimization of all waste generated in actinide processing facilities. Current emphasis is directed toward reducing and managing mixed waste in plutonium processing facilities. More specifically, the focus is on prioritizing plutonium processing technologies for development that will address major problems in mixed waste management. A five step methodological approach to identify, analyze, solve, and initiate corrective action for mixed waste problems in plutonium processing facilities has been developed.

870 (LA-UR-92-644) **Technology needs for treatment of DOE's low-level mixed wastes.** Harmon, L.H. (USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). Office of Waste Operations); Rhoderick, J.E.; Borduin, L.C.; Musgrave, B.C.; Ross, W.A. Los Alamos National Lab., NM (United States). [1992]. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-920307-30: Waste management '92, Tucson, AZ (United States), 1-5 Mar 1992). Order Number DE92008481. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy (DOE) stores and generates significant amounts of low-level mixed wastes (LLMW) consisting of radioactive materials mixed with hazardous chemical substances. Many of these wastes are regulated under the US Environmental Protection Agency (EPA) Land Disposal Restrictions and must be treated and disposed in compliance with applicable state and federal requirements. In general, treatment requirements include elimination of organic hazardous constituents and stabilization of inorganic hazardous constituents. Final waste forms must meet both EPA leach testing and DOE disposal acceptance criteria. The DOE currently does not have an adequate capability to meet these treatment objectives. The Mixed Waste Treatment Project has been established by the DOE to define needed LLMW treatment capabilities as a basis for either a prototype plant design or an existing facility modifications. Existing DOE mixed waste data bases were analyzed to identify the range of waste quantities and types and to define broad treatment categories needed to bring these wastes into compliance. Using these treatment categories as a starting point, we constructed a baseline flow sheet defining process steps from receipt through final form. From this baseline flow sheet, we developed functional and operational requirements (F & ORs) for each process train. An initial set of near-term technologies was identified for each process step, and alternative near- and long-term options were listed. Based on these analyses, we identified technology gaps and improvement needs in the areas of characterization, waste handling, segregation and sorting, size reduction, decontamination, materials recycle, primary

and secondary treatment for RCRA compliance, offgas treatment, and final waste forms.

871 (LA-UR-92-1312) **Packed bed reactor treatment of liquid hazardous and mixed wastes.** Tennant, R.A.; Wantuck, P.J.; Vargas, R. Los Alamos National Lab., NM (United States). [1992]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-920851-4: Spectrum '92: nuclear and hazardous waste management international topical meeting, Boise, ID (United States), 23-27 Aug 1992). Order Number DE92013534. Source: OSTI; NTIS; INIS; GPO Dep.

We are developing thermal-based packed bed reactor (PBR) technology as an alternative to incineration for treatment of hazardous organic liquid wastes. The waste streams targeted by this technology are machining fluids contaminated with chlorocarbons and/or chlorofluorocarbons and low levels of plutonium or tritium. The PBR offers several distinct advantages including simplistic design, rugged construction, ambient pressure processing, economical operations, as well as ease of scalability and maintainability. In this paper, we provide a description of the apparatus as well as test results using prepared mixtures of machining oils/emulsions with trichloroethylene (TCE), carbon tetrachloride (CCl_4), trichloroethane (TCA), and Freon TF. The current treatment system is configured as a two stage device with the PBR (1st stage) coupled to a silent discharge plasma (SDP) cell. The SDP serves as a second stage for further treatment of the gaseous effluent from the PBR. One of the primary advantages of this two stage system is that its suitability for closed loop operation where radioactive components are well contained and even CO_2 is not released to the environment.

872 (LA-UR-92-1383) **Advanced combustion and oxidation techniques for the destruction of hazardous wastes.** Coogan, J.J.; Anderson, G.K.; Heck, H.G.; Kang, M.; McCulla, W.H.; Rosocha, L.A. Los Alamos National Lab., NM (United States). [1992]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-920851-10: Spectrum '92: nuclear and hazardous waste management international topical meeting, Boise, ID (United States), 23-27 Aug 1992). Order Number DE92013944. Source: OSTI; NTIS; INIS; GPO Dep.

Silent discharge plasmas (SDP) have been demonstrated in the laboratory to be effective in destroying hazardous organic compounds, particularly halocarbons. These compact systems offer an alternative to existing incineration or post-incineration treatments, with the potential for closed-loop operation and millisecond response times. When combined with a packed bed precombustor, SDP allows both liquid and gaseous based waste streams to be treated with high destruction efficiencies. In stand-alone tests of the SDP reactor, gaseous influents containing 1000 ppm TCE (trichloroethylene) were reduced to below 100 ppb effluent. Other halocarbon solvents such as CCl_4 (carbon tetrachloride) and TCA (trichloroethane) have also been treated. The measured figures of merit, electrical energy per mass of removed chemical, are 10's of kW-hr/kg for $\geq 99\%$ removal of TCE and 100's of kW-hr/kg for 90% removal of CCl_4 , both being for a non-optimized system. Future designs are projected to reduce toxic levels below 10 ppb, with high overall efficiencies.

873 (LA-UR-93-998) **Application of geographic information systems to waste minimization efforts at Los Alamos National Laboratory.** Lyttle, T.W.; Smith, D.M.;

Burns, M.; Weinrach, J.B. Los Alamos National Lab., NM (United States). [1993]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-930523-1: 18. National Association of Environmental Professionals (NAEP) annual conference on current and future priorities for environmental management, Raleigh, NC (United States), 24-26 May 1993). Order Number DE93010726. Source: OSTI; NTIS; INIS; GPO Dep.

At Los Alamos National Laboratory (LANL), facility waste streams tend to be small but highly diverse. Initial characterization of such waste streams is often difficult in part due to a lack of tools to assist the generators themselves in completing such assessments. A methodology has been developed at LANL to allow process knowledgeable field personnel to develop baseline waste generation assessments and to evaluate potential waste minimization technology. This Process Waste Assessment (PWA) system is an application constructed within the Process Modeling System and currently being integrated with the InFoCAD Geographic Information System (GIS). The Process Modeling System (PMS) is an object-oriented, mass balance-based, discrete-event simulation framework written using the Common Lisp Object System (CLOS). Analytical capabilities supported within the PWA system include: complete mass balance specifications, historical characterization of selected waste streams and generation of facility profiles for materials consumption, resource utilization and worker exposure. Development activities include integration with the LANL facilities management Geographic Information System (GIS) and provisions for a Best Available Technologies (BAT) database. The environments used to develop these assessment tools will be discussed in addition to a review of initial implementation results.

874 (LA-UR-93-1204) Treating water-reactive wastes. Lussiez, G.W. Los Alamos National Lab., NM (United States). [1993]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-930873-9: 2. international mixed waste symposium, Baltimore, MD (United States), 17-20 Aug 1993). Order Number DE93012661. Source: OSTI; NTIS; INIS; GPO Dep.

Some compounds and elements, such as lithium hydride, magnesium, sodium, and calcium react violently with water to generate much heat and produce hydrogen. The hydrogen can ignite or even form an explosive mixture with air. Other metals may react rapidly only if they are finely divided. Some of the waste produced at Los Alamos National Laboratory includes these metals that are contaminated with radioactivity. By far the greatest volume of water-reactive waste is lithium hydride contaminated with depleted uranium. Reactivity of the water-reactive wastes is neutralized with an atmosphere of humid nitrogen, which prevents the formation of an explosive mixture of hydrogen and air. When we adjust the temperature of the nitrogen and the humidifier, the nitrogen can be more or less humid, and the rate of reaction can be adjusted and controlled. Los Alamos has investigated the rates of reaction of lithium hydride as a function of the temperature and humidity, and, as anticipated, they in with in temperature and humidity. Los Alamos will investigate other variables. For example, the nitrogen flow will be optimized to conserve nitrogen and yet keep the reaction rates high. Reaction rates will be determined for various forms of lithium waste, from small chips to powder. Bench work will lead to the design of a skid-mounted process for treating wastes. Other water-reactive wastes will also be investigated.

875 (LA-UR-93-1205) Hazardous waste treatment facility and skid-mounted treatment systems at Los Alamos. Lussiez, G.W.; Zygmunt, S.J. Los Alamos National Lab., NM (United States). [1993]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-930873-6: 2. international mixed waste symposium, Baltimore, MD (United States), 17-20 Aug 1993). Order Number DE93012660. Source: OSTI; NTIS; INIS; GPO Dep.

To centralize treatment, storage, and staging areas for hazardous wastes, Los Alamos National Laboratory has designed a 12,000-ft² hazardous waste treatment facility. The facility will house a treatment room for each of four kinds of wastes: nonradioactive characteristic wastes, nonradioactive listed wastes radioactive characteristic wastes, and radioactive listed wastes. The facility will be used for repackaging labpacks, bulking small organic waste volumes, processing scintillation vials, treating reactives such as lithium hydride and pyrophoric uranium, treating contaminated solids such as barium sand, and treating plating wastes. The treated wastes will then be appropriately disposed of. This report describes the integral features of the hazardous waste treatment facility.

876 (LA-UR-93-1206) Treating contaminated organics using the DETOX process. Elsberry, K.D. (Los Alamos National Lab., NM (United States)); Dhooze, P.M. Los Alamos National Lab., NM (United States). [1993]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-930873-2: 2. international mixed waste symposium, Baltimore, MD (United States), 17-20 Aug 1993). Order Number DE93012659. Source: OSTI; NTIS; INIS; GPO Dep.

Waste matrices containing organics, radionuclides, and metals pose difficult problems in waste treatment and disposal when the organic compounds and/or metals are considered to be hazardous. This paper describes the results of bench-scale studies of DETOX applied to the components of liquid mixed wastes, with the goal of establishing parameters for designing a prototype waste treatment unit. Apparent organic reaction rate orders and the dependence of apparent reaction rate on solution composition and the contact area were measured for vacuum pump oil scintillation fluids, and trichloroethylene. Reaction rate was superior in chloride-based solutions and was proportional to the contact area above about 2% w/w loading of organic. Oxidations in a 4-liter volume, mixed bench-top reactor have given destruction efficiencies of 99.9999 + % for common organics. Reaction rates achieved in the mixed bench-top reactor were one to two orders of magnitude greater than had been achieved in unmixed reactions; a thoroughly mixed reactor should be capable of oxidizing 10 to 100 + grams of organic per liter-hour. Results are also presented on the solvation efficiency of DETOX for mercury, cerium, and neodymium, and for removal/destruction of organics sorbed on vermiculite. The next stage of development will be converting the bench-top unit to continuous processing.

877 (LA-UR-93-2171) Neutronics-processing interface analyses for the Accelerator Transmutation of Waste (ATW) aqueous-based blanket system. Davidson, J.W.; Battat, M.E. Los Alamos National Lab., NM (United States). [1993]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-930913-11: Global '93: future nuclear systems - emerging fuel cycles and waste disposal options, Seattle,

WA (United States), 12-17 Sep 1993). Order Number DE93016606. Source: OSTI; NTIS; INIS; GPO Dep.

Neutronics-processing interface parameters have large impacts on the neutron economy and transmutation performance of an aqueous-based Accelerator Transmutation of Waste (ATW) system. A detailed assessment of the interdependence of these blanket neutronic and chemical processing parameters has been performed. Neutronic performance analyses require that neutron transport calculations for the ATW blanket systems be fully coupled with the blanket processing and include all neutron absorptions in candidate waste nuclides as well as in fission and transmutation products. The effects of processing rates, flux levels, flux spectra, and external-to-blanket inventories on blanket neutronic performance were determined. In addition, the inventories and isotopics in the various subsystems were also calculated for various actinide and long-lived fission product transmutation strategies.

878 (LA-UR-93-2377) Scaling of silent electrical discharge reactors for hazardous organics destruction. Coogan, J.J.; Rosocha, L.A.; Brower, M.J.; Kang, M.; Schmidt, C.A. Los Alamos National Lab., NM (United States). [1993]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9309146-1: 5. annual American Chemical Society (ACS) Industrial and Engineering Chemistry (I&EC) Division special symposium on emerging technologies for hazardous waste management; 11. ozone world congress, Atlanta, GA (United States); San Francis Order Number DE93016485. Source: OSTI; NTIS; INIS; GPO Dep.

Silent electrical discharges are used to produce highly reactive free radicals that destroy hazardous compounds entrained in gaseous effluents at ambient gas temperatures and pressures. We have carried out destruction experiments at Los Alamos on a range of volatile organic compounds (VOCs), including trichloroethylene (TCE), carbon tetrachloride, perchloroethylene (PCE), and chlorofluorocarbons (CFCs). We have measured a "nine-factor", the amount of energy required to reduce the VOC concentration by a factor of ten. For practical reactor power densities, the "nine-factor" can be used to predict the destruction and removal efficiency (DRE) in terms of gas flow rate and the number of reactor modules. This report proposes a modular, stackable architecture for scaling up the reactor throughput.

879 (LA-UR-93-3089) Metal decontamination for waste minimization using liquid metal refining technology. Joyce, E.L. Jr. (Los Alamos National Lab., NM (United States)); Lally, B.; Ozturk, B.; Fruehan, R.J. Los Alamos National Lab., NM (United States). [1993]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9308150-3: Environmentally conscious manufacturing congress '93, Arlington, VA (United States), 30 Aug - 1 Sep 1993). Order Number DE93040140. Source: OSTI; NTIS; INIS; GPO Dep.

The current Department of Energy Mixed Waste Treatment Project flow sheet indicates that no conventional technology, other than surface decontamination, exists for metal processing. Current Department of Energy guidelines require retrievable storage of all metallic wastes containing transuranic elements above a certain concentration. This project is in support of the National Mixed Low Level Waste Treatment Program. Because of the high cost of disposal, it is important to develop an effective decontamination and volume reduction method for low-level contaminated metals. It is important to be able to decontaminate complex shapes

where surfaces are hidden or inaccessible to surface decontamination processes and destruction of organic contamination. These goals can be achieved by adapting commercial metal refining processes to handle radioactive and organic contaminated metal. The radioactive components are concentrated in the slag, which is subsequently vitrified; hazardous organics are destroyed by the intense heat of the bath. The metal, after having been melted and purified, could be recycled for use within the DOE complex. In this project, we evaluated current state-of-the-art technologies for metal refining, with special reference to the removal of radioactive contaminants and the destruction of hazardous organics. This evaluation was based on literature reports, industrial experience, plant visits, thermodynamic calculations, and engineering aspects of the various processes. The key issues addressed included radioactive partitioning between the metal and slag phases, minimization of secondary wastes, operability of the process subject to widely varying feed chemistry, and the ability to seal the candidate process to prevent the release of hazardous species.

880 (LA-UR-93-3717) Optimization of a packed bed reactor for liquid waste treatment. Schmidt, C.A.; Brower, M.J.; Coogan, J.J.; Tennant, R.A. Los Alamos National Lab., NM (United States). [1993]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-931164-1: Annual meeting of the American Institute of Chemical Engineers, St. Louis, MO (United States), 7-12 Nov 1993). Order Number DE94002694. Source: OSTI; NTIS; INIS; GPO Dep.

The authors describe an optimization study of a packed bed reactor (PBR), developed for the treatment of hazardous liquid wastes. The focus is on the destruction of trichloroethylene (TCE). The PBR technology offers many distinct advantages over other processes: simple design, high destruction rates (99.99%), low costs, ambient pressure operation, easy maintenance and scaleability. The cost effectiveness, optimal operating parameters and scaleability were determined. As a second stage of treatment, a silent discharge plasma (SDP) reactor was installed to further treat offgases from the PBR. A primary advantage of this system is closed loop operation, where exhaust gases are continuously recycled and not released into the atmosphere.

881 (LA-UR-93-3750) Cost effectiveness analysis of the SEAMIST™ membrane system technology. Henriksen, A.D.; Booth, S.R. Los Alamos National Lab., NM (United States). [1993]. 54p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE94002687. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes the cost and performance characteristics of SEAMIST™, an innovative technology that facilitates measurements of contaminants in both vertical and horizontal vadose zone boreholes. This new technology consists of an airtight membrane linear that is pneumatically emplaced inside the borehole structure. Sampling ports with attached tubing, absorbent collectors, or various in situ measuring devices can be fabricated into the linear and used for monitoring volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides, herbicides, polynuclear aromatic hydrocarbons, polychlorinated biphenyls, or radioactive substances. In addition, small instruments can be guided through the lined borehole and measurements taken inside at specified intervals.

882 (LA-UR-94-361) Hazardous Waste Treatment Facility and skid-mounted treatment systems at Los Alamos. Lussiez, G.W.; Zygmunt, S.J. Los Alamos National Lab., NM (United States). [1994]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-940225-7: Waste management '94, Tucson, AZ (United States), 27 Feb - 3 mar 1994). Order Number DE94006152. Source: OSTI; NTIS; INIS; GPO Dep.

To centralize treatment, storage, and areas for hazardous wastes, Los Alamos National Laboratory has designed a 1115 m² hazardous waste treatment facility. The facility will house a treatment room for each of four kinds of wastes: nonradioactive characteristic wastes, nonradioactive listed wastes, radioactive characteristic wastes, and radioactive listed wastes. The facility will be used for repacking lab-packs; bulking small organic waste volumes; processing scintillation vials; treating reactives such as lithium hydride and pyrophoric uranium; treating contaminated solids such as barium sand; treating plating wastes and other solutions with heavy metals and oxidizing organics. Separate treatment rooms will allow workers to avoid mixing waste types and prevent cross-contamination. The ventilation air from the treatment areas may contain hazardous or radioactive dust. Gas may also leak from process equipment. The gas treatment process includes separating solids and gases and neutralization or adsorption of the hazardous gases. The ventilation air from each room will first be filtered before being scrubbed in a common gas caustic scrubber on an outside pad. There are two levels of exhaust in each treatment room, one for heavy gases and another for light gases. Several features help mitigate or eliminate hazards due to spills and releases: each treatment room is sealed and under slight negative pressure; each room has its own HEPA filtration; to avoid mixing of incompatible wastes and reagents, portable individual spill-containment trays are used for skids, to limit the danger of spills, the waste is directly transferred from outside storage to the treatment room; to mitigate the consequences of a gas release in the room, mobile hoods are connected to the exhaust-air treatment system; the floor, walls, ceilings, fixtures, ducts, and piping are made of acid-resistant material or are coated.

883 (LA-UR-94-363) Development of a process to neutralize water-reactive wastes. Lussiez, G.; Dziejewski, J. Los Alamos National Lab., NM (United States). [1994]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-940225-6: Waste management '94, Tucson, AZ (United States), 27 Feb - 3 mar 1994). Order Number DE94006154. Source: OSTI; NTIS; INIS; GPO Dep.

The mixed waste storage area at Los Alamos National Laboratory contains a considerable amount of lithium hydride and other water-reactive wastes. A process to neutralize these wastes by controlled hydration in an atmosphere of humid nitrogen is being developed. The kinetics of reaction of lithium hydride with water vapor has been studied at bench scale. The reaction progress can be predicted using the Unreacted Shrinking Core Model for noncatalytic solid-fluid reactions. This model will be utilized in designing of a skid-mounted treatment unit to neutralize water-reactive wastes.

884 (LA-UR-94-493) Recent accomplishments in low-level radioactive waste measurement at Los Alamos. Midkiff, W.S.; Attrep, M.; Covey, J.R. Los Alamos National Lab., NM (United States). [1994]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract

W-7405-ENG-36. (CONF-940225-48: Waste management '94, Tucson, AZ (United States), 27 Feb - 3 mar 1994). Order Number DE94007541. Source: OSTI; NTIS; INIS; GPO Dep.

Is Los Alamos National Laboratory (LANL) the only laboratory that has difficulty measuring low concentrations of alpha radioactivity in wastewater, or do the rest of the nation's laboratories just not realize the lack of precision/accuracy in its own measurements? DOE Order 5400.5 sets 30 pCi/L total alpha as a goal for effluent discharge. The State of Colorado requires 0.05 pCi/L. The EPA is considering standards in this range for drinking water and therefore, presumably in treated wastewater effluent. How reasonable are these limits with respect to ease and precision/accuracy of routine measurements and real risk to human health and environmental protection? After reviewing the constraints of various analytical methods, the paper describes a method using ²³⁸Pu and ²⁴³Am as traces to determine low levels of alpha in water samples.

885 (LA-UR-94-607) Mixed Waste Treatment Project: LLNL and LANL computer simulations of integrated flowsheets. Camp, D.W. (Lawrence Livermore National Lab., CA (United States)); Dietsche, L.J.; Upadhye, R.S.; Borduin, L.C.; Pendergrass, J.A.; Thompson, T.K. Los Alamos National Lab., NM (United States). [1994]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-940225-37: Waste management '94, Tucson, AZ (United States), 27 Feb - 3 mar 1994). Order Number DE94007563. Source: OSTI; NTIS; INIS; GPO Dep.

Computer simulations of mixed waste processing flowsheets using ASPEN PLUS process simulation software were completed by a joint Lawrence Livermore National Laboratory/Los National Laboratory (LLNL/LANL) effort for the US Department of Energy Mixed Waste Treatment Project. The LLNL model used relatively detailed synthesized chemical "cocktails" to simulate waste streams. The LANL approach used less detail but made extensive use of simple steam splitters and thermodynamic coal models for combustible waste compositions. The two modeling approaches agreed within 16% for the product streams and within 25% for the auxiliary fuel rate. The discrepancy between the auxiliary fuel rates was traced to different methods of handling organics in lab packs and scintillation vials with the process models. The ASPEN models are valuable tools for evaluating waste processing flowsheets.

886 (LA-UR-94-1056) The Controlled-Air Incinerator at Los Alamos. Newmyer, J.N. Los Alamos National Lab., NM (United States). [1994]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9404126-1: Mixed waste thermal treatment symposium, Denver, CO (United States), 12-14 Apr 1994). Order Number DE94009334. Source: OSTI; NTIS; GPO Dep.

The Controlled-Air Incinerator (CAI) at Los Alamos is being modified and upgraded to begin routine operations treating low-level mixed waste (LLMW), radioactively contaminated polychlorinated biphenyl (PCB) wastes, low-level liquid wastes, and possibly transuranic (TRU) wastes. This paper describes those modifications. Routine waste operations should begin in late FY95.

887 (NVO-325-Rev.1) Nevada Test Site defense waste acceptance criteria; certification, and transfer requirements: Revision 1. USDOE Nevada Field Office, Las

Vegas, NV (United States); Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV (United States). Waste Management Dept. Jun 1992. 126p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93008616. Source: OSTI; NTIS; INIS; GPO Dep.

Reference document NVO-325LRD-Rev.1.

The Nevada Test Site Defense Waste Acceptance Criteria, Certification, and Transfer Requirements establishes procedures, requirements, and criteria for safe transfer and disposal of low-level and mixed waste and storage of transuranic and transuranic mixed waste at the NTS. Included are the following: overview of the NTS Defense Waste Management Program, guidance for the application to dispose or store waste, the NTS waste acceptance criteria including the waste characterization certification requirements, and requirements for waste receipt.

888 (ORNL-6485) DOE assay methods used for characterization of contact-handled transuranic waste. Schultz, F.J. (Oak Ridge National Lab., TN (United States)); Caldwell, J.T. Oak Ridge National Lab., TN (United States). Aug 1991. 68p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92000389. Source: OSTI; NTIS; INIS; GPO Dep.

US Department of Energy methods used for characterization of contact-handled transuranic (CH-TRU) waste prior to shipment to the Waste Isolation Pilot Plant (WIPP) are described and listed by contractor site. The methods described are part of the certification process. All CH-TRU waste must be assayed for determination of fissile material content and decay heat values prior to shipment and prior to storage on-site. Both nondestructive assay (NDA) and destructive assay methods are discussed, and new NDA developments such as passive-action neutron (PAN) crate counter improvements and neutron imaging are detailed. Specifically addressed are assay method physics; applicability to CH-TRU wastes; calibration standards and implementation; operator training requirements and practices; assay procedures; assay precision, bias, and limit of detection; and assay limitation. While PAN is a new technique and does not yet have established American Society for Testing and Materials, American National Standards Institute, or Nuclear Regulatory Commission guidelines or methods describing proper calibration procedures, equipment setup, etc., comparisons of PAN data with the more established assay methods (e.g., segmented gamma scanning) have demonstrated its reliability and accuracy. Assay methods employed by DOE have been shown to be reliable and accurate in determining fissile, radionuclide, alpha-curie content, and decay heat values of CH-TRU wastes. These parameters are therefore used to characterize packaged waste for use in certification programs such as that used in shipment of CH-TRU waste to the WIPP. 36 refs., 10 figs., 7 tabs.

889 (ORNL/ER-12) Investigation of the organic matter in inactive nuclear tank liquids: Environmental Restoration Program. Schenley, R.L.; Griest, W.H. Oak Ridge National Lab., TN (United States). Aug 1990. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93014339. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental Protection Agency (EPA) methodology for regulatory organics fails to account for the organic matter that is suggested by total organic carbon (TOC) analysis in the Oak Ridge National Laboratory (ORNL) inactive nuclear waste-tank liquids and sludges. Identification and measurement of the total organics are needed to select appropriate

waste treatment technologies. An initial investigation was made of the nature of the organics in several waste-tank liquids. This report details the analysis of ORNL wastes.

890 (ORNL/ER-19) Sampling and analysis of the inactive waste tanks TH-2, WC-1, and WC-15: Environmental Restoration Program. Autrey, J.W.; Keller, J.M.; Griest, W.H.; Botts, J.L.; Schenley, R.L.; Sipe, M.A. Oak Ridge National Lab., TN (United States). Feb 1992. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92010937. Source: OSTI; NTIS; INIS; GPO Dep.

Thirty-eight inactive liquid low-level radioactive waste tanks are currently managed by the Environmental Restoration Program of Oak Ridge National Laboratory. The contents of these tanks are to be characterized in preparation for future corrective actions and remediation activities as part of compliance with the pending Federal Facility Agreement for the Oak Ridge Reservation. Twenty-nine of these tanks were sampled and analyzed in 1989. Three of the tanks (TH-2, WC-1, and WC-15) were not accessible from the surface and thus were not sampled until 1990. This report presents the sampling and analytical results of that campaign. All three tanks in this report had negligible regulatory organic compounds in the samples that were collected. There were no US Environmental Protection Agency (EPA) Target Compound List (TCL) constituents for volatile organics detected in any of the aqueous samples. The only semivolatile organics detected were 2-chlorophenol (52 $\mu\text{g/L}$) in tank TH-2 and dichloroethane (14–15 $\mu\text{g/L}$) and diethyl ether (15–17 $\mu\text{g/L}$) in tank WC-15. A thin oil layer was discovered floating on top of the aqueous contents in tank WC-15. The analysis of the oil layer detected no volatile organics and showed only one EPA TCL constituent, di-n-butylphthalate, at 1900 $\mu\text{g/L}$. Low levels of Resource Conservation and Recovery Act (RCRA) metals were observed in the samples from tank TH-2, but only the mercury level exceeded the RCRA limit. Samples from tank WC-1 had elevated levels of the RCRA metals barium, chromium, and lead. There were also finely suspended particles in one of the samples from tank WC-1, which was filtered and analyzed separately. This solid fines have levels of transuranium elements ^{238}Pu and ^{241}Am high enough to be classified as transuranic waste.

891 (ORNL/ER-52) Surface radiological investigations at White Wing Scrap Yard, Oak Ridge Reservation, Oak Ridge, Tennessee. Williams, J.K.; Rodriguez, R.E.; Uziel, M.S.; Tiner, P.F. Oak Ridge National Lab., TN (United States). Sep 1991. 62p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE91018993. Source: OSTI; NTIS; GPO Dep.

A surface radiological scoping survey of accessible areas at the White Wing Scrap Yard [Waste Area Grouping 11 (WAG 11)] was conducted intermittently from December 1989 through July 1991 by members of the Measurement Applications and Development Group, Health and Safety Research Division, Oak Ridge National Laboratory (ORNL) at the request of Environmental Restoration Program personnel at ORNL. The White Wing Scrap Yard is an estimated 30-acre, predominately wooded area located on the western edge of East Fork Ridge in the McNew Hollow area on the US Department of Energy's Oak Ridge Reservation. The scrap yard was formerly used for aboveground storage of contaminated material (e.g., steel tanks, metal, glass, concrete, and miscellaneous industrial trash) from the Oak Ridge K-25 Site, Oak Ridge Y-12 Plant, and ORNL. The

purposes of this cursory investigation were (1) to provide an updated contamination status of the site by locating and interpreting the presence, nature, and extent of surface radiological contamination and (2) to provide a basis for the formulation of interim corrective action to limit human exposures to radioactivity and minimize the potential for contaminant dispersion. 13 refs., 17 figs., 5 tabs.

892 (ORNL/ER-55) Annual hydrologic data summary for the White Oak Creek Watershed: Water Year 1990 (October 1989–September 1990). Borders, D.M.; Gregory, S.M.; Clapp, R.B.; Frederick, B.J.; Moore, G.K.; Watts, J.A.; Broders, C.C.; Bednarek, A.T. Oak Ridge National Lab., TN (United States). Sep 1991. 245p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92002436. Source: OSTI; NTIS; GPO Dep.

ESD Publication 3754.

This report summarizes, for the Water Year 1990 (October 1989–September 1990), the dynamic hydrologic data collected on the White Oak Creek (WOC) Watershed's surface and subsurface flow systems. These systems affect the quality or quantity of surface water and groundwater. The collection of hydrologic data is one component of numerous, ongoing Oak Ridge National Laboratory (ORNL) environmental studies and monitoring programs and is intended to 1. characterize the quantity and quality of water in the flow system, 2. plan and assess remedial action activities, and 3. provide long-term availability of data and assure quality. Characterizing the hydrology of the WOC watershed provides a better understanding of the processes which drive contaminant transport in the watershed. Identifying of spatial and temporal trends in hydrologic parameters and mechanisms that affect the movement of contaminants supports the development of interim corrective measures and remedial restoration alternatives. Hydrologic monitoring supports long-term assessment of the effectiveness of remedial actions in limiting the transport of contaminants across Waste Area Grouping boundaries and ultimately to the off-site environment. The majority of the data summarized in this report are available from the Remedial Action Programs Data and Information Management System data base. Surface water data available within the WOC flow system include discharge and runoff, surface water quality, radiological and chemical contamination of sediments, and descriptions of the outfalls to the WOC flow system. Climatological data available for the Oak Ridge area include precipitation, temperature, humidity, wind speed, and wind direction. Information on groundwater levels, aquifer characteristics, and groundwater quality are presented. Anomalies in the data and problems with monitoring and accuracy are discussed. 58 refs., 54 figs., 15 tabs.

893 (ORNL/ER-80) Waste characterization data manual for the inactive liquid low-level waste tank systems at Oak Ridge National Laboratory, Oak Ridge, Tennessee: Environmental Restoration Program. Oak Ridge National Lab., TN (United States). Jun 1992. 138p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92018074. Source: OSTI; NTIS; INIS; GPO Dep.

This Waste Characterization Data Manual contains the results of an analysis of the contents of liquid low-level waste (LLLW) tanks that have been removed from service in accordance with the requirements of the Oak Ridge Reservation (ORR) Federal Facility Agreement (FFA), Sect.

IX.G.1. This manual contains the results of sampling activities that were conducted at the Oak Ridge National Laboratory in 1988. Thirty-three tanks were sampled and analyzed at that time. Sampling of the remaining inactive tanks is currently underway, and data from these tanks will be added to this manual as they become available. Data are presented from analysis of volatile organic compounds, semivolatile organic compounds, polychlorinated biphenyls, radiochemical compounds, and inorganic compounds.

894 (ORNL/ER-118) Dewatering equipment recommendations for the solids/liquid separation project at Waste Area Grouping 6 at Oak Ridge National Laboratory, Oak Ridge, Tennessee: Environmental Restoration Program. Taylor, P.A. Oak Ridge National Lab., TN (United States). May 1992. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92014958. Source: OSTI; NTIS; GPO Dep.

The final closure of Waste Area Grouping (WAG) 6 at Oak Ridge National Laboratory will include the plugging and abandonment of many existing wells and boreholes and the installation of diversion trenches for groundwater control. These activities will generate soil that must be dewatered before it can be disposed of. Three different types of dewatering equipment—rotary vacuum drum filters, automatic discharge pressure filters, and centrifuges—have been evaluated to assess their suitability for the WAG 6 project. Because of its lower cost and minimal prescreening requirements, it is recommended that a centrifuge be used to dewater the WAG 6 soils.

895 (ORNL/ER-122) Characterization of secondary solid waste anticipated from the treatment of trench water from Waste Area Grouping 6 at Oak Ridge National Laboratory, Oak Ridge, Tennessee: Environmental Restoration Program. Kent, T.E.; Taylor, P.A. Oak Ridge National Lab., TN (United States). Environmental Restoration Div. Sep 1992. 31p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92040848. Source: OSTI; NTIS; INIS; GPO Dep.

This project was undertaken to demonstrate that new liquid waste streams, generated as a consequence of closure activities at Waste Area Grouping (WAG) 6, can be treated adequately by existing wastewater treatment facilities at Oak Ridge National Laboratory (ORNL) without producing hazardous secondary solid wastes. Previous bench-scale treatable studies indicated that ORNL treatment operations will adequately remove the contaminants although additional study was required in order to characterize the secondary waste materials produced as a result of the treatment. A 0.5-L/min pilot plant was designed and constructed to accurately simulate the treatment capabilities of ORNL full-scale (490 L/min) treatment facilities—the Process Waste Treatment Plant (PWTP) and Nonradiological Wastewater Treatment Plant (NRWTP). This new test system was able to produce secondary wastes in the quantities necessary for US Environmental Protection Agency toxicity characteristic leaching procedure (TCLP) testing. The test system was operated for a 45-d test period with a minimum of problems and downtime. The pilot plant operating data verified that the WAG 6 trench waters can be treated at the PWTP and NRWTP to meet the discharge limits. The results of TCLP testing indicate that none of the secondary solid wastes will be considered hazardous as defined by the Resource Conservation and Recovery Act.

896 (ORNL/ER-142) Feasibility study on the solidification of liquid low-level radioactive mixed waste in the inactive tank system at Oak Ridge National Laboratory, Oak Ridge, Tennessee: Environmental Restoration Program. Trussell, S. (Texas A and M Univ., College Station, TX (United States). Dept. of Civil Engineering); Spence, R.D. Oak Ridge National Lab., TN (United States). Jan 1993. 34p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93006363. Source: OSTI; NTIS; INIS; GPO Dep.

A literature survey was conducted to help determine the feasibility of solidifying a liquid low-level radioactive mixed waste in the inactive tank system at Oak Ridge National Laboratory (ORNL). The goal of this report is to facilitate a decision on the disposition of these wastes by identifying any waste constituents that might (1) compromise the strength or stability of the waste form or (2) be highly leachable. Furthermore, its goal is to identify ways to circumvent interferences and to decrease the leachability of the waste constituents. This study has sought to provide an understanding of inhibition of cement set by identifying the fundamental chemical mechanisms by which this inhibition takes place. From this fundamental information, it is possible to draw some conclusions about the potential effects of waste constituents, even in the absence of particular studies on specific compounds.

897 (ORNL/ER-148) Guidance document for the preparation of waste management plans for the Environmental Restoration Program at Oak Ridge National Laboratory: Environmental Restoration Program. Clark, C. Jr. Oak Ridge National Lab., TN (United States). Jul 1993. 98p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93019602. Source: OSTI; NTIS; INIS; GPO Dep.

A project waste management (WM) plan is required for all Oak Ridge National Laboratory (ORNL) Environmental Restoration (ER) Program remedial investigation, decommission and decontamination (D&D), and remedial action (RA) activities. The project WM plan describes the strategy for handling, packaging, treating, transporting, characterizing, storing, and/or disposing of waste produced as part of ORNL ER Program activities. The project WM plan also contains a strategy for ensuring worker and environmental protection during WM activities.

898 (ORNL/ER/Sub-87-99053/55) Waste Management Plan for the Remedial Investigation of Waste Area Grouping 10, Operable Unit 3, at Oak Ridge National Laboratory, Oak Ridge, Tennessee: Environmental Restoration Program. Bechtel National, Inc., Oak Ridge, TN (United States); Oak Ridge National Lab., TN (United States). Oct 1993. 42p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94003516. Source: OSTI; NTIS; INIS; GPO Dep.

This Waste Management Plan (WMP) supplements the Remedial Investigation/Feasibility Study (RI/FS) Project WMP and defines the criteria and methods to be used for managing and characterizing waste generated during activities associated with the RI of 23 wells near the Old Hydrofracture Facility (OHF). These wells are within the Waste Area Grouping (WAG) 5 area of contamination (AOC) at Oak Ridge National Laboratory (ORNL). Field activities for the limited RI of Operable Unit (OU) 3 of WAG 10 will involve sampling and measurement of various environmental media (e.g., liquids and gases). Many of these activities will occur

in areas known to be contaminated with radioactive materials or hazardous chemical substances, and it is anticipated that contaminated solid and liquid wastes and noncontaminated wastes will be generated as a result of these activities. On a project-wide basis, handling of these waste materials will be accomplished in accordance with the RI/FS Project WMP and the procedures referenced throughout the plan.

899 (ORNL/M-1528) Exploratory tests of washing radioactive sludge samples from the Melton Valley and evaporator facility storage tanks at ORNL. Sears, M.B.; Botts, J.L.; Keller, J.M. Oak Ridge National Lab., TN (United States). Sep 1991. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE91018524. Source: OSTI; NTIS; INIS; GPO Dep.

Exploratory tests were initiated to wash radioactive sludge samples from the waste storage tanks at the Oak Ridge National Laboratory (ORNL). The purpose was to provide preliminary information about (1) the anions in the sludge phase that are soluble in water or dilute acid (e.g., the anions in the interstitial liquid) and (2) the solubilities of sludge constituents in water under process conditions. The experiments were terminated before completion due to changing priorities by the Department of Energy (DOE). This memorandum was prepared primarily for documentation purposes and presents the incomplete data. 3 refs., 13 tabs.

900 (ORNL/M-2751/ES) Oak Ridge National Laboratory Technology Logic Diagram: Executive Summary. Oak Ridge K-25 Site, TN (United States). 30 Jun 1993. 110p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93016143. Source: OSTI; NTIS; GPO Dep.

This executive summary contains a description of the logic diagram format; some examples from the diagram (Vol. 2) and associated technology evaluation data sheets (Vol. 3); a complete (albeit condensed) listing of the RA, D&D, and WM problems at ORNL; and a complete listing of the technology rankings for all the areas covered by the diagram.

901 (ORNL/M-2751/V1/Pt.C) Oak Ridge National Laboratory Technology Logic Diagram: Volume 1, Technology Evaluation: Part C, Waste Management. Oak Ridge K-25 Site, TN (United States). Sep 1993. 220p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93016146. Source: OSTI; NTIS; INIS; GPO Dep.

This report documents activities at ORNL including waste management and remedial action at the site; also waste processing and disposal; robotics and automation of the laboratory; and regulatory compliance

902 (ORNL/M-2751/V2/Pt.C) Oak Ridge National Laboratory Technology Logic Diagram: Volume 2, Technology Logic Diagram: Part C, Waste Management. Oak Ridge K-25 Site, TN (United States). Sep 1993. 324p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93016149. Source: OSTI; NTIS; GPO Dep.

This report documents site remediation at ORNL, including ORNL site characterization technologies, waste management and robotics and automation of the laboratory for waste processing and analysis.

903 (ORNL/TM-10352) Treatment studies at the Process Waste Treatment Plant at Oak Ridge National Laboratory. Robinson, S.M.; Begovich, J.M. Oak Ridge National Lab., TN (United States). Mar 1991. 159p. Sponsored

by USDOE, Washington, DC (USA). DOE Contract AC05-84OR21400. Order Number DE91010444. Source: OSTI; NTIS; INIS; GPO Dep.

Precipitation and ion-exchange methods are being developed to decontaminate Oak Ridge National Laboratory process wastewaters containing small amounts of ^{90}Sr and ^{137}Cs while minimizing waste generation. Many potential processes have been examined in laboratory-scale screening tests. Based on these data, five process flowsheets were developed and are being evaluated under pilot- and full-scale operating conditions. Improvements in the existing treatment system based on this study have resulted in a 66 vol % reduction in waste generation. 19 refs., 26 figs., 45 tabs.

904 (ORNL/TM-11536) The emergency avoidance solidification campaign of liquid low-level waste at Oak Ridge National Laboratory. Myrick, T.E. (Oak Ridge National Lab., TN (United States)); Helms, R.E.; Scanlan, T.F.; Schultz, R.M.; Scott, C.B.; Williams, L.C.; Homan, F.J.; Keigan, M.V.; Monk, T.H.; Morrow, R.W.; Van Hoesen, S.D.; du Mont, S.P. Oak Ridge National Lab., TN (United States). Jan 1992. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92006764. Source: OSTI; NTIS; INIS; GPO Dep.

Since the beginning of nuclear research and development activities at the Oak Ridge National Laboratory (ORNL) in 1943, the generation, collection, treatment, storage, and disposal of the liquid low-level waste (LLLW) stream has been an integral part of ORNL's waste management operations. This waste stream, consisting principally of a high nitrate (4.5 molar), high pH (pH 13-14) mixture of reactor, hot cell, and research laboratory liquid radioactive wastes (<5 Ci/gal), has been treated and disposed of in a variety of ways over the years. Most recently, the hydrofracture technology had been used for deep-well disposal of a grout mix of LLLW, cement, fly ash, and other additives. In 1984, this disposal technique was discontinued due to regulatory permitting issues and the need for extensive facility modifications for future operations. With loss of this disposal capability and the continued generation of LLLW by ORNL research activities, the limited tank storage capacity was rapidly being depleted.

905 (ORNL/TM-11654) Development of an in-line grout meter for improved quality control: January 1990 progress report. Del Cul, G.D.; Gilliam, T.M. Oak Ridge National Lab., TN (United States). Apr 1991. 55p. Sponsored by USDOE, Washington, DC (USA). DOE Contract AC05-84OR21400. Order Number DE91012999. Source: OSTI; NTIS; GPO Dep.

Stabilization/solidification (S/S) technology is the most widely used technique for the treatment and ultimate disposal of both radioactive and chemically hazardous waste. Cement-based products, commonly referred to as grouts, are the predominate materials of choice due to their associated low processing costs, compatibility with a wide variety of disposal scenarios, and ability to meet stringent processing and performance requirements. It has long been recognized that there is a need for a monitor to use with freshly prepared grouts that would facilitate improved quality control. In the past, efforts in this area have not proven successful due to the fact that the freshly prepared grout tended to cake on the monitor probe, thus greatly reducing its effectiveness. This report documents progress to date on efforts at Oak Ridge National Laboratory (ORNL) in support of the Westinghouse Hanford Company Grout Technology Program to develop an in-line monitor for mix ratio verification

and, hence, improved quality control in the Westinghouse Hanford Grout Treatment Facility (GTF). Data have been presented which show that the electrical resistance of freshly prepared grouts is linear with respect to grout mix ratio over a wide range of values. The data serve to establish the merits for application to the Westinghouse Hanford GTF. The data further establish that special care must be maintained during design and installation to ensure that the electrodes are properly sealed. The data also indicate that a separate meter will be required in order to assess waste-feed variations. In addition, the data provide guidance on future efforts to be addressed in subsequent progress reports. In particular, the data suggest that waste-feed variability may be the most important future task. Future efforts will be directed towards assessing the effects of (1) variation in waste solids content and (2) variation in waste dilution. 14 figs., 7 tabs.

906 (ORNL/TM-11785) Evaluation of dry-solids-blend material source for grouts containing 106-AN waste: Final report. Spence, R.D.; Gilliam, T.M.; Osborne, S.C.; Francis, C.L.; Trotter, D.R. Oak Ridge National Lab., TN (United States). Sep 1993. 267p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93041041. Source: OSTI; NTIS; INIS; GPO Dep.

Stabilization/solidification technology is one of the most widely used techniques for the treatment and ultimate disposal of both radioactive and chemically hazardous wastes. Cement-based products, commonly referred to as grouts, are the predominant materials of choice because of their low associated processing costs, compatibility with a wide variety of disposal scenarios, and ability to meet stringent processing and performance requirements. Such technology is being utilized in a Grout Treatment Facility (GTF) by the Westinghouse Hanford Company (WHC) for the disposal of various wastes, including 106-AN wastes, located on the Hanford Reservation. The WHC personnel have developed a grout formula for 106-AN disposal that is designed to meet stringent performance requirements. This formula consists of a dry-solids blend containing 40 wt % limestone, 28 wt % granulated blast furnace slag (BFS), 28 wt % American Society for Testing and Materials (ASTM) Class F fly ash, and 4 wt % Type I-II-LA Portland cement. This blend is mixed with 106-AN at a mix ratio of 9 lb of dry-solids blend per gallon of waste. This report documents the final results of efforts at Oak Ridge National Laboratory in support of WHC's Grout Technology Program to assess the effects of the source of the dry-solids-blend materials on the resulting grout formula.

907 (ORNL/TM-11795) Federal facility agreement contingency, upgrade, and replacement plans for the ORNL active low-level radioactive waste tank system. Robinson, S.M.; DePaoli, S.M.; Walker, A.B. Oak Ridge National Lab., TN (United States). Jun 1991. 67p. Sponsored by USDOE, Washington, DC (USA). DOE Contract AC05-84OR21400. Order Number DE91015271. Source: OSTI; NTIS; GPO Dep.

The Superfund Amendment and Reauthorization Act (SARA) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) required that the Department of Energy (DOE) execute a Federal Facilities Agreement (FFA) with the Environmental Protection Agency (EPA) within six months of final listing of the Oak Ridge Reservation on the National Priorities List (NPL). This report summarizes the contingency, upgrade, and replacement plans that are being implemented at ORNL as a result of the FFA. The liquid low-level waste (LLLW) system at ORNL is

comprised of extensive underground piping and collection/treatment/storage tanks. In this report, contingency plans are defined as identification of and planning for alternate management of LLLW, while replacement and upgrade projects are defined as projects that install systems to meet the full secondary containment and leak testing requirements of the FFA. The report describes the objectives of the program, the existing LLLW system, the generated LLLW, and the contingency and upgrade/replacement plans. The alternative methods considered for meeting the FFA are discussed, and the selected plans are summarized by tank system and by generating divisions. The proposed FFA budget and schedules are also summarized. 5 figs., 11 tabs.

908 (ORNL/TM-11799) Treatment requirements for decontamination of ORNL low-level liquid waste. Lee, D.D.; Campbell, D.O. Oak Ridge National Lab., TN (United States). Oct 1991. 55p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92002393. Source: OSTI; NTIS; INIS; GPO Dep.

Experimental studies have been made to provide data for the development of improved processes for decontaminating low-level liquid wastes (LLW) that exist and continue to be generated at Oak Ridge National Laboratory. The concept underlying this work is that there is a net benefit if the major radionuclides (^{137}Cs , ^{134}Cs , ^{90}Sr , and actinides) can be separated into small volumes, thereby reducing the activity of the bulk of the waste so that it can be disposed of or managed at a lower total cost. Data-base calculations on the LLW supernate and sludges contained in the active Melton Valley Storage Tanks and evaporator storage and service tanks are essential in order to define and determine the extent of the problem. These calculations indicate to what extent alpha- and beta-gamma-emitting radionuclides must be removed and/or treated before final disposition of the waste can be made. They also show that many of the inorganic constituents (e.g., regulated metals and nitrate) and minor radionuclides such as ^{14}C and actinides (in terms of quantity present) must be removed before the LLW can be disposed of as either liquid to the environment or solidified and disposed of as solid NUS Class L-1 or L-2 LLW. 25 refs., 31 tabs.

909 (ORNL/TM-11824) Literature review of stabilization/solidification of volatile organic compounds and the implications for Hanford grouts. Spence, R.D.; Osborne, S.C. Oak Ridge National Lab., TN (United States). Sep 1993. 48p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94000730. Source: OSTI; NTIS; INIS; GPO Dep.

A literature review was conducted on the stabilization/solidification of volatile organic compounds (VOCs). Based on this literature, it is likely that the limestone-containing grout will not permanently immobilize VOCs and that no presently available additives can guarantee permanent immobilization. The Westinghouse Hanford company grout may be fairly effective at retarding aqueous leaching of VOCs, and commercial additives can improve this performance. Significant VOC losses do occur during stabilization/solidification, and the high temperatures of the Westinghouse Hanford Company waste and grout should exacerbate this problem. In fact, these high temperatures raise doubts about the presence of VOCs in the double-shell tanks supernates.

910 (ORNL/TM-11853/R1) Waste Reduction plan for Oak Ridge National Laboratory. Oak Ridge National

Lab., TN (United States). Dec 1991. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92007402. Source: OSTI; NTIS; GPO Dep.

Oak Ridge National Laboratory (ORNL) is a multipurpose research and development (R&D) facility owned and operated by the Department of Energy (DOE) and managed under subcontract by Martin Marietta Energy Systems (Energy Systems), Inc. ORNL R&D activities generate numerous small waste streams. In the hazardous waste category alone, over 300 streams of a diverse nature exist. Generation avoidance, reduction or recycling of wastes is an important goal in maintaining efficiency of ORNL R&D activities and protection of workers, the public, and the environment. Waste minimization is defined as any action that minimizes or eliminates the volume or toxicity of waste by avoiding its generation or recycling. This is accomplished by material substitution and inventory management, process modification, or recycling wastes for reuse. Waste reduction is defined as waste minimization plus treatment which results in volume or toxicity reduction. The ORNL Waste Reduction Program will include both waste minimization and waste reduction activities.

911 (ORNL/TM-11864) Costs of RCRA corrective action: Interim report. Tonn, B. (Oak Ridge National Lab., TN (United States)); Russell, M.; Hwang Ho-Ling; Goeltz, R.; Warren, J. Oak Ridge National Lab., TN (United States). Sep 1991. 104p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE91018509. Source: OSTI; NTIS; INIS; GPO Dep.

This report estimates the cost of the corrective action provisions of the Resource Conservation and Recovery Act (RCRA) for all non-federal facilities in the United States. RCRA is the federal law which regulates the treatment, storage, disposal, and recovery of hazardous waste. The 1984 amendment to RCRA, known as the Hazardous and Solid Waste Amendments, stipulates that facilities that treat, store or dispose of hazardous wastes (TSDs) must remediate situations where hazardous wastes have escaped into the environment from their solid waste management units (SWMUs). The US Environmental Protection Agency (USEPA 1990a), among others, believes that the costs of RCRA corrective action could rival the costs of SUPERFUND. Evaluated herein are costs associated with actual remedial actions. The remedial action cost estimating program developed by CH2M Hill is known as the Cost of Remedial Action Model (CORA). It provides cost estimates, in 1987 dollars, by technology used to remediate hazardous waste sites. Rules were developed to categorize each SWMU in the RTI databases by the kinds of technologies that would be used to remediate them. Results were then run through CORA using various assumptions for variable values that could not be drawn from the RTI databases and that did not have CORA supplied default values. Cost estimates were developed under several scenarios. The base case assumes a TSD and SWMU universe equal to that captured in the RTI databases, a point of compliance at the SWMU boundary with no ability to shift wastes from SWMU to SWMU, and a best-as-practical clean-up to health-based standards. 11 refs., 12 figs., 12 tabs.

912 (ORNL/TM-11867) Evaluation of dry-solids-blend material source for grouts containing 106-AN waste: September 1990 progress report. Gilliam, T.M.; Osborne, S.C.; Francis, C.L.; Scott, T.C. Oak Ridge National Lab., TN (United States). Sep 1993. 206p. Sponsored

by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94000561. Source: OSTI; NTIS; INIS; GPO Dep.

Stabilization/solidification (S/S) is the most widely used technology for the treatment and ultimate disposal of both radioactive and chemically hazardous wastes. Such technology is being utilized in a Grout Treatment Facility (GTF) by the Westinghouse Hanford Company (WHC) for the disposal of various wastes, including 106-AN wastes, located on the Hanford Reservation. The WHC personnel have developed a grout formula for 106-AN disposal that is designed to meet stringent performance requirements. This formula consists of a dry-solids blend containing 40 wt % limestone, 28 wt % granulated blast furnace slag (BFS), 28 wt % ASTM Class F fly ash, and 4 wt % Type I-II-LA Portland cement. The blend is mixed with 106-AN waste at a ratio of 9 lb of dry-solids blend per gallon of waste. This report documents progress made to date on efforts at Oak Ridge National Laboratory (ORNL) in support of WHC's Grout Technology Program to assess the effects of the source of the dry-solids-blend materials on the resulting grout formula.

913 (ORNL/TM-11927) Summary report on the demonstration of the Duratek process for treatment of mixed-waste contaminated groundwater. Singh, S.P.N.; Lomenick, T.F. Oak Ridge National Lab., TN (United States). Apr 1992. 144p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92014926. Source: OSTI; NTIS; GPO Dep.

This report presents the results of the demonstration of the Duratek process for removal of radioactive and hazardous waste compounds from mixed-waste contaminated groundwaters found at the Department of Energy (DOE) sites managed by Martin Marietta Energy Systems (Energy Systems). The process uses Duratek proprietary Durasil® ion-exchange media to remove the above contaminants from the water to produce treated water that can meet current and proposed drinking water quality standards with regard to the above contaminants. The demonstration showed that the process is simple, compact, versatile, and rugged and requires only minimal operator attention. It is thus recommended that this process be considered for remediating the mixed-waste contaminated waters found at the Energy Systems-managed DOE sites.

914 (ORNL/TM-11999) Long-reach manipulation for waste storage tank remediation: FY 1991 report. Jansen, J.F.; March-Leuba, S.; Kwon, D.S.; Babcock, S.M.; Burks, B.L.; Kress, R.L.; Hamel, W.R. Oak Ridge National Lab., TN (United States). Mar 1992. 94p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92014936. Source: OSTI; NTIS; GPO Dep.

Remediation of large underground storage tanks containing hazardous waste provides an application for state-of-the-art technology in flexible link manipulator design and control and indicates a need for additional research and development. Application requirements are described, and preliminary analyses associated with this problem are summarized. Inherent physical limitations of flexible manipulators are discussed. Potential kinematic configurations, drive-train elements, and control issues for both free-space motion and damping of forced vibration are addressed. Also induced are future directions for research and development in mechanical components and control strategies.

915 (ORNL/TM-12031) Treatability studies for decontamination of Melton Valley Storage Tank supernate. Arnold, W.D.; Fowler, V.L.; Perona, J.J.; McTaggart, D.R. Oak Ridge National Lab., TN (United States). Aug 1992. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92018097. Source: OSTI; NTIS; INIS; GPO Dep.

Liquid low-level waste, primarily nitric acid contaminated with radionuclides and minor concentrations of organics and heavy metals, is neutralized with sodium hydroxide, concentrated by evaporation, and stored for processing and disposal. The evaporator concentrate separates into sludge and supernate phases upon cooling. The supernate is 4 to 5 mol/L sodium nitrate contaminated with soluble radionuclides, principally ¹³⁷Cs, ⁹⁰Sr, and ¹⁴C, while the sludge consists of precipitated carbonates and hydroxides of metals and transuranic elements. Methods for treatment and disposal of this waste are being developed. In studies to determine the feasibility of removing ¹³⁷Cs from the supernates before solidification campaigns, batch sorption measurements were made from four simulated supernate solutions with four different samples of potassium hexacyanocobalt ferrate (KCCF). Cesium decontamination factors of 1 to 8 were obtained with different KCCF batches from a highly-salted supernate at pH 13. Decontamination factors as high as 50 were measured from supernates with lower salt content and pH, in fact, the pH had a greater effect than the solution composition on the decontamination factors. The decontamination factors were highest after 1 to 2 d of mixing and decreased with longer mixing times due to decomposition of the KCCF in the alkaline solution. The decontamination factors decreased with settling time and were lower for the same total contact time (mixing + settling) for the longer mixing times, indicating more rapid KCCF decomposition during mixing than during settling. There was no stratification of cesium in the tubes as the KCCF decomposed.

916 (ORNL/TM-12036) In-tank evaporator demonstrations during 1990/1991 at the ORNL Melton Valley Storage Tanks. Walker, J.F. Jr.; Perona, J.J.; Robinson, S.M. Oak Ridge National Lab., TN (United States). Oct 1992. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93002410. Source: OSTI; NTIS; GPO Dep.

The results of this report indicate that in-tank evaporation (ITE) should be continued to reduce the inventory of supernate in the Melton Valley Storage Tanks (MVST) until additional storage tanks and/or treatment facilities can be installed. Several equipment problems were encountered during the initial operation of the ITE. All of these have been addressed with the exception of the replacement of the air compressor that was originally used in the hydrofracture process and the intermittent wetting of the high efficiency particulate air (HEPA) filters. The compressor is being replaced with a unit that is designed for continuous operation. Filter wetting needs further investigation. ITE will help reduce the supernate inventory in the MVST using the existing equipment but will not eliminate the need for solidification campaigns. Several options are available to increase the evaporation rate above that achieved in this study to minimize dependence on solidification campaigns until new tanks and/or treatment systems become available. These include increasing the air sparge flow rate through the MVST, adding heat to the MVST, and pumping the supernate to an

evaporator located near the MVST. Evaluations of the feasibility and cost effectiveness for the more promising options began in FY 1991 and will continue in FY 1992.

917 (ORNL/TM-12063) The development of a zeolite system for upgrade of the Process Waste Treatment Plant. Robinson, S.M.; Kent, T.E.; Arnold, W.D.; Parrott, J.R. Jr. Oak Ridge National Lab., TN (United States). Oct 1993. 71p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94001117. Source: OSTI; NTIS; GPO Dep.

Studies have been undertaken to design an efficient zeolite ion exchange system for use at the ORNL Process Waste Treatment Plant to remove cesium and strontium to meet discharge limits. This report focuses on two areas: (1) design of column hardware and pretreatment steps needed to eliminate column plugging and channeling and (2) development of equilibrium models for the wastewater system. Results indicate that zeolite columns do not plug as quickly when the wastewater equalization is performed in the new Bethel Valley Storage Tanks instead of the former equalization basin where suspended solids concentration is high. A down-flow column with spent zeolite was used successfully as a prefilter to prevent plugging of the zeolite columns being used to remove strontium and cesium. Equilibrium studies indicate that a Langmuir isotherm models binary zeolite equilibrium data while the modified Dubinin-Polyani model predicts multicomponent data.

918 (ORNL/TM-12152) Criticality safety studies for the storage of waste from nuclear fuel service in Intercell Storage Wells 2 and 3 of Building 3019. Primm, R.T. III; Hopper, C.M.; Smolen, G.R. Oak Ridge National Lab., TN (United States). Nov 1992. 71p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93004309. Source: OSTI; NTIS; INIS; GPO Dep.

Contains 5 1/4 in. floppy disk.

This report provides computational evaluation results demonstrating that mixed oxide waste can be safely stored in Intercell Storage Wells 2 and 3 of Building 3019 at the Oak Ridge National Laboratory. Existing, verified computational techniques are validated with applicable critical experiments and tolerance limits for safety analyses are derived. Multiplication factors for normal and credible abnormal configurations are calculated and found to be far subcritical when compared to derived safety limits.

919 (ORNL/TM-12243) Evaporation studies on Oak Ridge National Laboratory liquid low-level waste. Fowler, V.L. (PAI Corp., Oak Ridge, TN (United States)); Perona, J.J. Oak Ridge National Lab., TN (United States). Mar 1993. 87p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93011692. Source: OSTI; NTIS; INIS; GPO Dep.

Evaporation studies were performed with Melton Valley storage tank liquid low-level radioactive waste concentrate and with surrogates (nonradioactive) to determine the feasibility of a proposed out-of-tank-evaporation project. Bench-scale tests indicated that volume reductions ranging from 30 to 55% could be attained. Vendor-site tests were conducted (with surrogate waste forms) using a bench-scale single-stage, low-pressure (subatmospheric), low-temperature (120 to 173°F) evaporator similar to units in operation at several nuclear facilities. Vendor tests were successful; a 30% volume reduction was attained with no crystallization of solids and no foaming, as would be

expected from a high pH solution. No fouling of the heat exchanger surfaces occurred during these tests. It is projected that 52,000 to 120,000 gal of water could be evaporated from the supernate stored in the Melton and Bethel Valley liquid low-level radioactive waste (LLLW) storage tanks with this type of evaporator.

920 (ORNL/TM-12272) A multicomponent ion-exchange equilibrium model for chabazite columns treating ORNL wastewaters. Perona, J.J. Oak Ridge National Lab., TN (United States). Jun 1993. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93017560. Source: OSTI; NTIS; INIS; GPO Dep.

Planned near-term and long-term upgrades of the Oak Ridge National Laboratory (ORNL) Process Waste Treatment Plant (PWTP) will use chabazite columns to remove ⁹⁰Sr and ¹³⁷Cs from process wastewater. A valid equilibrium model is required for the design of these columns and for evaluating their performance when influent wastewater composition changes. The cations exchanged, in addition to strontium and cesium, are calcium, magnesium, and sodium. A model was developed using the Wilson equation for the calculation of the solid-phase activity coefficients. The model was tested against chabazite column runs on two different wastewaters and found to be valid. A sensitivity analysis was carried out for the projected wastewater compositions, in which the model was used to predict changes in relative separation factors for strontium and cesium subject to changes in calcium, magnesium, and sodium concentrations.

921 (ORNL/TM-12283) In-situ grouting of the low-level radioactive waste disposal silos at ORNL's Solid Waste Storage Area Six. Francis, C.W. (Oak Ridge National Lab., TN (US)); Farmer, C.D.; Stansfield, R.G. Oak Ridge National Lab., TN (United States). Jul 1993. 54p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93017241. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental Sciences Division Publication No. 4026.

At Oak Ridge National Laboratory (ORNL), one method of solid low-level radioactive waste disposal has been disposed of in below-grade cylindrical concrete silos. Located in Solid Waste Storage Area 6 (SWSA 6), each silo measures 8 ft in diameter and 20 ft deep. Present day operations involve loading the silos with low-level radioactive waste and grouting the remaining void space with a particulate grout of low viscosity. Initial operations involving the disposal of wastes into the below-grade silos did not include the grouting process. Grouting was stated as a standard practice (in late 1988) after discovering that ~75% of the silos accumulated water in the bottom of the silos in the ~2 years after capping. Silo water (leachate) contained a wide range of types and concentrations of radionuclides. The migration of contaminated leachate out of the silo into adjoining soil and groundwater was considered to be a serious environmental concern. This report describes how a specially designed particulate-base grout was used to grout 54 silos previously filled with low-level radioactive waste. Grouting involved three steps: (1) silo preparation, (2) formulation and preparation of the grout mixture, and (3) injection of the grout into the silos. Thirty-five of the 54 silos grouted were equipped with a 3-in.-diam Polyvinyl Chloride (PVC) pipe used to monitor water levels in the silos. A method for rupturing the bottom section of these PVC wells was developed so that grout could be pumped to the bottom of those silos.

Holes (2-in. diam) were drilled through the ~18 in. thick concrete to fill the remaining 19 wells without the PVC monitoring wells. The formulation of grout injected into the silos was based on a Portland Type I cement, flyash, sand, and silica fume admixture. Compressive strength of grout delivered to SWSA6 during grouting operations averaged 1,808 lb/in² with a bulk density of 3,549 lb/yd³.

922 (ORNL/TM-12297) Liquid and Gaseous Waste Operations Department annual operating report, CY 1992. Gillespie, M.A.; Maddox, J.J.; Scott, C.B. Oak Ridge National Lab., TN (United States). Mar 1993. 105p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93013459. Source: OSTI; NTIS; INIS; GPO Dep.

A total of 6.05×10^7 gal of liquid waste was decontaminated by the Process Waste Treatment Plant (PWTP) ion exchange system during CY 1992. This averaged to 115 gpm throughout the year. When necessary, a wastewater sidestream of 50–80 gpm was treated through the use of a natural zeolite treatment system. An additional 8.00×10^6 gal (average of 15 gpm throughout the year) were treated by the zeolite system. Therefore, the average total flow treated at the PWTP for CY 1992 was 130 gpm. In mid-June, the zeolite system was repiped to allow it the capability to treat the ion exchange system's discharge due to rising Cs problems in the wastewater. While being used to treat the ion exchange system's discharge, it cannot treat a sidestream of wastewater. During the year, the regeneration of the cation exchange resins resulted in the generation of 7.83×10^3 gal of liquid low-level waste (LLLW) concentrate and 1.15×10^4 gal of LLLW evaporator feed. The head-end softening process (precipitation/clarification) generated 604 drums (4.40×10^3 ft³) of solid low-level waste sludge. The zeolite treatment system generated approximately 8.40×10^2 ft³ of spent zeolite resin, which was turned over to the Solid Waste Operations Department for disposal. See Table 1 for a monthly summary of activities at the PWTP. Figures 1, 2, 3, and 4 show a comparison of operations at the PWTP in 1992 with previous years. Figure 5 shows a comparison of annual rainfall at Oak Ridge National Laboratory (ORNL) since 1987. A total of 1.55×10^8 gal of liquid waste (average of 294 gpm throughout the year) was treated at the Nonradiological Wastewater Treatment Plant (NRWTP). Of this amount, 1.40×10^7 gal were treated by the precipitation/clarification process for removal of heavy metals. Twenty-five boxes (1.60×10^3 ft³) of solid sludge generated by the precipitation/clarification process were removed from the filter press room.

923 (ORNL/TM-12315) Development and testing of ion exchangers for treatment of liquid wastes at Oak Ridge National Laboratory. Collins, J.L. (Oak Ridge National Lab., TN (United States)); Davidson, D.J.; Chase, C.W.; Egan, B.Z.; Ensor, D.D.; Bright, R.M.; Glasgow, D.C. Oak Ridge National Lab., TN (United States). Mar 1993. 53p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93013460. Source: OSTI; NTIS; INIS; GPO Dep.

This report addresses three areas of waste treatment: (1) treatment of newly generated low-level liquid waste and Melton Valley Storage Tank (MVST) supernate using inorganic ion exchangers; (2) treatment of processing streams at the Radiochemical Engineering Development Center (REDC); and (3) removal of radionuclides from organic

solutions. Distribution of various radionuclides between simulated waste solutions and several sorbents was determined in batch tests. Inorganic ion exchangers were prepared in the form of microspheres by an internal gelation process. Microspheres of hydrous titania, hydrous zirconia, hydrous titania containing embedded sodium cobalt hexacyanoferrate, and the corresponding phosphate forms of these materials were prepared. Several zeolites (PDZ-140, PDZ-300, EE-96, CBV-10A) and inorganic ion exchangers (hydrous titania, hydrous zirconia, polyantimonic acid, sodium cobalt hexacyanoferrate) were tested for the removal of cesium and strontium from the acidic simulated Cleanex raffinate generated at REDC. A resorcinol-based ion-exchange resin and three types of sodium titanate were tested for removal of cesium and strontium from the REDC caustic dissolver solution. Hydrous titania, hydrous zirconia, and their corresponding phosphates were tested for the removal of Eu³⁺ from various solutions of di-2-ethylhexyl phosphoric acid (HDEHP) in toluene or dodecane.

924 (ORNL/TM-12317) In situ treatment of VOCs by recirculation technologies. Siegrist, R.L. (Oak Ridge National Lab., TN (US)); Webb, O.F.; Ally, M.R.; Sanford, W.E.; Kearn, P.M.; Zutman, J.L. Oak Ridge National Lab., TN (United States). Jun 1993. 110p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93017850. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental Sciences Division Publication No. 4056.

The project described herein was conducted by Oak Ridge National Laboratory (ORNL) to identify processes and technologies developed in Germany that appeared to have near-term potential for enhancing the cleanup of volatile organic compound (VOC) contaminated soil and groundwater at DOE sites. Members of the ORNL research team identified and evaluated selected German technologies developed at or in association with the University of Karlsruhe (UoK) for in situ treatment of VOC contaminated soils and groundwater. Project activities included contacts with researchers within three departments of the UoK (i.e., Applied Geology, Hydromechanics, and Soil and Foundation Engineering) during fall 1991 and subsequent visits to UoK and private industry collaborators during February 1992. Subsequent analyses consisted of engineering computations, groundwater flow modeling, and treatment process modeling. As a result of these project efforts, two processes were identified as having near-term potential for DOE: (1) the vacuum vaporizer well/groundwater recirculation well and (2) the porous pipe/horizontal well. This document was prepared to summarize the methods and results of the assessment activities completed during the initial year of the project. The project is still ongoing, so not all facets of the effort are completely described in this document. Recommendations for laboratory and field experiments are provided.

925 (ORNL/TM-12329) Separation techniques for the clean-up of radioactive mixed waste for ICP-AES/ICP-MS analysis. Swafford, A.M.; Keller, J.M. Oak Ridge National Lab., TN (United States). 17 Mar 1993. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93012726. Source: OSTI; NTIS; INIS; GPO Dep.

Two separation techniques were investigated for the clean-up of typical radioactive mixed waste samples requiring elemental analysis by Inductively Coupled Plasma-Atomic Emission Spectroscopy (ICP-AES) or Inductively

Coupled Plasma-Mass Spectrometry (ICP-MS). These measurements frequently involve regulatory or compliance criteria which include the determination of elements on the EPA Target Analyte List (TAL). These samples usually consist of both an aqueous phase and a solid phase which is mostly an inorganic sludge. Frequently, samples taken from the waste tanks contain high levels of uranium and thorium which can cause spectral interferences in ICP-AES or ICP-MS analysis. The removal of these interferences is necessary to determine the presence of the EPA TAL elements in the sample. Two clean-up methods were studied on simulated aqueous waste samples containing the EPA TAL elements. The first method studied was a classical procedure based upon liquid-liquid extraction using tri-n-octylphosphine oxide (TOPO) dissolved in cyclohexane. The second method investigated was based on more recently developed techniques using extraction chromatography; specifically the use of a commercially available Eichrom TRU-Spec™ column. Literature on these two methods indicates the efficient removal of uranium and thorium from properly prepared samples and provides considerable qualitative information on the extraction behavior of many other elements. However, there is a lack of quantitative data on the extraction behavior of elements on the EPA Target Analyte List. Experimental studies on these two methods consisted of determining whether any of the analytes were extracted by these methods and the recoveries obtained. Both methods produced similar results; the EPA target analytes were only slightly or not extracted. Advantages and disadvantages of each method were evaluated and found to be comparable.

926 (ORNL/TM-12403) Multicomponent liquid ion exchange with chabazite zeolites. Robinson, S.M.; Arnold, W.D. Jr.; Byers, C.W. Oak Ridge National Lab., TN (United States). Oct 1993. 218p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94001780. Source: OSTI; NTIS; INIS; GPO Dep.

In spite of the increasing commercial use of zeolites for binary and multicomponent sorption, the understanding of the basic mass-transfer processes associated with multicomponent zeolite ion-exchange systems is quite limited. This study was undertaken to evaluate Na-Ca-Mg-Cs-Sr ion exchange from an aqueous solution using a chabazite zeolite. Mass-transfer coefficients and equilibrium equations were determined from experimental batch-reactor data for single and multicomponent systems. The Langmuir isotherm was used to represent the equilibrium relationship for binary systems, and a modified Dubinin-Polyani model was used for the multicomponent systems. The experimental data indicate that diffusion through the microporous zeolite crystals is the primary diffusional resistance. Macropore diffusion also significantly contributes to the mass-transfer resistance. Various mass-transfer models were compared to the experimental data to determine mass-transfer coefficients. Effective diffusivities were obtained which accurately predicted experimental data using a variety of models. Only the model which accounts for micropore and macropore diffusion occurring in series accurately predicted multicomponent data using single-component diffusivities. Liquid and surface diffusion both contribute to macropore diffusion. Surface and micropore diffusivities were determined to be concentration dependent.

927 (ORNL/TM-12437/V1) Development of grout formulations for 106-AN waste: Mixture-experiment

results and analysis: Volume 1, Narrative and recommendations. Spence, R.D. (Oak Ridge National Lab., TN (United States)); McDaniel, E.W.; Anderson, C.M.; Lokken, R.O.; Piepel, G.F. Oak Ridge National Lab., TN (United States); Pacific Northwest Lab., Richland, WA (United States). Sep 1993. 68p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400 ; AC06-76RL01830. Order Number DE94001089. Source: OSTI; NTIS; INIS; GPO Dep.

Twenty potential ingredients were identified for use in developing a 106-AN grout formulation, and 18 were subsequently obtained and tested. Four ingredients-Type II-LA (moderate heat of hydration) Portland cement, Class F fly ash, attapulgite 150 drilling clay, and ground air-cooled blast-furnace slag (GABFS) were selected for developing the 106-AN grout formulations. A mixture experiment was designed and conducted around the following formulation: 2.5 lb of cement per gallon, 1.2 lb of fly ash per gallon, 0.8 lb of attapulgite per gallon, and 3.5 lb of GABFS per gallon. Reduced empirical models were generated from the results of the mixture experiment. These models were used to recommend several grout formulations for 106-AN. Westinghouse Hanford Company selected one of these formulations to be verified for use with 106-AN and a backup formulation in case problems arise with the first choice.

928 (ORNL/TM-12437/V2) Development of grout formulations for 106-AN waste: Mixture-experiment results and analysis: Volume 2, Data presentation. Spence, R.D. (Oak Ridge National Lab., TN (United States)); McDaniel, E.W.; Anderson, C.M.; Lokken, R.O.; Piepel, G.F. Oak Ridge National Lab., TN (United States). Sep 1993. 577p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400 ; AC06-76RL01830. Order Number DE94001090. Source: OSTI; NTIS; INIS; GPO Dep.

Twenty potential ingredients were identified for use in developing a 106-AN grout formulation, and 18 were subsequently obtained and tested. Four ingredients: Type II-LA (moderate heat of hydration) Portland cement, Class F fly ash, attapulgite 150 drilling clay, and ground air-cooled blast-furnace slag (GABFS) – were selected for developing the 106-AN grout formulations. A mixture experiment was designed and conducted around the following formulation: 2.5 lb of cement per gallon, 1.2 lb of fly ash per gallon, 0.8 lb of attapulgite per gallon, and 3.5 lb of GABFS per gallon. Reduced empirical models were generated from the results of the mixture experiment. These models were used to recommend several grout formulations for 106-AN. Westinghouse Hanford Company selected one of these formulations to be verified for use with 106-AN and a backup formulation in case problems arise with the first choice. This report presents the mixture-experimental results and leach data.

929 (ORNL/TM-12449) Cost estimates for the Uranium-in-Soils Integrated Demonstration field screening technologies. Douthat, D.M. (Oak Ridge National Lab., TN (United States)); Armstrong, A.Q.; Ladd, B. Oak Ridge National Lab., TN (United States). Sep 1993. 63p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94002979. Source: OSTI; NTIS; GPO Dep.

The objective of this document is to describe the work conducted by the ORNL Performance Assessment Group members responsible for developing the cost analysis reports for the uranium-in-soils Integrated Demonstration (ID). The following information is provided in this report: (1) an

explanation of the cost input questionnaires, which were sent to the developers of the field screening technologies and used by the cost estimator to acquire information and develop the cost estimates, (2) a description of the computer software package chosen to create the cost estimates, as well as why it was chosen, (3) a description of how the Uranium-in-Soils ID project is broken down structurally in terms of a work breakdown structure (WBS) for the cost estimates, (4) an explanation of the assumptions made by the cost estimator in developing the cost estimates, (5) a summary of the expected costs for each field screening technology, and (6) an explanation of how the cost analysis reports for a scenario evaluation (provided in the cost input questionnaires) were derived, as well as a summary of the scenario evaluation costs for each technology.

930 (ORNL/TM-12638) Liquid low-level waste generation projections for ORNL in 1993. DePaoli, S.M. Oak Ridge National Lab., TN (United States). Apr 1994. 32p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94010118. Source: OSTI; NTIS; INIS; GPO Dep.

Liquid low-level waste (LLLW) is generated by various programs and projects throughout Oak Ridge National Laboratory (ORNL). These wastes are collected in underground collection tanks, bottles, and trucks; they are then neutralized with sodium hydroxide and treated for volume reduction at the ORNL evaporator facility. This report presents historical and projected data concerning the volume and characterization of LLLW, prior to and after evaporation. Storage space for projected waste generation is also discussed.

931 (ORNL/TM-12642) Criticality safety study of the MSRE Fuel Drain Tank Cell in Building 7503. Hollenbach, D.F.; Hopper, C.M. Oak Ridge National Lab., TN (United States). Jan 1994. 43p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94007918. Source: OSTI; NTIS; GPO Dep.

Includes 1 3 1/2 in. floppy disk.

This report provides a criticality safety study of the molten salt reactor fuel currently being stored in the Fuel Drain Tank (FDT) Cell of the Molten Salt Reactor Experiment (MSRE) facility (Building 7503) located in the Melton Valley area of the Oak Ridge National Laboratory. The FDTs contain approximately 36 kg of uranium consisting primarily of ²³³U, some plutonium, and fission products in a solidified fluoride salt mixture. The nominal composition of the fluoride salt mixture in the FDTs is 42.16 wt % LiF, 35.79 wt % BeF₂, 21.01 wt % ZrF₄, 1.02 wt % UF₄, and 0.02 wt % PuF₃. The historic criticality safety study does not meet current standards. This work is in support of a new nuclear criticality safety analysis and approval update. Questions concerning the degree of subcriticality associated with the material in its current state and in its most reactive credible upset condition are addressed. The safety study consists of two parts. In the first part, the FDT Cell was modeled using KENO V.a and analyzed using a variety of cross-section sets. The base FDT Cell model was then modified to represent the most reactive credible upset conditions and analyzed. The second part consists of establishing a benchmark for the FDT Cell. Because of the lack of any other relevant benchmark experiments, the original MSRE was also modeled in KENO V.a and analyzed. The results of the reactor model were then compared with documented MSRE reactor conditions. The analysis shows that even under the most reactive

credible upset conditions, the MSRE FDT Cell is significantly subcritical.

932 (ORNL/TM-12656) A literature review of mixed waste components: Sensitivities and effects upon solidification/stabilization in cement-based matrices. Mattus, C.H.; Gilliam, T.M. Oak Ridge National Lab., TN (United States). Mar 1994. 118p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94009523. Source: OSTI; NTIS; INIS; GPO Dep.

The US DOE Oak Ridge Field Office has signed a Federal Facility Compliance Agreement (FFCA) regarding Oak Ridge Reservation (ORR) mixed wastes subject to the land disposal restriction (LDR) provisions of the Resource Conservation and Recovery Act. The LDR FFCA establishes an aggressive schedule for conducting treatability studies and developing treatment methods for those ORR mixed (radioactive and hazardous) wastes listed in Appendix B to the Agreement. A development, demonstration, testing, and evaluation program has been initiated to provide those efforts necessary to identify treatment methods for all of the wastes that meet Appendix B criteria. The program has assembled project teams to address treatment development needs in a variety of areas, including that of final waste forms (i.e., stabilization/solidification processes). A literature research has been performed, with the objective of determining waste characterization needs to support cement-based waste-form development. The goal was to determine which waste species are problematic in terms of consistent production of an acceptable cement-based waste form and at what concentrations these species become intolerable. The report discusses the following: hydration mechanisms of Portland cement; mechanisms of retardation and acceleration of cement set-factors affecting the durability of waste forms; regulatory limits as they apply to mixed wastes; review of inorganic species that interfere with the development of cement-based waste forms; review of radioactive species that can be immobilized in cement-based waste forms; and review of organic species that may interfere with various waste-form properties.

933 (ORNL/TM-12657) Evaluation of sulfur polymer cement as a waste form for the immobilization of low-level radioactive or mixed waste. Mattus, C.H.; Mattus, A.J. Oak Ridge National Lab., TN (United States). Mar 1994. 40p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94008748. Source: OSTI; NTIS; INIS; GPO Dep.

Sulfur polymer cement (SPC), also called modified sulphur cements, is a relatively new material in the waste immobilization field, although it was developed in the late seventies by the Bureau of Mines. The physical and chemical properties of SPC are interesting (e.g., development of high mechanical strength in a short time and high resistance to many corrosive environments). Because of its very low permeability and porosity, SPC is especially impervious to water, which, in turn, has led to its consideration for immobilization of hazardous or radioactive waste. Because it is a thermosetting process, the waste is encapsulated by the sulfur matrix; therefore, very little interaction occurs between the waste species and the sulfur (as there can be when waste prevents the set of portland cement-based waste forms).

934 (ORNL/TM-12679) Development and demonstration of treatment technologies for the processing of

US Department of Energy Mixed Waste. Bloom, G.A.; Berry, J.B. Oak Ridge National Lab., TN (United States). Jan 1994. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94007408. Source: OSTI; NTIS; INIS; GPO Dep.

Mixed waste is defined as "waste contaminated with chemically hazardous and radioactive species." The Mixed Waste Integrated Program (MWIP) was established in response to the need for a unified, DOE complexwide solution to issues of mixed waste treatment that meets regulatory requirements. MWIP is developing treatment technologies that reduce risk, minimize life-cycle cost, and improve process performance as compared to existing technologies. Treatment for waste streams for which no current technology exists, and suitable waste forms for disposal, will be provided to improve operations of the DOE Office of Waste Management. MWIP is composed of six technical areas within a mixed-waste treatment system: (1) systems analysis, (2) materials handling, (3) chemical/physical separation, (4) waste destruction and stabilization, (5) off-gas treatment, and (6) final waste form stabilization. The status of the technical initiatives and the current research, development, and demonstration in each of these areas are described in this paper

935 (ORNL/TM-12687) Liquid and Gaseous Waste Operations Department Annual Operating Report, CY 1993. Maddox, J.J.; Scott, C.B. Oak Ridge National Lab., TN (United States). Feb 1994. 108p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94008561. Source: OSTI; NTIS; INIS; GPO Dep.

This report summarizes the activities of the waste management operations section of the liquid and gaseous waste operations department at ORNL for 1993. The process waste, liquid low-level waste, gaseous waste systems activities are reported, as well as the low-level waste solidification project. Upgrade activities is the various waste processing and treatment systems are summarized. A maintenance activity overview is provided, and program management, training, and other miscellaneous activities are covered.

936 (PNL-6241-Rev.2) National briefing summaries: Nuclear fuel cycle and waste management. Schneider, K.J.; Bradley, D.J.; Fletcher, J.F.; Konzek, G.J.; Lakey, L.T.; Mitchell, S.J.; Molton, P.M.; Nightingale, R.E. Pacific Northwest Lab., Richland, WA (United States). Apr 1991. 732p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE91017242. Source: OSTI; NTIS; INIS; GPO Dep.

Since 1976, the International Program Support Office (IPSO) at the Pacific Northwest Laboratory (PNL) has collected and compiled publicly available information concerning foreign and international radioactive waste management programs. This National Briefing Summaries is a printout of an electronic database that has been compiled and is maintained by the IPSO staff. The database contains current information concerning the radioactive waste management programs (with supporting information on nuclear power and the nuclear fuel cycle) of most of the nations (except eastern European countries) that now have or are contemplating nuclear power, and of the multinational agencies that are active in radioactive waste management. Information in this document is included for three additional countries (China, Mexico, and USSR) compared to the prior issue. The database and this document were developed in response to needs of the US Department of Energy.

937 (PNL-8167) Hydrogeologic controls on ground-water and contaminant discharge to the Columbia River near the Hanford Townsite. Luttrell, S.P.; Newcomer, D.R.; Teel, S.S.; Vermeul, V.R. Pacific Northwest Lab., Richland, WA (United States). Nov 1992. 153p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93006605. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this study is to quantify ground-water and contaminant discharge to the Columbia River in the Hanford Townsite vicinity. The primary objectives of the work are to: describe the hydrogeologic setting and controls on ground-water movement and contaminant discharge to the Columbia River; understand the river/aquifer relationship and its effects on contaminant discharge to the Columbia River; quantify the ground-water and contaminant mass discharge to the Columbia River; and provide data that may be useful for a three-dimensional model of ground-water flow and contaminant transport in the Hanford Townsite study area. The majority of ground-water contamination occurs within the unconfined aquifer; therefore, ground-water and contaminant discharge from the unconfined aquifer is the emphasis of this study. The period of study is primarily from June 1990 through March 1992.

938 (PNL-8403) Sludge Treatment Evaluation: 1992 Technical progress. Silva, L.J.; Felmy, A.R.; Ding, E.R. Pacific Northwest Lab., Richland, WA (United States). Jan 1993. 83p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93007177. Source: OSTI; NTIS; INIS; GPO Dep.

This report documents Fiscal Year 1992 technical progress on the Sludge Treatment Evaluation Task, which is being conducted by Pacific Northwest Laboratory. The objective of this task is to develop a capability to predict the performance of pretreatment processes for mixed radioactive and hazardous waste stored at Hanford and other US Department of Energy (DOE) sites. Significant cost savings can be achieved if radionuclides and other undesirable constituents can be effectively separated from the bulk waste prior to final treatment and disposal. This work is initially focused on chemical equilibrium prediction of water washing and acid or base dissolution of Hanford single-shell tank (SST) sludges, but may also be applied to other steps in pretreatment processes or to other wastes. Although SST wastes contain many chemical species, there are relatively few constituents - Na, Al, NO₃, NO₂, PO₄, SO₄, and F - contained in the majority of the waste. These constituents comprise 86% and 74% of samples from B-110 and U-110 SSTs, respectively. The major radionuclides of interest (Cs, Sr, Tc, U) are present in the sludge in small molal quantities. For these constituents, and other important components that are present in small molal quantities, the specific ion-interaction terms used in the Pitzer or NRTL equations may be assumed to be zero for a first approximation. Model development can also be accelerated by considering only the acid or base conditions that apply for the key pretreatment steps. This significantly reduces the number of chemical species and chemical reactions that need to be considered. Therefore, significant progress can be made by developing all the specific ion interactions for a base model and an acid dissolution model.

939 (PNL-8492) Leach testing of in situ stabilization grouts containing additives to sequester contaminants. Serne, R.J. (Pacific Northwest Lab., Richland, WA (United States)); Ames, L.L.; Martin, P.F.C.;

LeGore, V.L.; Lindenmeier, C.W.; Phillips, S.J. Pacific Northwest Lab., Richland, WA (United States). Apr 1993. 48p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93012861. Source: OSTI; NTIS; INIS; GPO Dep.

This document discusses laboratory testing performed by Pacific Northwest Laboratory (PNL) for Westinghouse Hanford Company (WHC) of special grout formulations that incorporate specific sequestering agents to help improve the ability of the cement to resist contaminant leaching. To enhance the sequestering of contaminants we chose five additives to introduce (singly) to the control cement. The additives were Florida pebble phosphate, clinoptilolite (a natural zeolite), ferrous sulfide (a reductant), a mixed bed organic ion exchange resin and a proprietary anion-adsorbing mixed metal oxide. These additives were added one per test to the standard formulation and used to encapsulate a diluted high-salt alkaline liquid waste that is produced after various processes to remove uranium and plutonium from spent nuclear fuel. This report documents the testing of these additives.

940 (PNL-8534-Vol.1) Hanford Environmental Analytical Methods (methods of March 1990): Volume 1. Goheen, S.C.; McCulloch, M.; Daniel, J.L. Pacific Northwest Lab., Richland, WA (United States). May 1993. 451p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94001868. Source: OSTI; NTIS; INIS; GPO Dep.

Techniques in use at the Hanford Reservation as of March, 1990 for the analysis of liquids and radioactive effluents are described. Limitations and applications of the techniques are included.

941 (PNL-8534-Vol.2) Hanford Environmental Analytical Methods (methods as of March 1990): Volume 2, Appendix A1-O and appendix A1-I. Goheen, S.C.; McCulloch, M.; Daniel, J.L. Pacific Northwest Lab., Richland, WA (United States). May 1993. 396p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94001869. Source: OSTI; NTIS; INIS; GPO Dep.

Techniques in use at the Hanford Reservation as of March, 1990 for the analysis of liquids, organic wastes, soils, and sediments, are described. Limitations and applications of the techniques are included.

942 (PNL-8534-Vol.3) Hanford environmental analytical methods: Methods as of March 1990: Volume 3, Appendix A2-I. Goheen, S.C.; McCulloch, M.; Daniel, J.L. Pacific Northwest Lab., Richland, WA (United States). May 1993. 391p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94001870. Source: OSTI; NTIS; INIS; GPO Dep.

This paper from the analytical laboratories at Hanford describes the method used to measure pH of single-shell tank core samples. Sludge or solid samples are mixed with deionized water. The pH electrode used combines both a sensor and reference electrode in one unit. The meter amplifies the input signal from the electrode and displays the pH visually.

943 (PNL-8534-Vol.4) Hanford environmental analytical methods, methods as of March 1990: Appendix A2-R. Goheen, S.C.; McCulloch, M.; Daniel, J.L. Pacific Northwest Lab., Richland, WA (United States). May 1993. 329p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94001871. Source: OSTI; NTIS; INIS; GPO Dep.

Techniques in use at the Hanford Reservation (as of March, 1990) for the analysis of liquids and radioactive effluents are described. Limitations and applications of the techniques are included.

944 (PNL-8534-Vol.5) Hanford environmental analytical methods (methods as of March 1990): Appendix A3-O and Appendix A3-I. Goheen, S.D.; McCulloch, M.; Daniel, J.L. Pacific Northwest Lab., Richland, WA (United States). May 1993. 209p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94001872. Source: OSTI; NTIS; INIS; GPO Dep.

Information is provided on the techniques employed towards the chemical analysis of volatile, semi-volatile matter, pesticides and PCB's at the Hanford Reservation. Sample preparation methods are included.

945 (PNL-8534-Vol.6) Hanford environmental analytical methods (methods as of March 1990): Appendix A3-R. Goheen, S.C.; McCulloch, M.; Daniel, J.L. Pacific Northwest Lab., Richland, WA (United States). May 1993. 260p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94001873. Source: OSTI; NTIS; INIS; GPO Dep.

Techniques in use at the Hanford Reservation as of March, 1990 for the analysis of liquids and radioactive effluents are described. Limitations and applications of the techniques are included. This report is Appendix A3-R.

946 (PNL-8548) Phase 1 involvement for potential stakeholders of the VOC-Arid Integrated Demonstration. McCabe, G.H. (Battelle Seattle Research Center, WA (United States)). Pacific Northwest Lab., Richland, WA (United States); Battelle Seattle Research Center, WA (United States). Dec 1992. 48p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (BHARC-800/93/004). Order Number DE93011691. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes Phase I of a three-phased study to support evaluation of new cleanup technologies for federal facilities. It directly supports the Volatile Organic Compounds (VOC)-Arid Site Integrated Demonstration (VOC-Arid ID) being conducted at the Hanford Site. The purpose of the activity is to develop and demonstrate new technologies for cleaning up carbon tetrachloride and other VOCs in soils and groundwater. The institutional assessment task of the VOC-Arid ID, which is being performed by Battelle Seattle Research Center, is assessing regulatory and public acceptability of new technologies. Phase I focuses on gathering Hanford stakeholder input on how to evaluate technologies. Phase II will involve stakeholders applying the technology evaluation criteria to actual demonstration technologies. In Phase III, the task will evaluate stakeholder acceptability of innovative technologies at other DOE candidate sites. Only if a technology performs effectively during demonstration, and is accepted by the regulatory community and the public, can it be recommended for deployment. Phase I consisted of a series of stakeholder interviews and two stakeholder workshops, both designed to receive input about the criteria to be used to evaluate innovative technologies.

947 (PNL-8596) Evaluation of solid-based separation materials for the pretreatment of radioactive wastes. Lumetta, G.J.; Wagner, M.J.; Wester, D.W.; Morrey, J.R. Pacific Northwest Lab., Richland, WA (United States). May 1993. 29p. Sponsored by USDOE, Washington, DC (United States).

States). DOE Contract AC06-76RL01830. Order Number DE93013933. Source: OSTI; NTIS; INIS; GPO Dep.

Separation science will play an important role in pretreating nuclear wastes stored at various US Department of Energy Sites. The application of separation processes offers potential economic and environmental benefits with regards to remediating these sites. For example, at the Hanford Site, the sizeable volume of radioactive wastes stored in underground tanks could be partitioned into a small volume of high-level waste (HLW) and a relatively large volume of low-level waste (LLW). After waste separation, only the smaller volume of HLW would require costly vitrification and geologic disposal. Furthermore, the quality of the remaining LLW form (e.g., grout) would be improved due to the lower inventory of radionuclides present in the LLW stream. This report investigates extraction chromatography as a possible separation process for Hanford wastes.

948 (PNL-8618) 106-AN grout pilot-scale test HGTP-93-0501-02. Bagaasen, L.M. Pacific Northwest Lab., Richland, WA (United States). May 1993. 123p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93013110. Source: OSTI; NTIS; INIS; GPO Dep.

The Grout Treatment Facility (GTF) at Hanford, Washington will process the low-level fraction of selected double-shell tank (DST) wastes into a cementitious waste form. This facility, which is operated by Westinghouse Hanford Company (WHC), mixes liquid waste with cementitious materials to produce a waste form that immobilizes hazardous constituents through chemical reactions and/or microencapsulation. Over 1,000,000 gal of Phosphate/Sulfate Waste were solidified in the first production campaign with this facility. The next tank scheduled for treatment is 106-AN. After conducting laboratory studies to select the grout formulation, part of the normal formulation verification process is to conduct tests using the 1/4-scale pilot facilities at the Pacific Northwest Laboratory (PNL). The major objectives of these pilot-scale tests were to determine if the proposed grout formulation could be processed in the pilot-scale equipment and to collect thermal information to help determine the best way to manage the grout hydration heat.

949 (PNL-8620) Characterization of phosphate/sulfate waste grout cores. Martin, P.F.C.; Lokken, R.O. Pacific Northwest Lab., Richland, WA (United States). Sep 1993. 63p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94001999. Source: OSTI; NTIS; INIS; GPO Dep.

As part of efforts to clean up federal production sites, the U.S. Department of Energy (DOE) is treating selected low-level liquid wastes by incorporating them into cementitious waste forms. At the Hanford Site, low-level radioactive liquid wastes will be mixed with a blend of Portland cement, fly ash, clays, and other ingredients in a continuous process at the Grout Treatment Facility (GTF). The resulting grout slurry will be pumped to lined, underground concrete vaults where the grout will harden, thereby immobilizing contaminants. Physical property measurements and American Nuclear Society (ANS) 16.1 leach tests have been completed on 45 samples obtained from five cores from the phosphate/sulfate waste (PSW) grout vault. A summary of the compressive strength, bulk density, and sonic velocity data is compared with data from other PSW grout samples. Results of moisture content, thermal conductivity, and the leaching of aluminum, calcium, sodium, sulfate, cobalt-60, and cesium-137 are given.

950 (PNL-8626) Formulation verification study results for 241-AN-106 waste grout. Lokken, R.O.; Martin, P.F.C.; Morrison, L.C.; Palmer, S.E.; Anderson, C.M. Pacific Northwest Lab., Richland, WA (United States). Jun 1993. 78p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93016709. Source: OSTI; NTIS; INIS; GPO Dep.

Tests were conducted to determine whether the reference formulation and variations around the formulation are adequate for solidifying 241-AN-106 (106-AN) waste into a grout waste form. The reference formulation consists of 21 wt% type I/II Portland cement, 68 wt% fly ash, and 11 wt% attapulgite clay. The mix ratio is 8.4 lb/gal. Variations in dry blend component ratios, mix ratio, and waste concentration were assessed by using a statistically designed experimental matrix consisting of 44 grout compositions. Based on the results of the statistically designed variability study, the 106-AN grout formulations tested met all the formulation criteria except for the heat of hydration.

951 (PNL-8632) Pilot-scale decontamination solution test results HGTP-93-0702-02. Clemmer, R.G.; Allen, R.P.; Bagaasen, L.M.; Fetrow, L.K. Pacific Northwest Lab., Richland, WA (United States). May 1993. 56p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93013501. Source: OSTI; NTIS; INIS; GPO Dep.

Decontamination solution testing constitutes a task of the Hanford Grout Technology Program (HGTP) at Pacific Northwest Laboratory (PNL). The HGTP provides technical support to the Westinghouse Hanford Company (WHC) Grout Disposal Program. Cementitious grout has been identified as the waste form for low-level radioactive waste. Grout processing equipment, including mixers, pumps, and piping, will require periodic maintenance. Decontamination of components is needed to reduce radiation dose to maintenance workers. The purpose of this work was to develop and test methods for decontaminating grout processing equipment. The proposed method of decontamination is to use a mild chemical solution, such as a 6 N citric acid to dissolve the grout. The method should effectively remove grout without causing degradation of grout processing equipment.

952 (PNL-8655) Characterization results for 106-AN grout produced in a pilot-scale test. Lokken, R.O.; Bagaasen, L.M.; Martin, P.F.C.; Palmer, S.E.; Anderson, C.M. Pacific Northwest Lab., Richland, WA (United States). Jun 1993. 35p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93016776. Source: OSTI; NTIS; INIS; GPO Dep.

The Grout Treatment Facility (GTF) at Hanford, Washington, will process the low-level fraction of selected double-shell tank (DST) wastes into a cementitious waste form. This facility, which is operated by Westinghouse Hanford Company (WHC), mixes liquid waste with cementitious materials to produce a waste form that immobilizes hazardous constituents through chemical reactions and/or microencapsulation. Over one million gallons of phosphate/sulfate waste were solidified in the first production campaign with this facility. The next tank waste scheduled for treatment is 106-AN (the waste from Tank 241-AN-106). After laboratory studies were conducted to select the grout formulation, tests using the 1/4-scale pilot facilities at the Pacific Northwest Laboratory (PNL) were conducted as part of the formulation verification process. The major objectives of these pilot-scale tests were to determine if the proposed

grout formulation could be processed in the pilotscale equipment. to collect thermal information to help determine the best way to manage the grout hydration heat, and to characterize the solidified grout.

953 (PNL-8714) Analysis of volatile headspace gases sampled by cryogenic traps from Westinghouse Hanford Company Tank 242-C-112 March 1992. Lucke, R.B.; Clauss, S.A. Pacific Northwest Lab., Richland, WA (United States). Oct 1993. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94001551. Source: OSTI; NTIS; INIS; GPO Dep.

Results are given from gas chromatography/mass spectrometry (GC/MS) analyses of the headspace samples obtained by using cryogenic traps from Westinghouse Hanford Company (WHC) Tank 112-C during the month of March, 1992. Samples were analyzed as received with no sample preparation. Analyses included direct GC/MS for volatile/semivolatile components, and direct GC/MS for ammonia. Purge and trap GC/MS analysis was not done. In addition, aliquots were sent to Karl Pool, Pacific Northwest Laboratory, for hydrogen cyanide analysis by ion chromatography, the results are reported here. All concentrations are reported for the methanol extract solutions. To calculate concentrations in the headspace, the cryo-sampling air volume and the methanol rinse volume must be obtained from cryo-sampling personnel at WHC. Triplicate analyses were done on all samples, and average concentrations and standard deviations are reported. One significant result was that no ammonia was detected.

954 (PNL-8745) Statistical evaluation of core samples from Hanford tank B110. Heasler, P.G.; Anderson, C.M.; Baird, D.B.; Serne, R.J.; Whitney, P.D. Pacific Northwest Lab., Richland, WA (United States). Aug 1993. 80p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019981. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents an analysis of the core samples extracted from tank B110. The sampling campaign was quite extensive and resulted in a total of 9,179 chemical analyses on B110 waste. Approximately 70 different chemical constituents were measured in the laboratory, as well as physical and rheological properties. Many different types of replicate measurements were taken so that laboratory, sampling and spatial variability could be quantified. The sampling of tank B110 was part of an in-depth pilot study to determine the adequacy of current chemical analysis and sampling procedures. The major objectives of the analysis included: estimation of the average concentration of the measured analytes in the tank, estimation of the laboratory, sampling, and spatial variability within the tank, and evaluation of the sampling methodology.

955 (PNL-8808) Organic chemical aging mechanisms: An annotated bibliography: Waste Tank Safety Program. Samuels, W.D.; Camaioni, D.M.; Nelson, D.A. Pacific Northwest Lab., Richland, WA (United States). Sep 1993. 141p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94000633. Source: OSTI; NTIS; GPO Dep.

An annotated bibliography has been compiled of the potential chemical and radiological aging mechanisms of the organic constituents (non-ferrocyanide) that would likely be found in the UST at Hanford. The majority of the work that has been conducted on the aging of organic chemicals used

for extraction and processing of nuclear materials has been in conjunction with the acid or PUREX type processes. At Hanford the waste being stored in the UST has been stabilized with caustic. The aging factors that were used in this work were radiolysis, hydrolysis and nitrite/nitrate oxidation. The purpose of this work was two-fold: to determine whether or not research had been or is currently being conducted on the species associated with the Hanford UST waste, either as a mixture or as individual chemicals or chemical functionalities, and to determine what areas of chemical aging need to be addressed by further research.

956 (PNL-8818) The effect of gamma radiation on reference electrodes and platinum and carbon steel bare metal electrodes in a simulated waste solution: Final report. Danielson, M.J. Pacific Northwest Lab., Richland, WA (United States). Sep 1993. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94001080. Source: OSTI; NTIS; INIS; GPO Dep.

Electrochemical potential measurements of materials in waste tanks are important in determining if the materials have a propensity for stress corrosion cracking and pitting. Potential measurement requires a reference electrode, but the effect of radiation on the potential generated by the reference electrode has been an unknown quantity. To determine the significance of the radiation effect, Pacific Northwest Laboratory conducted studies of five types of electrodes under gamma radiation at room temperature. The subjects were two types of silver/silver chloride reference electrodes (Fisher and Lazaran), a mercury/calomel reference electrode, a platinum "flag," and a piece of A-537 carbon steel; the electrodes were exposed to a simulated caustic tank environment. The Fisher silver/silver chloride and mercury/calomel reference electrodes showed essentially no radiation effects up to a flux of $2.1E6$ R/h and fluence of $9.4E8$ R, indicating they would be useful reference electrodes for in-tank studies. The Lazaran® silver/silver chloride electrode showed serious potential deviations at fluences of $2.E8$ R, but it would be the electrode of choice in many situations because it is simple to maintain. Radiation affected the open circuit potential of both the platinum and carbon steel electrodes. This effect indicates that corrosion studies without radiation may not duplicate the corrosion processes expected in a waste tank. Mixed-potential theory was used to explain the radiation effects.

957 (PNL-8830) Air pathway effects of nuclear materials production at the Hanford Site, 1983 to 1992. Patton, G.W.; Cooper, A.T. Pacific Northwest Lab., Richland, WA (United States). Oct 1993. 58p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94002708. Source: OSTI; NTIS; GPO Dep.

This report describes the air pathway effects of Hanford Site operations from 1983 to 1992 on the local environment by summarizing the air concentrations of selected radionuclides at both onsite and offsite locations, comparing trends in environment concentrations to changing facility emissions, and briefly describing trends in the radiological dose to the hypothetical maximally exposed member of the public. The years 1983 to 1992 represent the last Hanford Site plutonium production campaign, and this report deals mainly with the air pathway effects from the 200 Areas, in which the major contributors to radiological emissions were located. An additional purpose for report was to review the environmental data for a long period of time to provide insight not

available in an annual report format. The sampling and analytical systems used by the Surface Environmental Surveillance Project (SESP) to collect air samples during the period of this report were sufficiently sensitive to observe locally elevated concentrations of selected radionuclides near onsite source of emission as well as observing elevated levels, compared to distant locations, of some radionuclides at the down wind perimeter. The US DOE Derived Concentration Guides (DCGs) for airborne radionuclides were not exceeded for any air sample collected during 1983 to 1992, with annual average concentrations of all radionuclides at the downwind perimeter being considerably below the DCG values. Air emissions at the Hanford Site during the period of this report were dominated by releases from the PUREX Plant, with ^{85}Kr being the major release on a curie basis and ^{129}I being the major release on a radiological dose basis. The estimated potential radiological dose from Hanford Site point source emissions to the hypothetical maximally exposed individual (MEI) ranged from 0.02 to 0.22 mrem/yr (effective dose equivalent), which is well below the DOE radiation limit to the public of 100 mrem/yr.

958 (PNL-8847) Initial evaluation of Sandia National Laboratory-prepared crystalline silico-titanates for cesium recovery. Bray, L.A.; Carson, K.J.; Elovich, R.J. Pacific Northwest Lab., Richland, WA (United States). Oct 1993. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94002382. Source: OSTI; NTIS; INIS; GPO Dep.

Pacific Northwest Laboratory initiated a study of a new class of inorganic ion exchange materials that selectively extracts cesium (Cs), strontium (Sr), and plutonium (Pu) from alkaline radioactive waste solutions. These materials, identified as crystalline silico-titanates (CST), were developed by scientists at the Sandia National Laboratory (SNL) and Texas A&M. This report summarizes preliminary results for the measurement of batch distribution coefficient (K_d) values for the powdered CST materials compared to previously tested ion exchange materials: IONSIV IE-96 (a zeolite produced by UOP), CS-100 (an organic resin produced by Rohm and Haas), and BIB-DJ (a new resorcinol-formaldehyde organic resin produced by Boulder Scientific). Excellent results were obtained for CST inorganic exchangers that could be significant in the development of processes for the near-term pretreatment of Hanford alkaline wastes. The following observations and conclusions resulted from this study: (1) Several CST samples prepared at SNL had a higher capacity to remove Cs from solution as compared to BIB-DJ, IE-96, and CS-100. (2) Cesium distribution results showed that CST samples TAM-40, -42, -43, -70, and -74 had λ values of $\sim 2,200$ ($\lambda = \text{Cs } K_d \times \rho_b$; where λ represents the number of exchanger bed volumes of feed that can be loaded on an ion exchange column) at a pH value > 14 . (3) Cesium distribution values for CST exchangers doubled as the aqueous temperature decreased from 40° to 10°C . (4) Crystalline silico-titanates have the capacity to remove Cs as well as Sr and Pu from alkaline wastes unless organic complexants are present. Experimental results indicated that complexed Sr was not removed, and Pu is not expected to be removed.

959 (PNL-8863) A literature review of methods of analysis of organic analytes in radioactive wastes with an emphasis on sources from the United Kingdom. Clauss, S.A.; Bean, R.M. Pacific Northwest Lab., Richland, WA (United States). Sep 1993. 65p. Sponsored by USDOE,

Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94000904. Source: OSTI; NTIS; INIS; GPO Dep.

This report, compiled by Pacific Northwest Laboratory (PNL), examines literature originating through the United Kingdom (UK) nuclear industry relating to the analyses of organic constituents of radioactive waste. Additionally, secondary references from the UK and other countries, including the United States, have been reviewed. The purpose of this literature review was to find analytical methods that would apply to the mixed-waste matrices found at Hanford.

960 (PNL-8875) Aerosol and vapor characterization of tank 241-C-103: Flammability assessment sampling system, and method validation. Ligotke, M.W. (Pacific Northwest Lab., Richland, WA (United States)); Clauss, T.R.; Dennis, G.W.; Lucke, R.B.; Goheen, S.C.; Huckaby, J.L. Pacific Northwest Lab., Richland, WA (United States). Oct 1993. 86p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94002381. Source: OSTI; NTIS; GPO Dep.

The purpose of the work was to support a flammability assessment and characterization of materials present in the vapor space of the Hanford waste tank designated 241-C-103. The single-shell tank contains floating organic layers on top of an aqueous supernate and, reportedly, a dense fog of unknown composition. An in-tank sampling method for aerosol concentrations of nominal paraffin hydrocarbons (NPH) was developed and validated. A sampling system was designed and assembled. Procedures and preparations for in-tank sampling were completed. The work was performed by Pacific Northwest Laboratory (PNL) as part of a waste tank vapor characterization project for Westinghouse Hanford Company (WHC). The need to sample NPH aerosols was established in a preliminary assessment in which the flammability of materials in the vapor space were related to NPH concentration. In the assessment, a total fuel load of 46 mg/L was estimated to be the lower flammability level (LFL). Aerosol chamber tests were performed that simulated tank vapor space conditions, and method validation data were obtained using sorbent traps designed to collect droplet- and vapor-phase aerosols. A range of aerosol characteristics and sampling conditions were tested. Test variables included sample flow rate, duration, relative humidity, aqueous fog, aerosol mass concentration, and sample mass loading in the sorbent traps. Analytical methods were developed to quantify NPH in the sorbent traps. Samples were analyzed for NPH mass and distribution of five analytes using a gas chromatograph/mass spectrometer (GC/MS) and compared to gravimetric results.

961 (PNL-8927) Sample preparation for semivolatile organics analysis of Hanford single-shell tank waste with high nitrate/nitrite and water content. Stromatt, R.W.; Hoppe, E.W.; Steele, M.J. Pacific Northwest Lab., Richland, WA (United States). Nov 1993. 59p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94003875. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes research work carried out to solve sample preparation problems associated with applying gas chromatography with mass spectrometric detection (GC/MS) to the analysis of single shell tank (SST) samples from Hanford for semivolatile organic compounds. Poor performance was found when applying the procedures based on the U.S. Environmental Protection Agency (EPA), Contract Laboratory Program, Statement of Work (CLP SOW). Analysis

work was carried out on simulated drainable liquid modeled after the SST core samples which had evidenced analysis problems. Some work was also conducted on true SST samples. It was found that the pH range was too broad in the original procedure. It was also found that by decreasing the amount of methanol used in the extraction process, problems associated with the formation of an azeotrope phase could be avoided. The authors suggest a new procedure, whose eventual application to a wide array of SST samples will lend itself to better quality control limits.

962 (PNL-8992) Characterization of Analytical Reference Glass-1 (ARG-1). Smith, G.L. Pacific Northwest Lab., Richland, WA (United States). Dec 1993. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94005296. Source: OSTI; NTIS; INIS; GPO Dep.

High-level radioactive waste may be immobilized in borosilicate glass at the West Valley Demonstration Project, West Valley, New York, the Defense Waste Processing Facility (DWPF), Aiken, South Carolina, and the Hanford Waste Vitrification Project (HWVP), Richland, Washington. The vitrified waste form will be stored in stainless steel canisters before its eventual transfer to a geologic repository for long-term disposal. Waste Acceptance Product Specifications (WAPS) (DOE 1993), Section 1.1.2 requires that the waste form producers must report the measured chemical composition of the vitrified waste in their production records before disposal. Chemical analysis of glass waste forms is receiving increased attention due to qualification requirements of vitrified waste forms. The Pacific Northwest Laboratory (PNL) has been supporting the glass producers' analytical laboratories by a continuing program of multilaboratory analytical testing using interlaboratory "round robin" methods. At the PNL Materials Characterization Center Analytical Round Robin 4 workshop "Analysis of Nuclear Waste Glass and Related Materials," January 16-17, 1990, Pleasanton, California, the meeting attendees decided that simulated nuclear waste analytical reference glasses were needed for use as analytical standards. Use of common standard analytical reference materials would allow the glass producers' analytical laboratories to calibrate procedures and instrumentation, to control laboratory performance and conduct self-appraisals, and to help qualify their various waste forms.

963 (PNL-SA-19796) Hazardous chemical and radioactive wastes at Hanford. Keller, J.F.; Stewart, T.L. Pacific Northwest Lab., Richland, WA (United States). Jul 1991. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9107153-3: 1. Hanford separations workshop, Richland, WA (United States), 23-25 Jul 1991). Order Number DE92005452. Source: OSTI; NTIS; INIS; GPO Dep.

The Hanford Site was established in 1944 to produce plutonium for defense. During the past four decades, a number of reactors, processing facilities, and waste management facilities have been built at Hanford for plutonium production. Generally, Hanford's 100 Area was dedicated to reactor operation; the 200 Area to fuel reprocessing, plutonium recovery, and waste management; and the 300 Area to fuel fabrication and research and development. Wastes generated from these operations included highly radioactive liquid wastes, which were discharged to single- and double-shell tanks; solid wastes, including both transuranic (TRU) and low-level wastes, which were buried or discharged to caissons; and waste water containing low- to intermediate-level radioactivity, which was discharged to the soil column via

near-surface liquid disposal units such as cribs, ponds, and retention basins. Virtually all of the wastes contained hazardous chemical as well as radioactive constituents. This paper will focus on the hazardous chemical components of the radioactive mixed waste generated by plutonium production at Hanford. The processes, chemicals used, methods of disposition, fate in the environment, and actions being taken to clean up this legacy are described by location.

964 (PNL-SA-20057) Locations, volumes, and characteristics of DOE's mixed low-level wastes. Ross, W.A. (Pacific Northwest Lab., Richland, WA (United States)); Elmore, M.R.; Warner, C.L.; Wachter, L.J.; Carlson, W.L.; Devries, R.L. Pacific Northwest Lab., Richland, WA (United States). Mar 1992. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-920307-69: Waste management '92, Tucson, AZ (United States), 1-5 Mar 1992). Order Number DE92011282. Source: OSTI; NTIS; INIS; GPO Dep.

The Mixed Waste Treatment Project (MWTP) has collected and analyzed mixed low-level waste data to assist in developing treatment capability for the US Department of Energy's (DOE) wastes. Initial data on the characteristics of mixed waste was obtained from the Waste Management Information System (WMIS) data base, and has been updated based on visits to DOE sites where most of the wastes are generated and stored. The streams of interest have a current inventory of about 70,000 m³ and a generation rate of about 7,700 m³/yr. The twelve sites with the most significant processing needs are Fernald, Hanford, K-25 (Oak Ridge), Idaho National Engineering Laboratory, Lawrence Livermore National Laboratory, Los Alamos National Laboratory, Oak Ridge National Laboratory (ORNL), Paducah Gaseous Diffusion Plant, Portsmouth Gaseous Diffusion Plant, Rocky Flats Plant, Savannah River Site (SRS), and Y-12 (Oak Ridge). These twelve sites account for about 98% of the mixed waste volumes. The wastes have been assigned to specific waste characterization categories. The largest category in current interim storage is inorganic solids, with sludges, filter cakes, and residues the largest specific subcategory. Aqueous liquids are the largest currently generated stream. The other large categories are solid organics, metals wastes, and heterogeneous wastes. Organic liquids, which have been a major focus, are the smallest of the categories.

965 (PNL-SA-20212) The Hybrid Treatment Process for treatment of mixed radioactive and hazardous wastes. Ross, W.A.; Kindle, C.H. Pacific Northwest Lab., Richland, WA (United States). Apr 1992. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-920448-1: 94. annual meeting and exposition of the American Ceramic Society, Minneapolis, MN (United States), 12-16 Apr 1992). Order Number DE92012342. Source: OSTI; NTIS; INIS; GPO Dep.

This paper describes a new process for treating mixed hazardous and radioactive waste, commonly called mixed waste. The process is called the Hybrid Treatment Process (HTP), so named because it is built on the 20 years of experience with vitrification of wastes in melters, and the 12 years of experience with treatment of wastes by the in situ vitrification (ISV) process.

966 (PNL-SA-20802) DOE mixed wastes: What are they and where can thermal technologies be applied?. Ross, W.A. (Pacific Northwest Lab., Richland, WA (United States)); Borduin, L.C.; Musgrave, B.C. Pacific Northwest

Lab., Richland, WA (United States). May 1992. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-920527-11: 1992 incineration conference, Albuquerque, NM (United States), 11-15 May 1992). Order Number DE93008259. Source: OSTI; NTIS; INIS; GPO Dep.

The Mixed Waste Treatment Project (MWTP) has collected and analyzed mixed low-level waste data to assist in developing treatment capability for the US Department of Energy is (DOE) wastes. Initial data on the characteristics of mixed waste was obtained from the Waste Management Information System (WMIS) data base, and has been updated based on visits to DOE sites where most of the wastes are generated and stored. The streams of interest to the MWTP have a current inventory of about 70,000 m³ and a generation rate of about 7,700 m³/yr. The 12 sites with the most significant processing needs are Fernald, Hanford, K-25 (Oak Ridge), Idaho National Engineering Laboratory (INEL), Lawrence Livermore National Laboratory (LLNL), Los Alamos National Laboratory (LANL), Oak Ridge National Laboratory (ORNL), Paducah Gaseous Diffusion Plant, Portsmouth Gaseous Diffusion Plant, Rocky Flats Plant (RFP), Savannah River Site (SRS), and Y-12 (Oak Ridge). These 12 sites account for about 98% of the mixed waste volumes. The wastes have been assigned to specific waste characterization categories and a flowsheet that identifies applicable technologies has been developed. The largest waste stream category, when considering the current inventory in storage, is inorganic solids, with sludges, filter cakes, and residues the largest specific subcategories. Aqueous liquids are the largest currently generated stream. The other large categories are solid organics, metals wastes, and heterogeneous wastes. Organic liquids, which have been a major focus, are the smallest of the categories. The major thermal treatment units include evaporators, incinerators, vitrifiers, metal melters, and off-gas treatment systems.

967 (PNL-SA-20888) A comprehensive definition and approach to waste minimization. Holter, G.M.; Stapp, D.C.; Beck, J.E. Pacific Northwest Lab., Richland, WA (United States). Nov 1992. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9211150-1: 8. international conference on solid waste management and secondary materials, Philadelphia, PA (United States), 15-18 Nov 1992). Order Number DE93005036. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes important concepts and needs related to waste minimization.

968 (PNL-SA-21166) DOE's mixed waste inventory and waste generation rates. Ross, W.A. (Pacific Northwest Lab., Richland, WA (United States)); Borduin, L.C.; Musgrave, B.C. Pacific Northwest Lab., Richland, WA (United States). Nov 1992. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-921102-51: Joint American Nuclear Society/European Nuclear Society (ANS/ENS) international meeting on fifty years of controlled nuclear chain reaction: past, present, and future, Chicago, IL (United States), 15-20 Nov 1992). Order Number DE93004842. Source: OSTI; NTIS; INIS; GPO Dep.

This document contains the inventories (70,000 cubic meters) and generation rates (7,700 cubic meters/year) of low-level mixed wastes for the U.S. DOE. The twelve sites with the most significant processing needs are Fernald, Hanford, K-25, Idaho National Engineering Laboratory (INEL),

Lawrence Livermore National Laboratory, Los Alamos National Laboratory (LANL), Oak Ridge National Laboratory (ORNL), Paducah Gaseous Diffusion Plant, Savannah River Site (SRS), and Y-12 plant. The largest inventories are located at INEL, Y-12, SRS, and K-25. The largest generation rates are located at INEL, Y-12, and SRS.

969 (PNL-SA-21215) The Hybrid Treatment Process for mixed radioactive and hazardous waste treatment. Ross, W.A.; Kindle, C.H. Pacific Northwest Lab., Richland, WA (United States). Jun 1992. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-920808-11: American Institute of Chemical Engineers (AIChE) summer national meeting, Minneapolis, MN (United States), 9-12 Aug 1992). Order Number DE93001307. Source: OSTI; NTIS; INIS; GPO Dep.

This paper describes a new process for treating mixed hazardous and radioactive waste, commonly called mixed waste. The process is called the Hybrid Treatment Process (HTP), so named because it is built on the 20 years of experience with vitrification of wastes in melters, and the 12 years of experience with treatment of wastes by the in situ vitrification (ISV) process. It also uses techniques from several additional technologies. Mixed wastes are being generated by both the US Department of Energy (DOE) and by commercial sources. The wastes are those that contain both a hazardous waste regulated under the US Environmental Protection Agency's (EPA) Resource, Conservation, and Recovery Act (RCRA) regulations and a radioactive waste with source, special nuclear, or byproduct materials. The dual regulation of the wastes increases the complexity of the treatment, handling, and storage of the waste. The DOE is the largest holder and generator of mixed waste. Its mixed wastes are classified as either high-level, transuranic (TRU), or low-level waste (LLW). High-level mixed wastes will be treated in vitrification plants. Transuranic wastes may be disposed of without treatment by obtaining a non-migration variance from the EPA. Low-level wastes, however, will require treatment, but treatment systems with sufficient capacity are not yet available to DOE. Various facilities are being proposed for the treatment of low-level waste. The concept described in this paper represents one option for establishing that treatment capacity.

970 (PNL-SA-21683) Containment and stabilization technologies for mixed hazardous and radioactive wastes. Buel, J.L. Pacific Northwest Lab., Richland, WA (United States). May 1993. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-930589-3: 4. international conference on contaminated soil, Berlin (Germany), 3-7 May 1993). Order Number DE93015697. Source: OSTI; NTIS; INIS; GPO Dep.

A prevalent approach to the cleanup of waste sites contaminated with hazardous chemicals and radionuclides is to contain and/or stabilize wastes within the site. Stabilization involves treating the wastes in some fashion, either in situ or above ground after retrieval, to reduce the leachability and release rate of waste constituents to the environment. This approach is generally reserved for radionuclide contaminants, inorganic hazardous contaminants such as heavy metals, and nonvolatile organic contaminants. This paper describes the recent developments in the technical options available for containing and stabilizing wastes. A brief description of each technology is given along with a discussion of the most recent developments and examples of useful applications.

971 (PNL-SA-22574) Radiological assessment for the dumping of radioactive wastes in the oceans. Templeton, W.L. Pacific Northwest Lab., Richland, WA (United States). Jun 1993. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9306199-2: American Defense Preparedness Association (ADPA) security technology symposium, Virginia Beach, VA (United States), 23 Jun 1993). Order Number DE93017148. Source: OSTI; NTIS; INIS; GPO Dep.

Over the last three decades or so, a number of international meetings have been convened to treat the specific problem of radioactive waste disposal into the oceans. The first of these meetings was held in 1958 at the United Nations Conference on the Law of the Sea. Immediately following, the International Atomic Energy Agency (IAEA), in the Brynolfsson Report, recommended measures for ensuring that disposal of radioactive waste into the sea would not result in unacceptable hazards to man (IAEA 1961). Since that time, major changes have occurred in the philosophy and recommendations of the International Commission on Radiological Protection that are crucial to the assessments of impacts arising from this practice. Knowledge of oceanographic processes has improved markedly, providing better understanding of the physical transport process and of the pathways by which radionuclides are transported from marine dumping and disposal sites back to man. Finally, radioecology has developed to the stage where predictions of radionuclide cycling pathways and rates are possible. The IAEA report of 1961 was revised in 1983 (IAEA 1983). The IAEA has published many documents (Safety Series and Technical Documents) covering relevant areas such as oceanographic models, bioaccumulation factors, sediment distribution coefficients, and effects of ionizing radiation on organisms.

972 (PNL-SA-23035) A DOE manual: DOE Methods for Evaluating Environmental and Waste Management Samples. Goheen, S.C. (and others); McCulloch, M.; Riley, R.G. Pacific Northwest Lab., Richland, WA (United States). [1994]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-940225-60: Waste management '94, Tucson, AZ (United States), 27 Feb - 3 mar 1994). Order Number DE94008056. Source: OSTI; NTIS; INIS; GPO Dep.

Waste Management inherently requires knowledge of the waste's chemical composition. The waste can often be analyzed by established methods; however, if the samples are radioactive, or are plagued by other complications, established methods may not be feasible. The US Department of Energy (DOE) has been faced with managing some waste types that are not amenable to standard or available methods, so new or modified sampling and analysis methods are required. These methods are incorporated into DOE Methods for Evaluating Environmental and Waste Management Samples (DOE Methods), which is a guidance/methods document for sampling and analysis activities in support of DOE sites. It is a document generated by consensus of the DOE laboratory staff and is intended to fill the gap within existing guidance documents (e. g., the Environmental Protection Agency's (EPA's) Test Methods for Evaluating Solid Waste, SW-846), which apply to low-level or non-radioactive samples. DOE Methods fills the gap by including methods that take into account the complexities of DOE site matrices. The most recent update, distributed in October 1993, contained quality assurance (QA), quality control (QC), safety, sampling, organic analysis, inorganic analysis, and radioanalytical guidance as well as 29 methods. The next update,

which will be distributed in April 1994, will contain 40 methods and will therefore have greater applicability. All new methods are either peer reviewed or labeled "draft" methods. Draft methods were added to speed the release of methods to field personnel.

973 (PNL-SA-23686) Radioactive waste tank Initial Pretreatment Module (IPM) technology development and selection. Beeman, G.H. (Pacific Northwest Lab., Richland, WA (United States)); Hansrote, G. Pacific Northwest Lab., Richland, WA (United States). [1994]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-940225-59: Waste management '94, Tucson, AZ (United States), 27 Feb - 3 mar 1994). Order Number DE94008058. Source: OSTI; NTIS; INIS; GPO Dep.

The processing of nuclear materials at the Hanford Site has resulted in the accumulation of radioactive wastes stored in 177 single- and double-shell tanks (SSTs and DSTs). Fifty-four of the 177 tanks are currently on a tank watch list because organic chemicals and ferrocyanide compounds in the tanks present a potential fire or explosion hazard. In addition, one additional SST is under consideration for placement on the watch list because of high organic concentration. Seventeen of the watch list tanks require pretreatment, and two DST complexant concentrate waste tanks not on the watch list may also need pretreatment. The proposed Initial Pretreatment Module (IPM) is expected to resolve the safety concerns by destroying the organics and ferrocyanide compounds in the tank wastes. The primary objective of the IPM is to destroy or modify constituents that cause safety concerns in the watch list tanks. A secondary objective is to enhance the cost effectiveness of processing the wastes by performing additional processing. Overall, IPM will achieve organic/ferrocyanide destruction (the primary goal) and will assist in the separation of cesium, strontium, and technetium from the tank wastes.

974 (POEF/ER-4547) X-616 Chromium Sludge Lagoons pictorial overview, Piketon, Ohio: Environmental Restoration Program. Portsmouth Gaseous Diffusion Plant, OH (United States). Oct 1992. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-76OR00001. Order Number DE93002255. Source: OSTI; NTIS; INIS; GPO Dep.

The Portsmouth Gaseous Diffusion Plant uses large quantities of water for process cooling. The X-616 Effluent Control Facility was placed in operation in December 1976 to treat recirculation cooling water blowdown from the process cooling system. A chromium-based corrosion inhibitor was used in the cooling water system. A chromium sludge was produced in a clarifier to control chromium levels in the water. Chromium sludge produced by this process was stored in two surface impoundments called the X-616 Chromium Sludge Lagoons. The sludge was toxic due to its chromium concentration and therefore required treatment. The sludge was treated, turning it into a sanitary waste, and buried in an Ohio EPA approved landfill. The plant's process cooling water system has changed to a more environmentally acceptable phosphate-based inhibitor. Closure activities at X-616 began in August 1990, with all construction activities completed in June 1991, at a total cost of \$8.0 million.

975 (SAND-91-1738C) Origin and composition of possible fluids in German and American high- and intermediate-level radioactive waste repositories in domal and bedded salt formations. Herbert,

H.J. (Gesellschaft fuer Strahlen- und Umweltforschung mbH Muenchen, Braunschweig (Germany). Inst. fuer Tieflagerung); Brush, L.H.; Rutherford, B.M. Sandia National Labs., Albuquerque, NM (United States). [1991]. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9109268-1: OECD/NEA workshop on long-term observation of the geological environment: needs and techniques, Helsinki (Finland), 9-11 Sep 1991). Order Number DE91019067. Source: OSTI; NTIS; INIS; GPO Dep.

This paper justifies the need for and describes studies of brine chemistry under way for German and American high- and intermediate-level radioactive waste repositories in domal and bedded salt formation. In particular, it discusses the origin and composition of fluids that could enter these repositories and some sampling, modeling, and statistical techniques used to characterize them. 24 refs., 4 figs., 5 tabs.

976 (SAND-91-2090C) Effective waste minimization in an R&D setting: The program at Sandia National Laboratories. Reilly, H.E. Sandia National Labs., Albuquerque, NM (United States). [1991]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9109259-2: 1. international congress on environmentally conscious manufacturing, Santa Fe, NM (United States), 18 Sep 1991). Order Number DE91019051. Source: OSTI; NTIS; GPO Dep.

An important aspect of environmentally-conscious operations is adoption of an aggressive waste minimization program. This paper describes the waste minimization and pollution prevention program at Sandia National Laboratories. Although Sandia's approach is patterned after the generic waste minimization models proposed by the Environmental Protection Agency and the Department of Energy, the specifics of implementation, and the potential for payoff, are influenced by the R&D nature of Sandia's work. Key aspects of the program are discussed, including why Sandia is developing and conducting the program; objectives; elements of the program; our approach to implementation; the magnitude of the undertaking; and the expected payoff. 3 refs., 2 figs.

977 (SAND-92-0409C) Overview of FY92/FY93 waste component recycle, treatment, and disposal integrated demonstration (WeDID) activities. Wheelis, W.T. Sandia National Labs., Albuquerque, NM (United States). [1992]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-920851-7: Spectrum '92: nuclear and hazardous waste management international topical meeting, Boise, ID (United States), 23-27 Aug 1992). Order Number DE92013693. Source: OSTI; NTIS; INIS; GPO Dep.

In September 1991, President Bush announced that the United State nuclear weapons stockpile would be significantly reduced to meet arms control treaty commitments and to encourage/promote similar activities in the Commonwealth of Independent States (CIS) to prevent proliferation of nuclear weapons to third world nations. To meet these goals will require the Department of Energy (DOE) to schedule the return of these weapon systems from Department of Defense (DoD) facilities to Pantex in Amarillo, Texas for dismantlement. After dismantlement, a wide variety of components (representing more than 30 years of hardware development) will need to be properly disposed of in accordance with Environmental Protection Agency (EPA) guidelines [principally Resource Conservation and Recovery

Act (RCRA) requirements]. To meet these disposal requirements in a fully regulatory compliant manner will require advanced processes that are technologically robust, cost-effective, and can provide true waste minimization. The Waste Component Recycle, Treatment, and Disposal Integrated Demonstration (WeDID) (formerly the Weapon Component Waste Disposal Integrated Demonstration) is addressing these issues for the non-nuclear portions of a nuclear weapon.

978 (SAND-92-0685C) Overview of waste component recycle, treatment, and disposal integrated demonstration (WeDID) activities. Wheelis, W.T. Sandia National Labs., Albuquerque, NM (United States). [1992]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-921090-1: International symposium on energetic materials technology: demilitarization, New Orleans, LA (United States), 4-7 Oct 1992). Order Number DE92040268. Source: OSTI; NTIS; INIS; GPO Dep.

Over the last year it has become apparent that there will be a reduction of nuclear weapon stockpiles in both the United States (US) as well as the Commonwealth of Independent States (CIS; formerly the Soviet Union). To meet these requirements in the United States will necessitate the dismantlement and safe disposal, in accordance with Environmental Protection Agency (EPA) guidelines, of a wide variety of types of components (representing more than 30 years of hardware development). The primary regulatory driver for these components is the Resource Conservation and Recovery Act (RCRA). Weapon components contain hazardous materials (e.g., heavy metals), PCBs, self-contained explosives, radioactive materials, gas-filled tubes, etc. Because of the wide range of materials found in these components, processes that are technologically robust (i.e., can handle the wide variation of weapon component materials), are cost-effective, recycle as much material as possible, provide true waste minimization, and are fully regulatory compliant are needed. The Waste Component Recycle, Treatment, and Disposal Integrated Demonstration (WeDID) is examining issues in these areas and demonstrating technologies that can be used for the safe disposal of the non-nuclear components of a nuclear weapon. The methods and technologies developed by WeDID for US weapon components would be directly applicable to CIS components. WeDID is a Department of Energy (DOE), Environmental Restoration and Waste Management (ERWM) sponsored program. The goal of WeDID is, to demonstrate the end-to-end disposal process for Sandia National Laboratory designed weapon components. It is anticipated that WeDID can demonstrate true waste minimization by recycling at least 30% (by total component weight) of the metals found in these components, and destruction of at least 30% of the organic materials typically found in a weapon component.

979 (SAND-92-1139C) Sandia National Laboratories Mixed Waste Landfill Integrated Demonstration. Tyler, L.D.; Phelan, J.M.; Prindle, N.K.; Purvis, S.T.; Stormont, J.C. Sandia National Labs., Albuquerque, NM (United States). [1992]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-920851-24: Spectrum '92: nuclear and hazardous waste management international topical meeting, Boise, ID (United States), 23-27 Aug 1992). Order Number DE92015005. Source: OSTI; NTIS; INIS; GPO Dep.

The Mixed-Waste Landfill Integrated Demonstration (MWLID) has been assigned to Sandia National Laboratories (SNL) by the US Department of Energy (DOE) Office of Technology Development. The mission of the MWLID is to assess, implement and transfer technologies and systems that lead to quicker, safer, and more efficient remediation of buried chemical and mixed-waste sites. The MWLID focus is on two landfills at SNL in Albuquerque, New Mexico: The Chemical Waste Landfill (CWL) and the Mixed-Waste Landfill (MWL). These landfills received chemical, radioactive and mixed wastes from various SNL nuclear research programs. A characterization system has been designed for the definition of the extent and concentration of contamination. This system includes historical records, directional drilling, and emplacement membrane, sensors, geophysics, sampling strategy, and on site sample analysis. In the remediation task, in-situ remediation systems are being designed to remove volatile organic compounds (VOC's) and heavy metals from soils. The VOC remediation includes vacuum extraction with electrical and radio-frequency heating. For heavy metal contamination, electrokinetic processes are being considered. The MWLID utilizes a phased, parallel approach. Initial testing is performed at an uncontaminated site adjacent to the CWL. Once characterization is underway at the CWL, lessons learned can be directly transferred to the more challenging problem of radioactive waste in the MWL. The MWL characterization can proceed in parallel with the remediation work at CWL. The technologies and systems demonstrated in the MWLID are to be evaluated based on their performance and cost in the real remediation environment of the landfills.

980 (SAND-92-1364C) Recycle and treatment approaches for weapon components. Wheelis, W.T. Sandia National Labs., Albuquerque, NM (United States). [1992]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9209164-4: New Mexico conference on the environment: toward a sustainable environment, Albuquerque, NM (United States), 13-15 Sep 1992). Order Number DE92019422. Source: OSTI; NTIS; INIS; GPO Dep.

Recent national and world events indicate that nuclear weapon stockpiles will be reduced. To meet these requirements will necessitate the dismantlement and safe disposal, in accordance with Environmental Protection Agency (EPA) guidelines, of a wide variety of components (representing more than 30 years of hardware development). The primary regulatory driver for these components is the Resource Conservation and Recovery Act (RCRA). Weapon components contain hazardous materials (e.g., heavy metals), PCBs, self-contained explosives, radioactive material, gas-filled tubes, etc. In addition, these components may be classified and are generally sealed in a potting compound, making waste stream separation difficult. Because of the wide range of materials found in these components, advanced processes that are technologically robust (i.e., can handle a wide variation of materials), cost-effective, recycle as much material as possible, provide true waste minimization, and are frilly regulatory compliant are needed. The Waste Component Recycle, Treatment, and Disposal Integrated Demonstration (WeDID) is a Department of Energy (DOE), Environmental Restoration and Waste Management (ERWM) program that is examining issues in these areas and demonstrating technologies that can be used for the safe disposal of the non-nuclear components of a nuclear weapon.

981 (SAND-92-1777) Commercial and research status report for inorganic membranes: Suggested uses in environmental and waste management processes. Pohl, P.I. Sandia National Labs., Albuquerque, NM (United States). Apr 1993. 33p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93013897. Source: OSTI; NTIS; INIS; GPO Dep.

This document reports on a search of the literature regarding inorganic membrane technology for use in hazardous and radioactive waste treatment. The report lists and discusses DOE waste management separation needs where membranes could be used and describes inorganic membranes and the characteristics that may make them applicable for these separations. It may serve as a tool for making waste treatment design decisions and for weighing technical proposals in the area of separations.

982 (SAND-92-2737C) Cesium separation using crystalline silicotitanate ion exchangers. Dosch, R.G. (Sandia National Labs., Albuquerque, NM (United States)); Brown, N.E.; Stephens, H.P.; Anthony, R.G. Sandia National Labs., Albuquerque, NM (United States). [1992]. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-930160-1: 2. semi-annual Office of Technology Development (OTD) information meeting, Houston, TX (United States), 26-28 Jan 1993). Order Number DE93005365. Source: OSTI; NTIS; INIS; GPO Dep.

A new class of ion-exchange materials that can selectively separate low parts per million level concentrations of Cs⁺ from 3-6 molar concentrations of Na⁺ over a wide pH range has recently been developed as a result of a collaborative effort between Sandia National Laboratories and Texas A&M University. The materials, called crystalline silicotitanates, show potential for application in the treatment of aqueous nuclear waste solutions.

983 (SAND-93-0466C) Waste minimization/pollution prevention at R&D facilities: Implementing the SNL/NM Process Waste Assessment Program. Kjeldgaard, E.A. (Sandia National Labs., Albuquerque, NM (United States)); Stermer, D.L.; Saloio, J.H. Jr.; Lorton, G.A. Sandia National Labs., Albuquerque, NM (United States). [1993]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-930483-8: 9. waste minimization and pollution prevention conference, San Francisco, CA (United States), 13-15 Apr 1993; TTC-1253). Order Number DE93012860. Source: OSTI; NTIS; INIS; GPO Dep.

The Sandia National Laboratories, New Mexico (SNL/NM) Process Waste Assessment (PWA) program began formally on November 2, 1992. This program represents the first laboratory-wide attempt to explicitly identify and characterize SNL/NM's waste generating processes for waste minimization purposes. This paper describes the major elements of the SNL/NM PWA program, the underlying philosophy for designing a PWA program at a highly diverse laboratory setting such as SNL/NM, and the experiences and insights gained from five months of implementing this living program. Specifically, the SNL/NM PWA program consists of four major, interrelated phases: (1) Process Definition, (2) Process Characterization, (3) Waste Minimization Opportunity Assessment, and (4) Project Evaluation, Selection, Implementation, and Tracking. This phased approach was developed to Provide a flexible, yet appropriate, level of detail to the multitude of different "processes" at SNL/NM.

Using a staff infrastructure of approximately 60 Waste Minimization Network Representatives (MinNet Reps) and consulting support, the SNL/NM PWA program has become the linchpin of even more progressive and proactive environmental, safety, and health (ES&H) initiatives such as: (1) cradle-to-grave material/waste tracking, (2) centralized ES&H reporting, and (3) detailed baselining and tracking for measuring multi-media waste reduction goals. Specific examples from the SNL/NM PWA program are provided, including the results from Process Definition, Process Characterization, and Waste Minimization Opportunity Assessments performed for a typical SNL/NM process.

984 (SAND-93-0469C) Waste minimization/pollution prevention at R&D facilities: A cradle-to-grave tracking and information system for Sandia National Laboratories. Kjeldgaard, E.A.; Gillenwater, M.W. Sandia National Labs., Albuquerque, NM (United States). [1993]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-930483-2: 9. waste minimization and pollution prevention conference, San Francisco, CA (United States), 13-15 Apr 1993). Order Number DE93011578. Source: OSTI; NTIS; INIS; GPO Dep.

Critical information required for Environment, Safety, and Health (ES&H) protection can be acquired with a comprehensive cradle-to-grave tracking and information system. The cradle-to-grave concept makes two initial assumptions. First, it is more effective to gather information at the origination of a process or entry point of a material and maintain that information during the rest of its life-cycle than to collect data on an ad hoc basis. Second, the information needs of the various ES&H programs have many commonalities. A system which adheres to a methodology based upon these assumptions requires a significant technical and administrative commitment; however, this investment, will in the long-term, reduce the effort and duplication of ES&H programs, improve the efficiency of ES&H and line personnel, and increase the scope and accuracy of ES&H data. The cradle-to-grave system being developed at Sandia National Laboratories (SNL) is designed to provide useful information on materials, personnel, facilities, hazards, wastes, and processes to fulfill the mission of pollution prevention, risk management, industrial hygiene, emergency preparedness, air/water quality, and hazardous and radioactive waste management groups. SNL is currently linking system modules, which are at various stages of development and production, to realize a cradle-to-grave tracking and information system that is functional for a large research and development laboratory.

985 (SAND-93-1027C) Waste component recycle, treatment, and disposal integrated demonstration (WeDID) nuclear weapon dismantlement activities. Wheelis, W.T. Sandia National Labs., Albuquerque, NM (United States). 12 Apr 1993. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-930483-4: 9. waste minimization and pollution prevention conference, San Francisco, CA (United States), 13-15 Apr 1993). Order Number DE93012862. Source: OSTI; NTIS; INIS; GPO Dep.

One of the drivers in the dismantlement and disposal of nuclear weapon components is Environmental Protection Agency (EPA) guidelines. The primary regulatory driver for these components is the Resource Conservation Recovery Act (RCRA). Nuclear weapon components are heterogeneous and contain a number of hazardous materials including heavy metals, PCB'S, selfcontained explosives,

radioactive materials, gas-filled tubes, etc. The Waste Component Recycle, Treatment, Disposal and Integrated Demonstration (WeDID) is a Department of Energy (DOE) Environmental Restoration and Waste Management (ERWM) sponsored program. It also supports DOE Defense Program (DP) dismantlement activities. The goal of WeDID is to demonstrate the end-to-end disposal process for Sandia National Laboratories designed nuclear weapon components. One of the primary objectives of WeDID is to develop and demonstrate advanced system treatment technologies that will allow DOE to continue dismantlement and disposal unhindered even as environmental regulations become more stringent. WeDID is also demonstrating waste minimization techniques by recycling a significant weight percentage of the bulk/precious metals found in weapon components and by destroying the organic materials typically found in these components. WeDID is concentrating on demonstrating technologies that are regulatory compliant, are cost effective, technologically robust, and are near-term to ensure the support of DOE dismantlement time lines. The waste minimization technologies being demonstrated by WeDID are cross cutting and should be able to support a number of ERWM programs.

986 (SAND-93-2330/1) Initial performance assessment of the disposal of spent nuclear fuel and high-level waste stored at Idaho National Engineering Laboratory: Volume 1, Methodology and results. Rechard, R.P. (ed.). Sandia National Labs., Albuquerque, NM (United States). Dec 1993. 591p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE94007981. Source: OSTI; NTIS; INIS; GPO Dep.

This performance assessment characterized plausible treatment options conceived by the Idaho National Engineering Laboratory (INEL) for its spent fuel and high-level radioactive waste and then modeled the performance of the resulting waste forms in two hypothetical, deep, geologic repositories: one in bedded salt and the other in granite. The results of the performance assessment are intended to help guide INEL in its study of how to prepare wastes and spent fuel for eventual permanent disposal. This assessment was part of the Waste Management Technology Development Program designed to help the US Department of Energy develop and demonstrate the capability to dispose of its nuclear waste. Although numerous caveats must be placed on the results, the general findings were as follows: Though the waste form behavior depended upon the repository type, all current and proposed waste forms provided acceptable behavior in the salt and granite repositories.

987 (SAND-93-2330/2) Initial performance assessment of the disposal of spent nuclear fuel and high-level waste stored at Idaho National Engineering Laboratory: Volume 2: Appendices. Rechard, R.P. (ed.). Sandia National Labs., Albuquerque, NM (United States). Dec 1993. 453p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE94008110. Source: OSTI; NTIS; INIS; GPO Dep.

This performance assessment characterized plausible treatment options conceived by the Idaho National Engineering Laboratory (INEL) for its spent fuel and high-level radioactive waste and then modeled the performance of the resulting waste forms in two hypothetical, deep, geologic repositories: one in bedded salt and the other in granite. The results of the performance assessment are intended to help guide INEL in its study of how to prepare wastes and spent fuel for eventual permanent disposal. This assessment

was part of the Waste Management Technology Development Program designed to help the US Department of Energy develop and demonstrate the capability to dispose of its nuclear waste, as mandated by the Nuclear Waste Policy Act of 1982. The waste forms comprised about 700 metric tons of initial heavy metal (or equivalent units) stored at the INEL: graphite spent fuel, experimental low enriched and highly enriched spent fuel, and high-level waste generated during reprocessing of some spent fuel. Five different waste treatment options were studied; in the analysis, the options and resulting waste forms were analyzed separately and in combination as five waste disposal groups. When the waste forms were studied in combination, the repository was assumed to also contain vitrified high-level waste from three DOE sites for a common basis of comparison and to simulate the impact of the INEL waste forms on a moderate-sized repository. The performance of the waste form was assessed within the context of a whole disposal system, using the U.S. Environmental Protection Agency's Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes, 40 CFR 191, promulgated in 1985. Though the waste form behavior depended upon the repository type, all current and proposed waste forms provided acceptable behavior in the salt and granite repositories.

988 (SAND-93-7040) Individual and combined effects of chloride, sulfate, and magnesium ions on hydrated Portland-cement paste. Poole, T.S. (Army Engineer Waterways Experiment Station, Vicksburg, MS (United States). Structures Lab.); Wakeley, L.D.; Young, C.L. Sandia National Labs., Albuquerque, NM (United States); Army Engineer Waterways Experiment Station, Vicksburg, MS (United States). Structures Lab. Mar 1994. 74p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE94011247. Source: OSTI; NTIS; INIS; GPO Dep.

Ground water with a high concentration of magnesium ion is known to cause deterioration to portland cement concretes. A proposed mechanism for this deterioration process published previously involves an approximate 1:1 replacement of Ca ions by Mg ions in the crystalline phases of hydrated cement. The current study was undertaken to determine which ions, among magnesium, chloride, and sulfate, cause deterioration; whether their deleterious action is individual or interdependent; and to relate this mechanism of deterioration to the outlook for a 100-yr service life of concretes used in mass placements at the Waste Isolation Pilot Plant. Loss of Ca ion by cement pastes was found to be strongly related to the concentration of Mg ion in simulated ground-water solutions in which the paste samples were aged. This was true of both salt-containing and conventional cement pastes. No other ion in the solutions exerted a strong effect on Ca loss. Ca ion left first from calcium hydroxide in the pastes, depleting all calcium hydroxide by 60 days. Some calcium silicate hydrate remained even after 90 days in the solutions with the highest concentration of Mg ion, while the paste samples deteriorated noticeably. The results indicated a mechanism that involves dissolution of Ca phases and transport of Ca ions to the surface of the sample, followed by formation of Mg-bearing phases at this reaction surface rather than directly by substitution within the microstructure of hydrated cement. Given that calcium hydroxide and calcium silicate hydrate are the principal strength-giving phases of hydrated cement, this mechanism indicates the likelihood of significant loss of integrity of a concrete exposed to Mg-bearing ground water at the WIPP.

The rate of deterioration ultimately will depend on Mg-ion concentration, the microstructure materials of the concrete exposed to that groundwater, and the availability of brine.

989 (UCRL-21174) Site Safety Plan for Lawrence Livermore National Laboratory CERCLA Investigations. Bainer, R.; Duarte, J. Lawrence Livermore National Lab., CA (United States). Jul 1993. 169p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93040493. Source: OSTI; NTIS; GPO Dep.

The safety policy of LLNL is to take every reasonable precaution in the performance of work to protect the environment and the health and safety of employees and the public, and to prevent property damage. With respect to hazardous agents, this protection is provided by limiting human exposures, releases to the environment, and contamination of property to levels that are as low as reasonably achievable (ALARA). It is the intent of this Plan to supply the broad outline for completing environmental investigations within ALARA guidelines. It may not be possible to determine actual working conditions in advance of the work; therefore, planning must allow the opportunity to provide a range of protection based upon actual working conditions. Requirements will be the least restrictive possible for a given set of circumstances, such that work can be completed in an efficient and timely fashion. Due to the relatively large size of the LLNL Site and the different types of activities underway, site-specific Operational Safety Procedures (OSPs) will be prepared to supplement activities not covered by this Plan. These site-specific OSPs provide the detailed information for each specific activity and act as an addendum to this Plan, which provides the general plan for LLNL Main Site operation.

990 (UCRL-CR-116354) Waste glass corrosion modeling: Comparison with experimental results. Bourcier, W.L. Lawrence Livermore National Lab., CA (United States). Nov 1993. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE94008794. Source: OSTI; NTIS; INIS; GPO Dep.

A chemical model of glass corrosion will be used to predict the rates of release of radionuclides from borosilicate glass waste forms in high-level waste repositories. The model will be used both to calculate the rate of degradation of the glass, and also to predict the effects of chemical interactions between the glass and repository materials such as spent fuel, canister and container materials, backfill, cements, grouts, and others. Coupling between the degradation processes affecting all these materials is expected. Models for borosilicate glass dissolution must account for the processes of (1) kinetically-controlled network dissolution, (2) precipitation of secondary phases, (3) ion exchange, (4) rate-limiting diffusive transport of silica through a hydrous surface reaction layer, and (5) specific glass surface interactions with dissolved cations and anions. Current long-term corrosion models for borosilicate glass employ a rate equation consistent with transition state theory embodied in a geochemical reaction-path modeling program that calculates aqueous phase speciation and mineral precipitation/dissolution. These models are currently under development. Future experimental and modeling work to better quantify the rate-controlling processes and validate these models are necessary before the models can be used in repository performance assessment calculations.

991 (UCRL-JC-109768-Rev.1) Survey of life-cycle costs of glass-paper HEPA filters: Revision 1. Moore, P.; Bergman, W.; Gilbert, H. Lawrence Livermore National Lab., CA (United States). Dec 1992. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-920823-6-Rev.1: 22. Department of Energy (DOE)/Nuclear Regulatory Commission (NRC) nuclear air cleaning and treatment conference, Denver, CO (United States), 24-27 Aug 1992). Order Number DE93005823. Source: OSTI; NTIS; GPO Dep.

We have conducted a survey of the major users of glass-paper HEPA filters in the DOE complex to ascertain the life cycle costs of these filters. Purchase price of the filters is only a minor portion of the costs; the major expenditures are incurred during the removal and disposal of contaminated filters. Through a combination of personal interviews, site visits and completion of questionnaires, we have determined the costs associated with the use of HEPA filters in the DOE complex. The total approximate, life-cycle cost for a glass-paper HEPA filter is \$3,000 for one considered low-level waste (LLW), \$11,780 for transuranic (TRU) and \$15,000 for high-level waste (HLW). The weighted-average cost for a standard HEPA filter in the complex is \$4,753. Although the cost estimate represents an average for all sizes and types of HEPA filters used in DOE facilities, the majority of the filters are 2 ft x 2 ft x 1 ft filters with wooden frames, deep pleated glass-fiber media, and an adhesive sealant.

992 (UCRL-JC-109769) Development and evaluation of a cleanable high efficiency steel filter. Bergman, W. (Lawrence Livermore National Lab., CA (United States)); Larsen, G.; Weber, F.; Wilson, P.; Lopez, R.; Valha, G.; Conner, J.; Garr, J.; Williams, K.; Biermann, A.; Wilson, K.; Moore, P.; Gellner, C.; Rapchun, D.; Simon, K.; Turley, J.; Frye, L.; Lawrence Livermore National Lab., CA (United States). Jan 1993. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-920823-8: 22. Department of Energy (DOE)/Nuclear Regulatory Commission (NRC) nuclear air cleaning and treatment conference, Denver, CO (United States), 24-27 Aug 1992). Order Number DE93008024. Source: OSTI; NTIS; INIS; GPO Dep.

We have developed a high efficiency steel filter that can be cleaned in-situ by reverse air pulses. The filter consists of 64 pleated cylindrical filter elements packaged into a 610 x 610 x 292 mm aluminum frame and has 13.5 m² of filter area. The filter media consists of a sintered steel fiber mat using 2 µm diameter fibers. We conducted an optimization study for filter efficiency and pressure drop to determine the filter design parameters of pleat width, pleat depth, outside diameter of the cylinder, and the total number of cylinders. Several prototype cylinders were then built and evaluated in terms of filter cleaning by reverse air pulses. The results of these studies were used to build the high efficiency steel filter. We evaluated the prototype filter for efficiency and cleanability. The DOP filter certification test showed the filter has a passing efficiency of 99.99% but a failing pressure drop of 0.80 kPa at 1,700 m³/hr. Since we were not able to achieve a pressure drop less than 0.25 kPa, the steel filter does not meet all the criteria for a HEPA filter. Filter loading and cleaning tests using AC Fine dust showed the filter could be repeatedly cleaned by reverse air pulses. The next phase of the prototype evaluation consisted of installing the unit and support housing in the exhaust duct work of a uranium grit blaster for a field evaluation at the Y-12 Plant in Oak Ridge, TN. The grit blaster is used to clean the surface

of uranium parts and generates a cloud of UO₂ aerosols. We used a 1,700 m³/hr slip stream from the 10,200 m³/hr exhaust system.

993 (UCRL-JC-111345) Preliminary minimum detectable limit measurements in 208-L drums for selected actinide isotopes in mock-waste matrices. Camp, D.C.; Wang, Tzu-Fang; Martz, H.E. Lawrence Livermore National Lab., CA (United States). 30 Jul 1992. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-920882-5: Transuranic waste characterization conference, Pocatello, ID (United States), 10-12 Aug 1992). Order Number DE93012585. Source: OSTI; NTIS; INIS; GPO Dep.

Preliminary minimum detectable levels (MDLS) of selected actinide isotopes have been determined in full-scale, 55-gallon drums filled with a range of mock-waste materials from combustibles (0.14 g/cm³) to sand (1.7 g/cm³). Measurements were recorded from 100 to 10,000 seconds with selected actinide sources located in these drums at an edge position, on the center axis of a drum and midway between these two positions. Measurements were also made with a ¹⁶⁶Ho source to evaluate the attenuation of these mock-matrix materials as a function of energy. By knowing where the source activity is located within a drum, our preliminary results show that a simply collimated 90% HPGE detector can differentiate between TRU (>100 nCi/g) and LLW amounts of ²³⁹Pu in only 100s of measurement time and with sufficient accuracy in both low and medium density, low Z materials. Other actinides measured so far include ²³⁵U, ²⁴¹Am, and ²⁴⁴Cm. These measurements begin to establish the probable MDLs achievable in the nondestructive assays of real waste drums when using active and passive CT. How future measurements may differ from these preliminary measurements is also discussed.

994 (UCRL-JC-112062) In situ bioremediation of trichloroethylene-contaminated water by a resting-cell methanotrophic microbial filter. Taylor, R.T.; Duba, A.G.; Durham, W.B.; Hanna, M.L.; Jackson, K.J.; Jovanovich, M.C.; Knapp, R.B.; Knezovich, J.P.; Shah, N.N.; Shonnard, D.R.; Wijesinghe, A.M. Lawrence Livermore National Lab., CA (United States). Oct 1992. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9209296-1: International Association of Hydrodynamical Science (IAHS) conference of the international in-situ bioremediation, Ontario (Canada), 20-24 Sep 1992). Order Number DE93005828. Source: OSTI; NTIS; INIS; GPO Dep.

The Lawrence Livermore National Laboratory is testing and developing an in situ microbial filter technology for remediating migrating subsurface plumes contaminated with low concentrations of trichloroethylene (TCE). Their current focus is the establishment of a replenishable bioactive zone (catalytic filter) along expanding plume boundaries by the injection of a representative methanotrophic bacterium, *Methylosinus trichosporium* OB3b. We have successfully demonstrated this microbial filter strategy using emplaced, attached resting cells (no methane additions) in a 1.1-m flow-through test bed loaded with water-saturated sand. Two separate 24 h pulses of TCE (109 ppb and 85 ppb), one week apart, were pumped through the system at a flow velocity of 1.5 cm/h; no TCE (<0.5 ppb) was detected on the downstream side of the microbial filter. Subsequent excavation of the wet sand confirmed the existence of a TCE-bioactive zone 19 days after it had been created. An

enhanced longevity of the cellular, soluble-form methane monooxygenase produced by this methanotroph is a result of our laboratory bioreactor culturing conditions. Additional experiments with cells in sealed vials and emplaced in the 1.1-m test bed yielded a high resting-cell finite TCE biotransformation capacity of ~ 0.25 mg per mg of bacteria; this is suitable for a planned sand-filled trench field demonstration at a Lawrence Livermore National Laboratory site.

995 (UCRL-JC-112832) Modeling surface area to volume effects on borosilicate glass dissolution. Bourcier, W.L. (Lawrence Livermore National Lab., CA (United States)); Ebert, W.L.; Feng, X. Lawrence Livermore National Lab., CA (United States). Nov 1992. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48 ; W-31109-ENG-38. (CONF-921101-111: 16. Materials Research Society (MRS) fall meeting, Boston, MA (United States), 30 Nov - 5 dec 1992). Order Number DE93011891. Source: OSTI; NTIS; INIS; GPO Dep.

We simulated the reaction of SRL-131 glass with equilibrated J-13 water in order to investigate the effects of surface area to volume ratio (SA/V) on glass dissolution. We show that glass-fluid ion exchange causes solution pH to rise to progressively higher values as SA/V increases. Because the ion exchange is rapid relative to the duration of the glass dissolution experiment, the pH effect does not scale with (SA/V)*time. Experiments compared at the same (SA/V)*time value therefore have different pHs, with higher pHs at higher SA/V ratios. Both experimental data and our simulation results show similar trends of increasing reaction rate as a function of SA/V ratio when scaled to (SA/V)*time. Glasses which react in systems of differing SA/V ratio therefore follow different reaction paths and high SA/V ratios cannot be used to generate data which accurately scales to long time periods unless the ion exchange effect is taken into account. We suggest some simple test designs which enable more reliable high. SA/V accelerated tests.

996 (UCRL-JC-112934) Criticality benchmark comparisons leading to cross-section upgrades. Alesso, H.P.; Annese, C.E.; Heinrichs, D.P.; Lloyd, W.R.; Lent, E.M. Lawrence Livermore National Lab., CA (United States). 1 Mar 1993. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-930907-5: ANS topical meeting on physics and methods in criticality safety, Nashville, TN (United States), 19-23 Sep 1993). Order Number DE93017184. Source: OSTI; NTIS; INIS; GPO Dep.

For several years criticality benchmark calculations with COG. COG is a point-wise Monte Carlo code developed at Lawrence Livermore National Laboratory (LLNL). It solves the Boltzmann equation for the transport of neutrons and photons. The principle consideration in developing COG was that the resulting calculation would be as accurate as the point-wise cross-sectional data, since no physics computational approximations were used. The objective of this paper is to report on COG results for criticality benchmark experiments in concert with MCNP comparisons which are resulting in corrections an upgrades to the point-wise ENDL cross-section data libraries. Benchmarking discrepancies reported here indicated difficulties in the Evaluated Nuclear Data Livermore (ENDL) cross-sections for U-238 at thermal neutron energy levels. This led to a re-evaluation and selection of the appropriate cross-section values from several cross-section sets available (ENDL, ENDF/B-V). Further cross-section upgrades anticipated.

997 (UCRL-JC-116132) Constraints on the affinity term for modeling long-term glass dissolution rates. Bourcier, W.L.; Carroll, S.A.; Phillips, B.L. Lawrence Livermore National Lab., CA (United States). Nov 1993. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48 ; W-31109-ENG-38. (CONF-931108-100: Fall meeting of the Materials Research Society (MRS), Boston, MA (United States), 29 Nov - 3 dec 1993). Order Number DE94011740. Source: OSTI; NTIS; INIS; GPO Dep.

Predictions of long-term glass dissolution rates are highly dependent on the form of the affinity term in the rate expression. Analysis of the quantitative effect of saturation state on glass dissolution rate for CSG glass (a simple analog of SRL-165 glass), shows that a simple (1-Q/K) affinity term does not match experimental results. Our data at 100°C show that the data is better fit by an affinity term having the form $(1 - (Q/K)^{1/\sigma})$ where $\sigma = 10$.

998 (WHC-EP-0063-2) Hanford Site radioactive solid waste acceptance criteria. Willis, N.P. Westinghouse Hanford Co., Richland, WA (United States). Sep 1990. 166p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91009164. Source: OSTI; NTIS; INIS; GPO Dep.

Westinghouse Hanford Company manages and operates the Hanford Site 200 Area radioactive solid waste treatment, storage, and disposal facilities for the US Department of Energy-Richland Operations Office. These facilities include radioactive solid waste disposal sites and radioactive solid waste storage areas. This manual defines the criteria that must be met by waste generators for radioactive solid waste to be accepted by Westinghouse Hanford Company for storage or disposal at the 200 Areas facilities. It is to be used by all waste generators preparing radioactive solid waste for storage or disposal at the Hanford Site facilities. This manual is also intended for use by Westinghouse Hanford Company solid waste technical staff involved with approval and acceptance of radioactive solid waste. The criteria in this manual represent a compilation of state and federal regulations; US Department of Energy orders; Hanford site requirements; and other rules, regulations, guidelines, and standards as they apply to management of radioactive solid waste. Where appropriate, these requirements are included in the manual by reference. It is the intent of this manual to provide guidance to the waste generator in meeting the applicable requirements. Chapters describe criteria for administrative procedures, transuranic wastes, low-level wastes, radioactive mixed waste storage and disposal. Chapters have been indexed separately for inclusion on the database.

999 (WHC-EP-0063-3) Hanford Site solid waste acceptance criteria. Willis, N.P.; Triner, G.C. Westinghouse Hanford Co., Richland, WA (United States). Sep 1991. 278p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92006492. Source: OSTI; NTIS; INIS; GPO Dep.

Westinghouse Hanford Company manages the Hanford Site solid waste treatment, storage, and disposal facilities for the US Department of Energy Field Office, Richland under contract DE-AC06-87RL10930. These facilities include radioactive solid waste disposal sites, radioactive solid waste storage areas and hazardous waste treatment, storage, and/or disposal facilities. This manual defines the criteria that must be met by waste generators for solid waste to be accepted by Westinghouse Hanford Company for treatment, storage and/or disposal facilities. It is to be used

by all waste generators preparing radioactive solid waste for storage or disposal at the Hanford Site facilities and for all Hanford Site generators of hazardous waste. This manual is also intended for use by Westinghouse Hanford Company solid waste technical staff involved with approval and acceptance of solid waste. The criteria in this manual represent a compilation of state and federal regulations; US Department of Energy orders; Hanford Site requirements; and other rules, regulations, guidelines, and standards as they apply to management of solid waste. Where appropriate, these requirements are included in the manual by reference. It is the intent of this manual to provide guidance to the waste generator in meeting the applicable requirements.

1000 (WHC-EP-0063-4) Hanford Site Solid Waste Acceptance Criteria. Westinghouse Hanford Co., Richland, WA (United States). 17 Nov 1993. 358p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94004869. Source: OSTI; NTIS; INIS; GPO Dep.

This manual defines the Hanford Site radioactive, hazardous, and sanitary solid waste acceptance criteria. Criteria in the manual represent a guide for meeting state and federal regulations; DOE Orders; Hanford Site requirements; and other rules, regulations, guidelines, and standards as they apply to acceptance of radioactive and hazardous solid waste at the Hanford Site. It is not the intent of this manual to be all inclusive of the regulations; rather, it is intended that the manual provide the waste generator with only the requirements that waste must meet in order to be accepted at Hanford Site TSD facilities.

1001 (WHC-EP-0125-2) Summary of radioactive solid waste received in the 200 Areas during calendar year 1989. Anderson, J.D.; McCann, D.C.; Poremba, B.E. Westinghouse Hanford Co., Richland, WA (United States). Apr 1990. 118p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE90017232. Source: NTIS, PC A06/MF A01 - OSTI; GPO Dep.

Westinghouse Hanford Company manages and operates the Hanford Site 200 Area radioactive solid waste storage and disposal facilities for the US Department of Energy-Richland Operations Office under contract AC06-87RL10930. These facilities include radioactive solid waste disposal sites and radioactive solid waste storage areas. This document summarizes the amount of radioactive materials that have been buried and stored in the 200 Area radioactive solid waste storage and disposal facilities since startup in 1944 through calendar year 1989. This report does not include solid radioactive wastes in storage or disposal in other facilities or areas such as the underground tank farms. Unless packaged within the scope of WHC-EP-0063, liquid waste data is not included in this document. 1 tab.

1002 (WHC-EP-0125-3) Summary of radioactive solid waste received in the 200 Areas during calendar year 1990. Anderson, J.D.; McCann, D.C.; Poremba, B.E. Westinghouse Hanford Co., Richland, WA (United States). Apr 1991. 124p. Sponsored by USDOE, Washington, DC (USA). DOE Contract AC06-87RL10930. Order Number DE91014691. Source: OSTI; NTIS; INIS; GPO Dep.

Westinghouse Hanford Company manages and operates the Hanford Site 200 Areas radioactive solid waste storage and disposal facilities for the US Department of Energy-Richland Operations Office under contract AC06-87RL10930. These facilities include radioactive solid waste

disposal sites and radioactive solid waste storage areas. This document summarizes the amount of radioactive materials that have been buried and stored in the 200 Areas radioactive solid waste storage and disposal facilities since startup in 1944 through calendar year 1990. This report does not include solid radioactive wastes in storage or disposal in other areas or facilities such as the underground tank farms. Unless packaged within the scope of Hanford Site radioactive solid waste acceptance criteria, liquid waste data are not included in this document. 10 refs., 1 tab.

1003 (WHC-EP-0125-5) Summary of radioactive solid waste received in the 200 Areas during calendar year 1992. Anderson, J.D.; Hagel, D.L. Westinghouse Hanford Co., Richland, WA (United States). May 1992. 160p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93016221. Source: OSTI; NTIS; INIS; GPO Dep.

Westinghouse Hanford Company manages and operates the Hanford Site 200 Area radioactive solid waste storage and disposal facilities for the US Department of Energy, Richland Field Office, under contract DE-AC06-87RL10930. These facilities include radioactive solid waste disposal sites and radioactive solid waste storage areas. This document summarizes the amount of radioactive materials that have been buried and stored in the 200 Area radioactive solid waste storage and disposal facilities since startup in 1944 through calendar year 1991. This report does not include solid radioactive wastes in storage or disposed of in other areas or facilities such as the underground tank farms, or backlog wastes. Unless packaged within the scope of WHC-EP-0063, Hanford Site Solid Waste Acceptance Criteria, (WHC 1988), liquid waste data are not included in this document.

1004 (WHC-EP-0141-2) Westinghouse Hanford Company effluent discharges and solid waste management report for calendar year 1989: 200/600 Areas. Brown, M.J.; P'Pool, R.K.; Thomas, S.P. Westinghouse Hanford Co., Richland, WA (United States). May 1990. 154p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91002443. Source: NTIS, PC A08/MF A01; OSTI; INIS; GPO Dep.

This report presents calendar year 1989 radiological and nonradiological effluent discharge data from facilities in the 200 Areas and the 600 Area of the Hanford Site. Both summary and detailed effluent data are presented. In addition, radioactive and nonradioactive solid waste storage and disposal data for calendar year 1989 are furnished. Where appropriate, comparisons to previous years are made. The intent of the report is to demonstrate compliance of Westinghouse Hanford Company-operated facilities with administrative control values for radioactive constituents and applicable guidelines and standards (including Federal permit limits) for nonradioactive constituents. 11 refs., 20 tabs.

1005 (WHC-EP-0212-1) Hanford Site Environmental Restoration and Waste Technology Plan: Calendar year 1990. Anantatmula, R.P. (comp.). Westinghouse Hanford Co., Richland, WA (United States). Jun 1990. 615p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE90015390. Source: NTIS, PC A99/MF A01 - OSTI; GPO Dep.

The Hanford Site Environmental Restoration and Waste Management Technology Plan provides a description of the

technology required to implement waste disposal and inactive site cleanup as dictated by environmental requirements. The Hanford Site Environmental Restoration and Waste Management Technology Plan is composed of sections that address the technology requirements related to eight different functional and waste categories. Each category includes descriptions of related technical issues and the tasks that must be performed to resolve them. Summary projections of cost and schedule for resolution of pertinent technical issues are included within each functional or waste category and within an overall cost summary section. The document is compiled from reports authored by individuals directly involved in the planning and implementation of technology development activities related to the various technical issues. The Hanford Site Environmental Restoration and Waste Management Technology Plan is revised periodically. 67 figs., 26 tabs.

1006 (WHC-EP-0250-Draft-Rev.B-App.) **Hanford Waste Vitrification Plant preliminary safety analysis report: Appendix.** Westinghouse Hanford Co., Richland, WA (United States). Jul 1990. 626p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE90014060. Source: NTIS, PC A99/MF A01 - OSTI.

This document contains the appendix for Chapter 6 of the "Hanford Waste Vitrification Plant Preliminary Safety Analysis Report." This report contains information on activities at the proposed Vitrification Plant at Hanford Reservation. Topics include material balance tables, process flow schematics, and piping and instrumentation diagrams. (KJD)

1007 (WHC-EP-0250-Draft-Rev.B-Vol.1) **Hanford Waste Vitrification Plant Preliminary Safety Analysis Report: Draft, Revision B: Volume 1.** Westinghouse Hanford Co., Richland, WA (United States). Jul 1990. 523p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE90013935. Source: NTIS, PC A22/MF A01 - OSTI; GPO Dep.

This document comprises the safety analysis report for the proposed vitrification plant at the Hanford Reservation. Topics discussed in Volume 1 include a safety analysis, site characterization, and principal design criteria. (KJD)

1008 (WHC-EP-0250-Draft-Rev.B-Vol.2) **Hanford Waste Vitrification Plant preliminary safety analysis report: Draft, Revision B, Volume 2.** Westinghouse Hanford Co., Richland, WA (United States). Jul 1990. 474p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE90013936. Source: NTIS, PC A20/MF A01 - OSTI; GPO Dep.

This volume of the Hanford Waste Vitrification Project (HWVP) preliminary safety analysis report (PSAR) provides descriptive information on the buildings, structures, and design features for the HWVP. It emphasizes features that serve a confinement and safety function. Special design features employed to withstand environmental and accident forces are also discussed. Also discussed are the safety analysis of the HWVP facility, details on the characteristics of the Hanford Site including geology, meteorology, and hydrology, the design criteria for the HWVP facility, details on the process systems, including process flow diagrams, and a discussion of physical and chemical data for the HWVP. 51 refs., 51 figs., 43 tabs.

1009 (WHC-EP-0250-Draft-Rev.B-Vol.3) **Hanford Waste Vitrification Plant preliminary safety analysis report: Draft, Revision B, Volume 3.** Westinghouse Hanford

Co., Richland, WA (United States). Jul 1990. 433p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE90013937. Source: NTIS, PC A19/MF A01 - OSTI; GPO Dep.

This volume provides a detailed description of Hanford Waste Vitrification Plant (HWVP) process systems and selected process support systems. Items of safety analysis concern related to the process and process support systems. Items of safety analysis concern related to the process and process support systems, waste management and the confinements of radioactive and nonradioactive wastes generated during the course of the processing operations at HWVP, and the HWVP design features and methods for protecting personnel and the public from radiation during operations. 66 refs., 67 figs., 58 tabs., (KJD)

1010 (WHC-EP-0250-Draft-Rev.B-Vol.4) **Hanford Waste Vitrification Plant preliminary safety analysis report: Draft, Revision B: Volume 4.** Westinghouse Hanford Co., Richland, WA (United States). Jul 1990. 395p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE90013938. Source: NTIS, PC A17/MF A01 - OSTI; GPO Dep.

This document contains five chapters in activities at the proposed vitrification plant at the Hanford Reservation. Chapter topics include waste confinement and management, health protection, accident safety analysis, operational safety requirements, and quality assurance. (KJD)

1011 (WHC-EP-0300) **Alternatives to land disposal of solid radioactive mixed wastes on the Hanford Site.** Jacobsen, P.H.; Duncan, D.R. Westinghouse Hanford Co., Richland, WA (United States). Mar 1990. 62p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE90008209. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

This report was prepared in response to Hanford Federal Facility Agreement and Consent Order to provide annual reports of studies/efforts that are in progress to identify alternatives to land disposal of radioactive mixed wastes (RMW). The annual reports will provide information regarding actions taken to minimize waste generation, recycle/reclaim wastes, or treat wastes. The scope of the report is "solid" waste. This is the first of such annual reports. It will summarize Hanford Site efforts to employ alternatives to land disposal of RMW, which contain both radioactive and hazardous constituents, by reviewing waste minimization and treatment plans, activities, and other related waste management activities presently and in future work. This report will be current as of the first quarter of fiscal year (FY) 1990. 9 refs., 4 figs., 1 tab.

1012 (WHC-EP-0324) **Restart of the 242-A Evaporator: Effluent retention, treatment, and disposal facilities program plan.** Lini, D.C.; Forehand, G.D.; Kelley, D.E. Westinghouse Hanford Co., Richland, WA (United States). Apr 1990. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE90008208. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Operation of the 242-A Evaporator supports waste management activities including single-shell tank stabilization, grout processing, waste pretreatment before disposal, and production waste storage. In April 1989, the 242-A Evaporator was placed in temporary standby pending resolution of issues on the disposal of potential regulated dangerous wastes that may be in the 242-A effluent. Restart of the

evaporator is required by December 1990, to maintain adequate double-shell tank space for storage of new generated wastes. A liquid effluent retention facility will be constructed to store the 242-A process condensate until a treatment and disposal facility is constructed and placed in operation. The liquid effluent retention facility will include basins for storing two effluent streams from the plutonium-uranium extraction operation that will be treated in the same facility before disposal. The liquid effluent retention facility is scheduled to be operational by December 1990, and the treatment and disposal facilities are scheduled to be operational by June 1992. 18 refs., 6 figs., 1 tab.

1013 (WHC-EP-0336-Rev.1) Motor carrier evaluation program plan: Revision 1. Portsmouth, J.H.; Maxwell, J.E.; Boness, G.O.; Rice, L.E. Westinghouse Hanford Co., Richland, WA (United States). Apr 1991. 100p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91016790. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy (DOE) Transportation Management Program (TMP) has established a program to assist the DOE field offices and their contractors in evaluating the motor carriers used to transport DOE-owned hazardous and radioactive materials. This program was initiated to provide the DOE field offices with the tools necessary to help ensure, during this period of motor carrier deregulation, that only highly qualified carriers transport radioactive and hazardous commodities for the DOE. This program will assist DOE in maintaining their excellent performance record in the safe transportation of hazardous commodities. The program was also developed in response to public concern surrounding the transportation of hazardous materials. Representatives of other federal agencies, states, and tribal governments, as well as the news media, have expressed concern about the selection and qualification of carriers engaged in the transportation of Highway Route-Controlled Quantities (HRCQ) and Truckload (TL) quantities of radioactive material for the DOE. 8 refs.

1014 (WHC-EP-0337-Rev.1) Motor carrier evaluation program procedure: Revision 1. Portsmouth, J.H.; Maxwell, J.E.; Boness, G.O.; Rice, L.E. Westinghouse Hanford Co., Richland, WA (United States). Apr 1991. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91016783. Source: OSTI; NTIS; GPO Dep.

The US Department of Energy (DOE) Transportation Management Program (DOE-TMP) has the overall responsibility to provide a well-managed transportation program for the safe, efficient, and economical transportation of DOE-owned material. In the performance of these duties, the DOE-TMP has established an exemplary safety record in the transportation of hazardous materials. The DOE recognizes that its responsibility for hazardous material does not end when the shipments leave the DOE sites. A special partnership is needed between the DOE, the DOE contractors, and the carriers chosen to transport hazardous materials. As in any partnership, it is critical that DOE know essential information about its partner in this joint venture. In fulfillment of its responsibility for the safe transportation of radioactive materials as well as other hazardous commodities and wastes routinely shipped from many DOE locations nationwide, the DOE-TMP has developed this policy for a motor carrier evaluation program. It is the intent of the DOE-TMP that this Motor Carrier Evaluation Program be implemented at all DOE locations. This program will assist in the evaluation of

carriers transporting Highway Route Controlled Quantities (HRCQ) of radioactive material, because these shipments frequently are in the "public eye." The program will also evaluate truckload (TL) quantity transporters of radioactive materials and chemical wastes. The expansion of the program to include motor carriers transporting less-than-truckload (LTL) quantities of these materials will be implemented through a gradually phased in program during future years. 11 refs.

1015 (WHC-EP-0337-Rev.2) Motor Carrier Evaluation Program procedure: Revision 2. Birkland, J.A.; Maxwell, J.E.; Portsmouth, J.H.; Toolson, G.P. Westinghouse Hanford Co., Richland, WA (United States). Sep 1992. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93004070. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy (DOE) Transportation Management Division (DOE-TMD) has the overall responsibility to provide a well-managed transportation program for the safe, efficient, and economical transportation of DOE-owned material. In the performance of these duties, the DOE-TMD has established an exemplary safety record in the transportation of hazardous materials. The DOE recognizes that its responsibility for hazardous material does not end when the shipments leave the DOE sites. A special partnership is needed between the DOE, the DOE contractors, and the carriers chosen to transport hazardous materials. As in any partnership, it is critical that DOE know essential information about its partner in this joint venture. In fulfillment of its responsibility for the safe transportation of radioactive materials as well as other hazardous commodities and wastes routinely shipped from many DOE locations nationwide, the DOE-TMD has developed this policy for a motor carrier evaluation program. It is the intent of the DOE-TMD that this Motor Carrier Evaluation Program be implemented at all DOE locations to the fullest extent practicable. This program will assist in the evaluation of carriers transporting Highway Route Controlled Quantities (HRCQ) of radioactive material, because these shipments frequently are in the "public eye." The program will also evaluate truckload (TL) quantity transporters of hazardous materials, including radioactive material and chemical wastes. The program has also recently been expanded to include motor carriers transporting less-than-truckload (LTL) quantities of these materials.

1016 (WHC-EP-0339) High-resolution inductively coupled plasma-atomic emission spectrophotometric analysis of PUREX [Plutonium-Uranium Extraction] head-end solutions. Douglas, J.G. Westinghouse Hanford Co., Richland, WA (United States). May 1990. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE90014764. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

High-resolution inductively coupled plasma-atomic emission spectrophotometry has value as a method for the rapid determination of total plutonium and $^{240}/^{239}$ Pu ratios. High-resolution inductively coupled plasma-atomic emission spectrophotometry has been compared to isotope-dilution mass spectrometry, the standard accountability method for determining total plutonium and plutonium isotopic distributions, using a sample of dissolved N-Reactor fuel from the Plutonium-Uranium Extraction Plant head-end E6 tank. Of the two methods, isotope-dilution mass spectrometry has better analytical accuracy, precision, and detection limits, while high-resolution inductively coupled plasma-atomic emission spectrophotometry has shorter sample preparation

and analytical turnaround times (4 to 8 hours). Therefore, high-resolution inductively coupled plasma-atomic emission spectrophotometry will be more valuable as a rapid screening method to generate process control and preliminary accountability data than as a competitive replacement for isotope-dilution mass spectrometry. This should be especially true in relatively uranium-free process streams such as those in the plutonium finishing and recovery processes. 4 refs., 4 figs., 10 tabs.

1017 (WHC-EP-0346) Automated calculation of alpha energy spectra. Troyer, G.L. Westinghouse Hanford Co., Richland, WA (United States). Jun 1990. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE90014064. Source: NTIS, PC A03/MF A01; OSTI; Order software packages from National Energy Software Center, Argonne National Laboratory, 9800 South Cass Avenue, Argonne, IL 60439. Order documentation without complete package from NTIS.; GPO Dep.

The external and operating specifications for a general alpha energy analysis data reduction program are presented in this document. A brief description of the methodology is given to identify the main features and reasons for use. Specifications for the supporting data files are also presented. Brief operating step procedures are presented as appendices.

1018 (WHC-EP-0363) Solid Waste Management Program Plan. Duncan, D.R. Westinghouse Hanford Co., Richland, WA (United States). Aug 1990. 66p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91000295. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The objective of the Solid Waste Management Program Plan (SWMPP) is to provide a summary level comprehensive approach for the storage, treatment, and disposal of current and future solid waste received at the Hanford Site (from onsite and offsite generators) in a manner compliant with current and evolving regulations and orders (federal, state, and Westinghouse Hanford Company [Westinghouse Hanford]). The Plan also presents activities required for disposal of selected wastes currently in retrievable storage. The SWMPP provides a central focus for the description and control of cost, scope, and schedule of Hanford Site solid waste activities, and provides a vehicle for ready communication of the scope of those activities to onsite and offsite organizations. This Plan represents the most complete description available of Hanford Site Solid Waste Management (SWM) activities and the interfaces between those activities. It will be updated annually to reflect changes in plans due to evolving regulatory requirements and/or the SWM mission. 8 refs., 9 figs., 4 tabs.

1019 (WHC-EP-0363-Rev.1) Solid Waste Program Plan: Revision 1. Duncan, D.R. Westinghouse Hanford Co., Richland, WA (United States). Aug 1991. 97p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92000528. Source: OSTI; NTIS; INIS; GPO Dep.

The objective of the Solid Waste Program Plan (SWPP) is to provide a summary level comprehensive approach for the storage, treatment, and disposal of current and future solid waste received at the Hanford Site (from onsite and offsite generators) in a manner compliant with current and evolving applicable regulations and orders [federal, state, local, and Westinghouse Hanford Company (Westinghouse Hanford)].

A previous version of the SWPP (entitled Solid Waste Management Program Plan) was drafted in 1990 and released as WHC-EP-0363 (WHC 1990c). The SWPP also presents activities required for disposal of selected wastes currently in retrievable storage. The SWPP provides a central focus for the description and control of cost, scope, and schedule of Hanford Site solid waste activities and provides a vehicle for ready communication of the scope of these activities to onsite and offsite organizations. This SWPP represents the most complete description available of Hanford Site solid waste activities and the interfaces between those activities. It will be updated annually to reflect changes in plans due to evolving regulatory requirements and/or the solid waste mission. 26 refs., 11 figs., 1 tabs.

1020 (WHC-EP-0375) Engineering study for the treatment of spent ion exchange resin resulting from nuclear process applications. Place, B.G. Westinghouse Hanford Co., Richland, WA (United States). Sep 1990. 98p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91004550. Source: OSTI; NTIS; INIS; GPO Dep.

This document is an engineering study of spent ion exchange resin treatment processes with the purpose of identifying one or more suitable treatment technologies. Classifications of waste considered include all classes of low-level waste (LLW), mixed LLW, transuranic (TRU) waste, and mixed TRU waste. A total of 29 process alternatives have been evaluated. Evaluation parameters have included economic parameters (both total life-cycle costs and capital costs), demonstrated operability, environmental permitting, operational availability, waste volume reduction, programmatic consistency, and multiple utilization. The results of this study suggest that there are a number of alternative process configurations that are suitable for the treatment of spent ion exchange resin. The determinative evaluation parameters were economic variables (total life-cycle cost or capital cost) and waste volume reduction. Immobilization processes are generally poor in volume reduction. Thermal volume reduction processes tend to have high capital costs. There are immobilization processes and thermal volume reduction processes that can treat all classifications of spent ion exchange resin likely to be encountered. 40 refs., 19 figs., 17 tabs.

1021 (WHC-EP-0376) Hanford Waste Vitrification Plant preliminary waste form and canister description: Fiscal year 1990 update. Colburn, R.P. Westinghouse Hanford Co., Richland, WA (United States). Oct 1990. 43p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91004581. Source: OSTI; NTIS; INIS; GPO Dep.

This document describes the canisters of borosilicate glass waste to be produced at the Hanford Waste Vitrification Plant. Each area of the anticipated waste acceptance requirements is addressed and contains estimates of the nominal chemical compositions and radionuclide inventories in the waste canister expected for the four waste feed types in the current Hanford Waste Vitrification Plant mission. The resulting heat generation rates and surface dose rates expected for these waste canisters also are indicated. The bases for meeting the various anticipated waste acceptance requirements are described briefly. 19 refs., 8 figs., 10 tabs.

1022 (WHC-EP-0382) Transportation Institutional considerations of NEPA [National Environmental Policy Act] implementation. McGinnis, K. (Westinghouse Hanford

Co., Richland, WA (USA)); Cluett, C.; Grant, T. Westinghouse Hanford Co., Richland, WA (United States). Sep 1990. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91001190. Source: NTIS; PC A03/MF A01; OSTI; INIS; GPO Dep.

The US Department of Energy's Transportation Management Division (TMD) is considering the need for additional environmental analysis of radioactive material transportation to meet the National Environmental Policy Act (NEPA) requirements and support needed for preparation of NEPA documentation. This overview was prepared to provide background material on institutional requirements and support needed preparation of NEPA documentation. The Transportation Institutional Program can and should be responsive to the public interest and regulatory requirements through the NEPA process. Public involvement, particularly through the NEPA scoping process, is a key means of identifying transportation issues that must be addressed. The TMD Institutional Program is responsible for establishing and maintaining relationships with the public to resolve these issues. The NEPA process calls for various forms of public involvement at different points. Continuing safe technical performance and the ability to demonstrate fast, open, and competent response to problems will be vitally important to program credibility. Public confidence is also created by drawing them into the program and offering them a sense of meaningful participation in the decisions about transportation that most closely impact their lives. 4 refs.

1023 (WHC-EP-0390) Hanford site asbestos abatement plan. Wells, G.T.; Hughes, M.C. Westinghouse Hanford Co., Richland, WA (United States). Dec 1990. 93p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91007914. Source: OSTI; NTIS; GPO Dep.

The Hanford Site Asbestos Abatement Plan presents budget planning cost estimates and recommends priorities for asbestos abatement activities to be conducted on Hanford Site Facilities. The Plan uses asbestos assessment information gathered in fiscal year 1989 to evaluate all Hanford Site facilities. Of those facilities evaluated, 414 were found to contain asbestos-containing materials and were classified according to the potential risk of asbestos exposure to building personnel. Sixty-four facilities are determined to be Class A, indicating a high potential for exposure. The Class A facilities are recommended to be the highest priority for asbestos abatement activities with an estimated \$19.3 million required to abate the Class A facilities. 8 refs., 3 figs., 2 tabs.

1024 (WHC-EP-0390-Rev.1) Hanford Site Asbestos Abatement Plan: Revision 1. Mewes, B.S. Westinghouse Hanford Co., Richland, WA (United States). Sep 1993. 89p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94002356. Source: OSTI; NTIS; INIS; GPO Dep.

The Hanford Site Asbestos Abatement Plan (Plan) lists priorities for asbestos abatement activities to be conducted in Hanford Site facilities. The Plan is based on asbestos assessment information gathered in fiscal year 1989 that evaluated all Hanford Site facilities for the presence and condition of asbestos. Of those facilities evaluated, 414 contain asbestos-containing materials and are classified according to the potential risk of asbestos exposure to building personnel. The Plan requires that asbestos condition update reports be prepared for all affected facilities. The reporting is completed by the asbestos coordinator for each of the 414

affected facilities and transmitted to the Plan manager annually. The Plan manager uses this information to reprioritize future project lists. Currently, five facilities are determined to be Class A1, indicating a high potential for asbestos exposure. Class A1 and B1 facilities are the highest priority for asbestos abatement. Abatement of the Class A1 and B1 facilities is scheduled through fiscal year 1997. Removal of asbestos in B1 facilities will reduce the risk for further Class "A" conditions to arise.

1025 (WHC-EP-0391) Hanford Waste Vitrification Systems Risk Assessment action plan. Miller, W.C. Westinghouse Hanford Co., Richland, WA (United States). Nov 1990. 42p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91004586. Source: OSTI; NTIS; GPO Dep.

Recent events in the Hanford waste storage tanks and delays in the startup of US Department of Energy vitrification plans suggest that the schedule for waste vitrification activities at the Hanford Site should be reexamined. As a result, a Hanford Waste Vitrification Systems Risk Assessment will be performed to identify significant risks associated with the vitrification of Hanford high-level and transuranic wastes. This document defines the purpose, scope, plan of execution, responsibilities, reporting requirements, and preliminary schedule and cost estimate to complete this assessment. The study will identify and evaluate uncertainties, quantify potential consequences from these uncertainties, and identify the risks to successful completion of the Hanford vitrification mission. Waste characterization, retrieval, pre-treatment, and vitrification will be addressed. Uncertainties associated with the vitrification of double-shell and single-shell tank wastes and cesium and strontium capsules, as well as a limited assessment of the grouting of low-level wastes, will be defined. Technical, regulatory (safety and environmental), and programmatic (cost and schedule) uncertainties will be defined. Recommendations for mitigating strategies and assessments of technical alternatives will be made to reduce substantial risks. 2 refs., 1 fig., 1 tab.

1026 (WHC-EP-0401) Solid, low-level radioactive waste certification program. Grams, W.H. Westinghouse Hanford Co., Richland, WA (United States). Nov 1991. 44p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92003628. Source: OSTI; NTIS; INIS; GPO Dep.

The Hanford Site solid waste treatment, storage, and disposal facilities accept solid, low-level radioactive waste from onsite and offsite generators. This manual defines the certification program that is used to provide assurance that the waste meets the Hanford Site waste acceptance criteria. Specifically, this program defines the participation and responsibilities of Westinghouse Hanford Company Solid Waste Engineering Support, Westinghouse Hanford Company Quality Assurance, and both onsite and offsite waste generators. It is intended that waste generators use this document to develop certification plans and quality assurance program plans. This document is also intended for use by Westinghouse Hanford Company solid waste technical staff involved in providing assurance that generators have implemented a waste certification program. This assurance involves review and approval of generator certification plans, and review of generator's quality assurance program plans to ensure that they address all applicable requirements. The document also details the Westinghouse Hanford Company Waste Management Audit and Surveillance Program. 5 refs.

1027 (WHC-EP-0417) Hanford Waste Vitrification Plant Applied Technology Plan. Kruger, O.L. Westinghouse Hanford Co., Richland, WA (United States). Jan 1992. 134p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92008208. Source: OSTI; NTIS; GPO Dep.

This Applied Technology Plan describes the process development, equipment adaptation, and waste form qualification technical issues and plans for resolution to support the design, permitting, and operation of the Hanford Waste Vitrification Plant. The scope of this Plan includes work to be performed by the Research and Development Contractor (Pacific Northwest Laboratory), organizations within Westinghouse Hanford Company not directly associated with the Hanford Waste Vitrification Plant Project, universities and companies with glass technology expertise, and other US Department of Energy sites. Work to be performed under this Plan is divided into major areas that develop an acceptable glass composition envelope, provide specific data for verification of Hanford Waste Vitrification Plant detailed design, and demonstrate feed processing and glass production for the range of Hanford Waste Vitrification Plant feeds. Included in this work is the evaluation and verification testing of equipment and technology obtained from the Defense Waste Processing Facility, the West Valley Demonstration Project, foreign countries, and the Hanford Site. Applied technology work has been planned in detail to support the scheduled design, permitting, and startup activities for the Hanford Waste Vitrification Plant Project. Summary level milestone schedules are provided for information and reference. The total estimated required budget (in escalated dollars) for applied technology work from fiscal year 1992 through the first quarter of fiscal year 2000 is \$114,150,000 expense plus \$10,190,000 capital equipment not related to construction.

1028 (WHC-EP-0420) Hanford Site Grout Disposal Program Interim management plan. Wood, R.F. Westinghouse Hanford Co., Richland, WA (United States). Jan 1992. 90p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92014212. Source: OSTI; NTIS; INIS; GPO Dep.

This plan was developed to implement the Hanford Defense Waste-Environmental Impact Statement Record of Decision. The plan is also a management tool for use in defining Hanford Site Grout Disposal Program activities required to ensure the safe, environmentally sound, and cost-effective disposal of the low-level fraction of radioactive double-shell tank mixed wastes at the Hanford Site. This plan includes a discussion of the program mission, vision, and objectives; a brief description of the process; descriptions of major and supporting facilities involved in the process; as well as management, organization, responsibilities, operational requirements, assumptions, and cost and schedule controls.

1029 (WHC-EP-0421) Hanford waste vitrification systems risk assessment: Final report. Miller, W.C.; Hamilton, D.W.; Holton, L.K.; Bailey, J.W. Westinghouse Hanford Co., Richland, WA (United States). Sep 1991. 341p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92002976. Source: OSTI; NTIS; INIS; GPO Dep.

A systematic Risk Assessment was performed to identify the technical, regulatory, and programmatic uncertainties and to quantify the risks to the Hanford Site double-shell

tank waste vitrification program baseline (as defined in December 1990). Mitigating strategies to reduce the overall program risk were proposed. All major program elements were evaluated, including double-shell tank waste characterization, Tank Farms, retrieval, pretreatment, vitrification, and grouting. Computer-based techniques were used to quantify risks to proceeding with construction of the Hanford Waste Vitrification Plant on the present baseline schedule. Risks to the potential vitrification of single-shell tank wastes and cesium and strontium capsules were also assessed. 62 refs., 38 figs., 26 tabs.

1030 (WHC-EP-0427-Pt.1) Hanford Waste Vitrification Systems Risk Assessment: Final report supporting information: Part 1. Westinghouse Hanford Co., Richland, WA (United States). Sep 1991. 485p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92003283. Source: OSTI; NTIS; INIS; GPO Dep.

This document contains the background information developed in the assessment of the uncertainties associated with the successful completion of the Hanford Site waste vitrification program. This supporting information was assembled and issued as a separate document to facilitate distribution of the large volume of detailed data and supporting materials to the smaller group needing access to this information. Section 2.0 includes a reference documentation list used during by Risk Assessment authors, and a copy of the documentation associated with the retirement and disposition schedule for the Risk Assessment files. This report, Appendix A includes the single-shell tank waste supporting information, a risk assessment report prepared by the Science Applications International Corporation (SAIC), the Venture Evaluation and Review Technique (VERT) model database used to generate the risk analysis results, and a VERT user's manual, also prepared by the SAIC. Also included in Appendix A are selected VERT program run output documentation, which are provided as examples of the VERT model outputs.

1031 (WHC-EP-0427-Pt.2) Hanford Waste Vitrification Systems Risk Assessment: Final report supporting information: Part 2. Westinghouse Hanford Co., Richland, WA (United States). Sep 1991. 482p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92003284. Source: OSTI; NTIS; INIS; GPO Dep.

This report contains Double-shell Tank Waste Risk Analysis Forms. The worksheets prepared in developing assessments on individual activities are presented in this appendix. The assessment of each schedule activity required completion of a minimum of three forms, a Risk Analysis Results Form, an Input to Science Applications International Corporation (SAIC) Form, and an Uncertainty Report Form. A Risk Analysis Results Form was used to identify the assessments made with respect to a given activity. An Input to SAIC Form was used to identify the optimistic, most likely, and pessimistic costs and durations for the activity, as well as the probability of completing the activity within the most likely duration. The rationale used in developing the input is also provided in this appendix. The activity assessment worksheets are grouped by the seven major program activities, i.e., characterization, retrieval, pretreatment technology, pretreatment facilities, Hanford Waste Vitrification Plant, grout, and Tank Farms.

1032 (WHC-EP-0437) Polyethylene liners in radioactive mixed waste packages: An engineering study. Whitney, G.A. Westinghouse Hanford Co., Richland, WA (United States). May 1991. 73p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91016393. Source: OSTI; NTIS; INIS; GPO Dep.

Westinghouse Hanford Company manages and operates the Hanford Site 200 Area radioactive solid waste treatment, storage, and disposal facilities for the US Department of Energy-Richland Operations Office under contract AC06-87RL10930. These facilities include solid waste disposal sites and radioactive solid waste storage areas. This document is 1 in a series of 25 reports or actions identified in a Solid Waste Management Event Fact Sheet and critique report (Appendix E) to address the problem of stored, leaking 183-H Solar Evaporation Basin waste drums. It specifically addresses the adequacy of polyethylene liners used as internal packaging of radioactive mixed waste. This document is to be used by solid waste generators preparing solid waste for storage at Hanford Site facilities. This document is also intended for use by Westinghouse Hanford Company solid waste technical staff involved with approval and acceptance of radioactive solid waste.

1033 (WHC-EP-0462) Treatment technology for transuranic waste streams: Cementation, vitrification, and incineration testing for the treatment of spent ion exchange media. Place, B.G. Westinghouse Hanford Co., Richland, WA (United States). Apr 1992. 81p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93006250. Source: OSTI; NTIS; INIS; GPO Dep.

This document reports the results of testing of spent ion exchange media pretreatment technologies. Emphasis of the testing activities has been on screening pretreatment technologies, such as drying and emulsification, which are compatible with vitrification, cementation, and incineration. Ion exchange media tested for cementation and incineration pretreatment technologies were typical organic ion exchange resins and inorganic zeolites. The ion exchange medium tested for vitrification pretreatment technologies was inorganic zeolite. The results of testing activities are discussed in detail in this report.

1034 (WHC-EP-0463) Facility Effluent Monitoring Plan determination for the Liquid Effluent Retention Facility. Crummel, G.M. Westinghouse Hanford Co., Richland, WA (United States). Oct 1991. 36p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92002258. Source: OSTI; NTIS; GPO Dep.

The purpose of this document is to determine whether the Liquid Effluent Retention Facility meets the criteria for requiring a Facility Effluent Monitoring Plan. This document contains a brief facility description, the source term (i.e., inventory) of radioactive and nonradioactive materials at the facility, and a determination of the annual effective dose equivalent that would be received by members of the public (offsite) as calculated from conversion factors generated from the US Environmental Protection Agency-approved CAP-88 computer program. This document was developed under the guidance given in WHC-EP-0438, A Guide For Preparing Hanford Site Facility Effluent Monitoring Plans. The source terms used in this document were developed from various referenced sources. Because of insufficient characterization of the 200 Area Tank Farm waste, the

source terms developed within this document may not be identical to the source terms used throughout other documents. As this document was being developed, an effort was underway to standardize the source terms within the Tank Farms. The conversion factors used in this evaluation to convert projected radionuclide releases to offsite doses were developed by Pacific Northwest Laboratory (Rhoades 1990). Airborne releases were assumed to occur from ground level at a central location in the 200 East Area. The distance from the 200 East release point to individuals at the offsite location (i.e., at the Ringold) is assumed to be 16,000 m. 21 refs., 9 tabs.

1035 (WHC-EP-0464) Calibration of the RLS HPGe spectral gamma ray logging system. Koizumi, C.J.; Brodeur, J.R.; Ulbricht, W.H.; Price, R.K. Westinghouse Hanford Co., Richland, WA (United States). Nov 1991. 39p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92006494. Source: OSTI; NTIS; INIS; GPO Dep.

Gamma-ray spectral data have been recorded with the Radionuclide Logging System (RLS) high purity germanium (HPGe) system at (1) the American Petroleum Institute (API) spectral gamma-ray calibration center in Houston, Texas; (2) the US Department of Energy (DOE) spectral gamma-ray field calibration facility in Spokane, Washington; and (3) the DOE spectral gamma-ray primary calibration center in Grand Junction, Colorado. Analyses of the Grand Junction data yielded: calibration constants for the natural gamma-ray sources (potassium, uranium and thorium), energy-dependent borehole diameter corrections for the aid-filled borehole, energy-dependent borehole casing corrections for steel casing over a range of thicknesses from 0 to 79 cm (5/16 in.), a casing index function that varies with casing thickness and provides a method for verifying that the correct casing correction is applied, and an energy-dependent inverse function that is the basis for assessment of subsurface concentrations of man-made gamma-ray emitters such as cesium-137 and cobalt-60.

1036 (WHC-EP-0466) Facility Effluent Monitoring Plan for the 242-A Evaporator. Crummel, G.M.; Gustavson, R.D. Westinghouse Hanford Co., Richland, WA (United States). Nov 1991. 230p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92008574. Source: OSTI; NTIS; INIS; GPO Dep.

A facility effluent monitoring plan is required by the US Department of Energy in DOE Order 5400.1 for any operations that involve hazardous materials and radioactive substances that could impact employee or public safety or the environment. This document is prepared using the specific guidelines identified in A Guide for Preparing Hanford Site Facility Effluent Monitoring Plans, WHC-EP-0438. This facility effluent monitoring plan assesses effluent monitoring systems and evaluates whether they are adequate to ensure the public health and safety as specified in applicable federal, state, and local requirements. This report describes the monitoring plan for the 242-A evaporator. The 242-A Evaporator is the primary waste concentrator for Hanford Site waste that is stored in underground double-shell tanks (DST). Low heat-generating liquid waste (<0.1 Btu/h/gal) that contains relatively small amounts of fission products is stored in the underground tanks. The 242-A Evaporator uses evaporative concentration followed by crystallization and precipitation of salts to reduce the volume of waste, thus reducing the number of tanks required for storage. The

facility receives a mixed waste stream containing radionuclides in excess of release limits as well as organic and inorganic constituents.

1037 (WHC-EP-0466-1-Rev.1) Facility effluent monitoring plan for 242-A Evaporator facility: Revision 1. Crummel, G.M.; Gustavson, R.D. Westinghouse Hanford Co., Richland, WA (United States). Mar 1993. 275p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93014623. Source: OSTI; NTIS; INIS; GPO Dep.

A facility effluent monitoring plan is required by the US Department of Energy in DOE Order 5400.1* for any operations that involve hazardous materials and radioactive substances that could affect employee or public safety or the environment. A facility effluent monitoring plan determination was performed during Calendar Year 1991 and the evaluation showed the need for a facility effluent monitoring plan. This document is prepared using the specific guidelines identified in A Guide for Preparing Hanford Site Facility Effluent Monitoring Plans, WHC-EP-0438-1**. This facility effluent monitoring plan assesses effluent monitoring systems and evaluates whether they are adequate to ensure the public health and safety as specified in applicable federal, state, and local requirements.

1038 (WHC-EP-0467) Facility effluent monitoring plan for the B Plant. Peterson, K.A. (Westinghouse Hanford Co., Richland, WA (United States)); Daubert, R.L. Westinghouse Hanford Co., Richland, WA (United States). Nov 1991. 210p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92008550. Source: OSTI; NTIS; INIS; GPO Dep.

A facility effluent monitoring plan is required by the US Department of Energy in DOE Order 5400.1 for any operations that involve hazardous materials and radioactive substances that could impact employee or public safety or the environment. This document is prepared using the specific guidelines identified in A Guide for Preparing Hanford Site Facility Effluent Monitoring Plans, WHC-EP-0438. This facility effluent monitoring plan assesses effluent monitoring systems and evaluates whether they are adequate to ensure the public health and safety as specified in applicable federal, state, and local requirements. This report describes the monitoring of the B Plant. B Plant was originally designed to chemically process spent nuclear fuels. Radiological containment and confinement features were incorporated in the various facilities and support systems to prevent exposure of plant personnel and the general public to excessive radiation. After this initial mission was completed, the plant was modified to provide for the separation of strontium and cesium, in the Plutonium Uranium Extraction (PUREX) Plant. The recovered, purified, and concentrated solutions were then transferred to Waste Encapsulation and Storage Facility (WESF) for conversion to solid compounds, encapsulation, and interim storage. After strontium and cesium removal, the remaining waste was transferred from B Plant to the Tank Farms. B Plant is an operating facility that is required to ensure safe storage and management of the WESF cesium and strontium capsules, as well as a substantial radiological inventory remaining in the plant from previous campaigns.

1039 (WHC-EP-0468) Facility effluent monitoring plan for the plutonium-uranium extraction facility. Thompson, R.J. (Westinghouse Hanford Co., Richland, WA (United States)); Sontage, S. Westinghouse Hanford Co., Richland, WA (United States). Nov 1991. 122p. Sponsored

by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92008552. Source: OSTI; NTIS; INIS; GPO Dep.

A facility effluent monitoring plan is required by the US Department of Energy in DOE Order 5400.1 for any operations that involve hazardous materials and radioactive substances that could impact employee or public safety or the environment. This document is prepared using the specific guidelines identified in A Guide for Preparing Hanford Site Facility Effluent Monitoring Plans, WHC-EP-0438. This facility effluent monitoring plan assesses effluent monitoring systems and evaluates whether they are adequate to ensure the public health and safety as specified in applicable federal, state, and local requirements. This facility effluent monitoring plan is the first annual report. It shall ensure long-range integrity of the effluent monitoring systems by requiring an update whenever a new process or operation introduces new hazardous materials or significant radioactive materials. This document must be reviewed annually even if there are no operational changes, and it must be updated as a minimum every three years.

1040 (WHC-EP-0468-1) Facility effluent monitoring plan for the plutonium-uranium extraction facility. Nickels, J.M.; Geiger, J.L. Westinghouse Hanford Co., Richland, WA (United States). Nov 1992. 221p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93005890. Source: OSTI; NTIS; INIS; GPO Dep.

A facility effluent monitoring plan is required by the US Department of Energy in DOE Order 5400.1 for any operations that involve hazardous materials and radioactive substances that could impact employee or public safety or the environment. A facility effluent monitoring plan determination was performed during Calendar Year 1991 and the evaluation requires the need for a facility effluent monitoring plan. This document is prepared using the specific guidelines identified in A Guide for Preparing Hanford Site Facility Effluent Monitoring Plans, WHC-EP-0438. This facility effluent monitoring plan assesses effluent monitoring systems and evaluates whether they are adequate to ensure the public health and safety as specified in applicable federal, state, and local requirements.

1041 (WHC-EP-0468-2) Facility effluent monitoring plan for the plutonium-uranium extraction facility. Lohrasbi, J. (Westinghouse Hanford Co., Richland, WA (United States)); Johnson, D.L.; De Lorenzo, D.S. Westinghouse Hanford Co., Richland, WA (United States). Dec 1993. 249p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94004845. Source: OSTI; NTIS; INIS; GPO Dep.

A facility effluent monitoring plan is required by the US Department of Energy in DOE Order 5400.1 for any operations that involve hazardous materials and radioactive substances that could impact employee or public safety or the environment. This document is prepared using the specific guidelines identified in A Guide for Preparing Hanford Site Facility Effluent Monitoring Plans, WHC-EP-0438-01. This facility effluent monitoring plan assesses effluent monitoring systems and evaluates whether they are adequate to ensure the public health and safety as specified in applicable federal, state, and local requirements. This facility effluent monitoring plan shall ensure long-range integrity of the effluent monitoring systems by requiring an update whenever a new process or operation introduces new hazardous materials or significant radioactive materials. This

document must be reviewed annually even if there are no operational changes, and it must be updated at a minimum of every three years.

1042 (WHC-EP-0469) Facility Effluent Monitoring Plan for the 340 Waste Handling Facility. Nickels, J.M. (Westinghouse Hanford Co., Richland, WA (United States)); Bolls, R.E.; McLaughlin, T.J. Westinghouse Hanford Co., Richland, WA (United States). Oct 1991. 120p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92008575. Source: OSTI; NTIS; INIS; GPO Dep.

A facility effluent monitoring plan is required by the US Department of Energy in DOE Order 5400.1 for any operations that involve hazardous materials and radioactive substances that could impact employee or public safety or the environment. This document is prepared using the specific guidelines identified in A Guide for Preparing Hanford Site Facility Effluent Monitoring Plans, WHC-EP-0438. This facility effluent monitoring plan assesses effluent monitoring systems and evaluates whether they are adequate to ensure the public health and safety as specified in applicable federal, state, and local requirements. This facility effluent monitoring plan is the first annual report. It shall ensure long-range integrity of the effluent monitoring systems by requiring an update whenever a new process or operation introduces new hazardous materials or significant radioactive materials. This document must be reviewed annually even if there are no operational changes, and it must be updated as a minimum every three years.

1043 (WHC-EP-0469-1) Facility effluent monitoring plan for the 340 waste handling facility. Nickels, J.M.; Berneski, L.H. Westinghouse Hanford Co., Richland, WA (United States). Nov 1992. 226p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93005877. Source: OSTI; NTIS; INIS; GPO Dep.

A facility effluent monitoring plan is required by the US Department of Energy in DOE Order 5400.1 for any operations that involve hazardous materials and radioactive substances that could impact employee or public safety or the environment. A facility effluent monitoring plan determination was performed during Calendar Year 1991 and the evaluation requires the need for a facility effluent monitoring plan. This document is prepared using the specific guidelines identified in A Guide for Preparing Hanford Site Facility Effluent Monitoring Plans, WHC-EP-0438. This facility effluent monitoring plan assesses effluent monitoring systems and evaluates whether they are adequate to ensure the public health and safety as specified in applicable federal, state, and local requirements.

1044 (WHC-EP-0470) Facility effluent monitoring plan for the uranium trioxide facility. Thompson, R.J. (Westinghouse Hanford Co., Richland, WA (United States)); Sontag, S. Westinghouse Hanford Co., Richland, WA (United States). Nov 1991. 98p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92008594. Source: OSTI; NTIS; INIS; GPO Dep.

A facility effluent monitoring plant is required by the US Department of Energy in DOE Order 5400.1 for any operations that involve hazardous materials and radioactive substances that could impact employee or public safety or the environment. This document is prepared using the specific guidelines identified in A Guide for Preparing Hanford

Site Facility Effluent Monitoring Plans, WHC-EP-0438. This facility effluent monitoring plan assesses effluent monitoring systems and evaluates whether they are adequate to ensure the public health and safety as specified in applicable federal, state, and local requirements. This facility effluent monitoring plan is the first annual report. It shall ensure long-range integrity of the effluent monitoring systems by requiring an update whenever a new process or operation introduces new hazardous materials or significant radioactive materials. This document must be reviewed annually even if there are no operational changes, and it must be updated as a minimum every three years. The UO₃ Plant is located in the south-central portion of the 200 West Area of the Hanford Site. The plant consists of two primary processing buildings and several ancillary facilities. The purpose of the UO₃ Plant is to receive uranyl nitrate hexahydrate (UNH) from the Plutonium-Uranium Extraction (PUREX) Plant, concentrate it, convert the UNH to uranium trioxide (UO₃) powder by calcination and package it for offsite shipment. The UO₃ Plant has been placed in a standby mode. There are two liquid discharges, and three gaseous exhaust stacks, and seven building exhausters that are active during standby conditions.

1045 (WHC-EP-0470-1) Facility Effluent Monitoring Plan for the uranium trioxide facility. Lohrasbi, J. (Westinghouse Hanford Co., Richland, WA (United States)); Johnson, D.L.; De Lorenzo, D.S. Westinghouse Hanford Co., Richland, WA (United States). Dec 1993. 131p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94005987. Source: OSTI; NTIS; INIS; GPO Dep.

A facility effluent monitoring plan is required by the US Department of Energy in DOE Order 5400.1 for any operations that involve hazardous materials and radioactive substances that could impact employee or public safety or the environment. This document is prepared using the specific guidelines identified in A Guide for Preparing Hanford Site Facility Effluent Monitoring Plans, WHC-EP-0438-01. This facility effluent monitoring plan assesses effluent monitoring systems and evaluates whether they are adequate to ensure the public health and safety as specified in applicable federal, state, and local requirements. This facility effluent monitoring plan shall ensure long-range integrity of the effluent monitoring systems by requiring an update whenever a new process or operation introduces new hazardous materials or significant radioactive materials. This document must be reviewed annually even if there are no operational changes, and it must be updated at a minimum of every three years.

1046 (WHC-EP-0471) Facility Effluent Monitoring Plan for the 2724-W Protective Equipment Decontamination Facility. Carter, G.J. Westinghouse Hanford Co., Richland, WA (United States). Nov 1991. 51p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92008595. Source: OSTI; NTIS; INIS; GPO Dep.

A facility effluent monitoring plan is required by the US Department of Energy in DOE Order 5400.1* for any operations that involve hazardous materials and radioactive substances that could impact employee or public safety or the environment. This document is prepared using the specific guidelines identified in A Guide for Preparing Hanford Site Facility Effluent Monitoring Plans, WHC-EP-0438. This facility effluent monitoring plan assesses effluent monitoring

systems and evaluates whether they are adequate to ensure the public health and safety as specified in applicable federal, state, and local requirements. This facility effluent monitoring plan is the first annual report. It shall ensure long-range integrity of the effluent monitoring systems by requiring an update whenever a new process or operation introduces new hazardous materials or significant radioactive materials. This document must be reviewed annually even if there are no operational changes, and it must be updated as a minimum every three years.

1047 (WHC-EP-0471-1) Facility effluent monitoring plan for the 2724-W Protective Equipment Decontamination Facility. Nickels, J.M.; Lavey, G.H. Westinghouse Hanford Co., Richland, WA (United States). Dec 1992. 68p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93011298. Source: OSTI; NTIS; INIS; GPO Dep.

A facility effluent monitoring plan is required by the US Department of Energy in DOE Order 5400.1* for any operations that involve hazardous materials and radioactive substances that could impact employee or public safety or the environment. A facility effluent monitoring plan determination was performed during Calendar Year 1991 and the evaluation requires the need for a facility effluent monitoring plan. This document is prepared using the specific guidelines identified in A Guide for Preparing Hanford Site Facility Effluent Monitoring Plans, WHC-EP-0438**. This facility effluent monitoring plan assesses effluent monitoring systems and evaluates whether they are adequate to ensure the public health and safety as specified in applicable federal, state, and local requirements.

1048 (WHC-EP-0472) Facility Effluent Monitoring Plan for the 284-E and 284-W power plants. Herman, D.R. Westinghouse Hanford Co., Richland, WA (United States). Nov 1991. 83p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92008547. Source: OSTI; NTIS; INIS; GPO Dep.

A facility effluent monitoring plan is required by the US Department of Energy in DOE Order 5400.1 for any operations that involve hazardous materials and radioactive substances that could impact employee or public safety or the environment. This document is prepared using the specific guidelines identified in A Guide for Preparing Hanford Site Facility Effluent Monitoring Plans, WHC-EP-0438. This facility effluent monitoring plan assesses effluent monitoring systems and evaluates whether they are adequate to ensure the public health and safety as specified in applicable federal, state, and local requirements. This facility effluent monitoring plan is the first annual report. It shall ensure long-range integrity of the effluent monitoring systems by requiring an update whenever a new process or operation introduces new hazardous materials or significant radioactive materials. This document must be reviewed annually even if there are no operational changes, and it must be updated as a minimum every three years. The 284-E and 284-W Power Plants are coal-fired plants used to generate steam. Electricity is not generated at these facilities. The maximum production of steam is approximately 159 t (175 tons)/h at 101 kg (225 lb)/in². Steam generated at these facilities is used in other process facilities (i. e., the B Plant, Plutonium-Uranium Extraction Plant, 242-A Evaporator) for heating and process operations. The functions or processes associated with these facilities do not have the potential to generate radioactive airborne effluents or radioactive liquid effluents, therefore, radiation monitoring equipment is not used on the

discharge of these streams. The functions or processes associated with the production of steam result in the use, storage, management and disposal of hazardous materials.

1049 (WHC-EP-0472-1) Facility effluent monitoring plan for the 284-E and 284-W power plants. Nickels, J.M.; Herman, D.R. Westinghouse Hanford Co., Richland, WA (United States). Nov 1992. 99p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93005878. Source: OSTI; NTIS; INIS; GPO Dep.

A facility effluent monitoring plan is required by the US Department of Energy in DOE Order 5400.1 for any operations that involve hazardous materials and radioactive substances that could impact employee or public safety or the environment. A facility effluent monitoring plan determination was performed during calendar year 1991 and the evaluation requires the need for a facility effluent monitoring plan. This facility effluent monitoring plan assesses effluent monitoring systems and evaluates whether they are adequate to ensure the public health and safety as specified in applicable federal, state, and local requirements.

1050 (WHC-EP-0474-3) Quarterly report on Defense Nuclear Facilities Safety Board Recommendation 90-7 for the period ending December 31, 1991. Cash, R.J.; Dukelow, G.T.; Atwood, J.M. Westinghouse Hanford Co., Richland, WA (United States). Jan 1992. 92p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92012197. Source: OSTI; NTIS; INIS; GPO Dep.

This quarterly report provides a status of the activities underway at the Hanford Site on the ferrocyanide safety issues as requested by the Defense Nuclear Facilities Safety Board (DNFSB) in their Recommendation 90-7 (FR 1990). In March 1991, an DNFSB Implementation Plan (Cash 1991a) was prepared and sent to the DNFSB responding to the six parts of Recommendation 90-7. All of the activities in the DNFSB Implementation Plan are underway and the status of each is described.

1051 (WHC-EP-0474-4) Quarterly report on Defense Nuclear Facilities Safety Board Recommendation 90-7 for the period ending March 31, 1992. Cash, R.J.; Dukelow, G.T. Westinghouse Hanford Co., Richland, WA (United States). May 1992. 101p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92019699. Source: OSTI; NTIS; INIS; GPO Dep.

This is the fourth quarterly report on the progress of activities addressing safety issues associated with Hanford Site high-level radioactive waste tanks that contain ferrocyanide compounds. In the presence of oxidizing materials, such as nitrates or nitrites, ferrocyanide can be made to explode in the laboratory by heating it to high temperatures [above 285°C (545°F)]. In the mid 1950s approximately 140 metric tons of ferrocyanide were added to 24 underground high-level radioactive waste tanks. An implementation plan (Cash 1991) responding to the Defense Nuclear Facilities Safety Board Recommendation 90-7 (FR 1990) was issued in March 1991 describing the activities planned and underway to address each of the six parts of the recommendation.

1052 (WHC-EP-0474-5) Quarterly report on Defense Nuclear Facilities Safety Board Recommendation 90-7 for the period ending June 30, 1992. Cash, R.J.; Dukelow, G.T. Westinghouse Hanford Co., Richland, WA (United States). Jul 1992. 130p. Sponsored by USDOE, Washington,

DC (United States). DOE Contract AC06-87RL10930. Order Number DE92040797. Source: OSTI; NTIS; GPO Dep.

This is the fifth quarterly report on the progress of activities addressing safety issues associated with Hanford Site high-level radioactive waste tanks that contain ferrocyanide compounds.

1053 (WHC-EP-0474-6) Quarterly report on Defense Nuclear Facilities Safety Board Recommendation 90-7 for the period ending September 30, 1992. Cash, R.J.; Dukelow, G.T.; Miska, C.R.; Forbes, C.J. Westinghouse Hanford Co., Richland, WA (United States). Nov 1992. 133p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93008162. Source: OSTI; NTIS; GPO Dep.

This is the sixth quarterly report on the progress of activities addressing safety issues associated with Hanford Site high-level radioactive waste tanks that contain ferrocyanide compounds.

1054 (WHC-EP-0474-7) Quarterly report on Defense Nuclear Facilities Safety Board Recommendation 90-7 for the period ending December 31, 1992. Cash, R.J.; Dukelow, G.T.; Forbes, C.J. Westinghouse Hanford Co., Richland, WA (United States). Mar 1993. 115p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93014631. Source: OSTI; NTIS; INIS; GPO Dep.

This is the seventh quarterly report on the progress of activities addressing safety issues associated with Hanford Site high-level radioactive waste tanks that contain ferrocyanide compounds. In the presence of oxidizing materials, such as nitrates or nitrites, ferrocyanide can be made to explode in the laboratory by heating it to high temperatures [above 285°C (545°F)]. In the mid 1950s approximately 140 metric tons of ferrocyanide were added to 24 underground high-level radioactive waste tanks. An implementation plan (Cash 1991) responding to the Defense Nuclear Facilities Safety Board Recommendation 90-7 (FR 1990) was issued in March 1991 describing the activities that were planned and underway to address each of the six parts of Recommendation 90-7. A revision to the original plan was transmitted to US Department of Energy by Westinghouse Hanford Company in December 1992. Milestones completed this quarter are described in this report. Contents of this report include: Introduction; Defense Nuclear Facilities Safety Board Implementation Plan Task Activities (Defense Nuclear Facilities Safety Board Recommendation for enhanced temperature measurement, Recommendation for continuous temperature monitoring, Recommendation for cover gas monitoring, Recommendation for ferrocyanide waste characterization, Recommendation for chemical reaction studies, and Recommendation for emergency response planning); Schedules; and References. All actions recommended by the Defense Nuclear Facilities Safety Board for emergency planning by Hanford Site emergency preparedness organizations have been completed.

1055 (WHC-EP-0474-08) Quarterly report on Defense Nuclear Facilities Safety Board Recommendation 90-7 for the period ending March 31, 1993. Cash, R.J.; Dukelow, G.T.; Forbes, C.J.; Meacham, J.E. Westinghouse Hanford Co., Richland, WA (United States). Jun 1993. 110p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93040340. Source: OSTI; NTIS; GPO Dep.

This is the eighth quarterly report on the progress of activities addressing safety issues associated with Hanford Site high-level radioactive waste tanks that contain ferrocyanide compounds. In the presence of oxidizing materials, such as nitrates or nitrites, ferrocyanide can be made to explode in the laboratory by heating it to high temperatures [above 285°C (545°F)]. In the mid 1950s, approximately 140 metric tons of ferrocyanide were added to 24 underground high-level radioactive waste tanks. An implementation plan (Cash 1991) responding to the Defense Nuclear Facilities Safety Board Recommendation 90-7 (FR 1990) was issued in March 1991 describing the activities that were planned and underway to address each of the six parts of Recommendation 90-7. A revision to the original plan was transmitted to the US Department of Energy by Westinghouse Hanford Company in December 1992.

1056 (WHC-EP-0474-9) Quarterly report on Defense Nuclear Facilities Safety Board Recommendation 90-7 for the period ending June 30, 1993. Cash, R.J.; Dukelow, G.T.; Forbes, C.J.; Meacham, J.E. Westinghouse Hanford Co., Richland, WA (United States). Oct 1993. 98p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94004824. Source: OSTI; NTIS; INIS; GPO Dep.

This is the ninth quarterly report on the progress of activities that address safety issues associated with Hanford Site high-level radioactive waste tanks containing ferrocyanide compounds. Milestones completed this quarter include (1) a report on the credibility of hot spots and a recommendation on infrared scans; (2) a document discussing the strength and limitations of proposed moisture monitoring technologies; (3) limited calibration of the neutron probe in simulant-filled drums; (4) a report interpreting data from auger surface samples of ferrocyanide tank 241-BY-104; (5) a document on the effect of possible catalyst, initiator, and diluents on ferrocyanide reactivity; (6) a report on small scale sensitivity tests of ferrocyanide flowsheet simulants; and (7) preparation and shipment of T Plant simulants for calorimetric and dryout tests.

1057 (WHC-EP-0474-11) Quarterly report on ferrocyanide safety program for the period ending December 31, 1993. Meacham, J.E.; Cash, R.J.; Dukelow, G.T. Westinghouse Hanford Co., Richland, WA (United States). Feb 1994. 98p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94010341. Source: OSTI; NTIS; GPO Dep.

This is the eleventh quarterly report on the progress of activities addressing safety issues associated with Hanford Site high-level radioactive waste tanks that contain ferrocyanide compounds. In the presence of oxidizing materials, such as nitrates or nitrites, ferrocyanide can be made to explode in the laboratory by heating to high temperatures [above 285°C (545°F)]. In the mid 1950s, approximately 140 metric tons of ferrocyanide were added to waste now stored in underground high-level radioactive waste tanks. An implementation plan (Cash 1991) responding to the Defense Nuclear Facilities Safety Board Recommendation 90-7 (FR 1990) was issued in March 1991 describing the activities that were planned and underway to address each of the six parts of Recommendation 90-7. A revision to the original plan (Borsheim et al. 1992) was transmitted to the US Department of Energy by Westinghouse Hanford Company in December 1992, and subsequently to the Defense Nuclear Facilities Safety Board in 1993. The implementation plan was updated and revised this quarter and re-released as the

ferrocyanide safety program plan (Borsheim et al, 1993a). The program plan still addresses the six parts of Recommendation 90-7; however, it also includes all work in the Ferrocyanide Safety Program. This quarterly report is reported against the new program plan.

1058 (WHC-EP-0474-12) Ferrocyanide Safety Program: Quarterly report for the period ending March 31, 1994. Meacham, J.E.; Cash, R.J.; Dukelow, G.T. Westinghouse Hanford Co., Richland, WA (United States). Apr 1994. 84p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94011390. Source: OSTI; NTIS; GPO Dep.

Various high-level radioactive waste from defense operations has accumulated at the Hanford Site in underground storage tanks since the mid-1940s. During the 1950s, additional tank storage space was required to support the defense mission. To obtain this additional storage volume within a short time period, and to minimize the need for constructing additional storage tanks, Hanford Site scientists developed a process to scavenge ¹³⁷Cs from tank waste liquids. In implementing this process, approximately 140 metric tons of ferrocyanide were added to waste that was later routed to some Hanford Site single-shell tanks. The reactive nature of ferrocyanide in the presence of an oxidizer has been known for decades, but the conditions under which the compound can undergo endothermic and exothermic reactions have not been thoroughly studied. Because the scavenging process precipitated ferrocyanide from solutions containing nitrate and nitrite, an intimate mixture of ferrocyanides and nitrates and/or nitrites is likely to exist in some regions of the ferrocyanide tanks. This quarterly report provides a status of the activities underway at the Hanford Site on the Ferrocyanide Safety Issue, as requested by the Defense Nuclear Facilities Safety Board (DNFSB) in their Recommendation 90-7. A revised Ferrocyanide Safety Program Plan addressing the total Ferrocyanide Safety Program, including the six parts of DNFSB Recommendation 90-7, was recently prepared and released in March 1994. Activities in the revised program plan are underway or have been completed, and the status of each is described in Section 4.0 of this report.

1059 (WHC-EP-0475) Facility effluent monitoring plan for the Fast Flux Test Facility: FFTF Regulatory Compliance. Dahl, N.R. Westinghouse Hanford Co., Richland, WA (United States). Nov 1991. 103p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92014211. Source: OSTI; NTIS; INIS; GPO Dep.

It is the policy of the US Department of Energy and its contractor, Westinghouse Hanford Company to conduct facility effluent monitoring (sampling and monitoring) that is adequate in determining whether the public and the environment are sufficiently protected during DOE Operations and whether operations are in compliance with DOE and other applicable federal, state, and local emission standards and requirements. It is also DOE and Westinghouse Hanford policy that effluent monitoring programs meet high standards of quality and credibility. The purpose of this plan is to fulfill the General Environmental Protection Program, DOE Order 5400.1, for a Facility Effluent Monitoring Plant to exist for each site, facility, or process that uses, generates, releases, or manages significant pollutants of radioactive or hazardous materials which could impact public and employee safety and the environment. This document is specifically

intended to meet this requirement for the Fast Flux Test Facility on the Hanford Site. The purpose of the FEMP is to assess and document this information to determine if the monitoring, sampling, and controls are sufficient to protect the public and the environment; and to assess whether these systems are in compliance with all federal, state, and local requirements and regulations. Facility Effluent Monitoring Plans are written to provide sufficient information on the effluent characteristics and the effluent monitoring systems of facilities so that a compliance assessment against the applicable requirements may be easily accomplished. Adequate details are supplied such that radioactive source terms related to specific effluent discharge points can be finally compared to the effluent monitoring system capability.

1060 (WHC-EP-0475-1) Facility effluent monitoring plan for the fast flux test facility. Nickels, J.M.; Dahl, N.R. Westinghouse Hanford Co., Richland, WA (United States). Nov 1992. 105p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93005876. Source: OSTI; NTIS; INIS; GPO Dep.

A facility effluent monitoring plan is required by the US Department of Energy in US Department of Energy Order 5400.1 for any operations that involve hazardous materials and radioactive substances that could affect employee or public safety or the environment. A Facility Effluent Monitoring Plan determination was performed during calendar year 1991 and the evaluation requires the need for a facility effluent monitoring plan. This facility effluent monitoring plan assesses effluent monitoring systems and evaluates whether they are adequate to ensure the public health and safety as specified in applicable federal, state, and local requirements.

1061 (WHC-EP-0476) Facility effluent monitoring plan for the plutonium finishing plant. Garner, L.A. (Westinghouse Hanford Co., Richland, WA (United States)); Moeller, M.P. Westinghouse Hanford Co., Richland, WA (United States). Nov 1991. 122p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92008570. Source: OSTI; NTIS; GPO Dep.

A facility effluent monitoring plan is required by the US Department of Energy in DOE Order 5400.1 for any operations that involve hazardous materials and radioactive substances that could impact employee or public safety or the environment. This document is prepared using the specific guidelines identified in A Guide for Preparing Hanford Site Facility Effluent Monitoring Plans, WHC-EP-0438. This facility effluent monitoring plan assesses effluent monitoring systems and evaluates whether they are adequate to ensure the public health and safety as specified in applicable federal, state, and local requirements. This facility effluent monitoring plan is the first annual report. It shall ensure long-range integrity of the effluent monitoring systems by requiring an update whenever a new process or operation introduces new hazardous materials or significant radioactive materials. The purpose of this FEMP is to assess the magnitude of routine and potential liquid and airborne effluent releases from the Plutonium Finishing Plant (PFP) to determine the compliance of effluent monitoring systems and sampling programs with applicable Federal, State, and local regulations.

1062 (WHC-EP-0476-Rev.1) Facility effluent monitoring plan for the Plutonium Finishing Plant: Revision 1. Sullivan, P.J. Westinghouse Hanford Co., Richland, WA

(United States). Dec 1993. 127p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94005977. Source: OSTI; NTIS; INIS; GPO Dep.

A facility effluent monitoring plan is required by the US Department of Energy in DOE Order 5400.1 for any operations that involve hazardous materials and radioactive substances that could impact employee or public safety or the environment. This document is prepared using the specific guidelines identified in A Guide for Preparing Hanford Site Facility Effluent Monitoring Plans, WHC-EP-0438-01. This facility effluent monitoring plan assesses effluent monitoring systems and evaluates whether they are adequate to ensure the public health and safety as specified in applicable federal, state, and local requirements. This facility effluent monitoring plan is an update to the first annual report. It shall ensure long-range integrity of the effluent monitoring systems by requiring an update whenever a new process or operation introduces new hazardous materials or significant radioactive materials. This document must be reviewed annually even if there are no operational changes, and it must be updated as a minimum every three years.

1063 (WHC-EP-0477) Facility Effluent Monitoring Plan for the N Reactor. Watson, D.J. (Westinghouse Hanford Co., Richland, WA (United States)); Brendel, D.F.; Shields, K.D. Westinghouse Hanford Co., Richland, WA (United States). Nov 1991. 260p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92008625. Source: OSTI; NTIS; INIS; GPO Dep.

A facility effluent monitoring plan is required by the US Department of Energy in DOE Order 5400.1 for any operations that involve hazardous materials and radioactive substances that could impact employee or public safety or the environment. This document is prepared using the specific guidelines identified in A Guide for Preparing Hanford Site Facility Effluent Monitoring Plans, WHC-EP-0438. This facility effluent monitoring plan assesses effluent monitoring systems and evaluates whether they are adequate to ensure the public health and safety as specified in applicable federal, state, and local requirements. This facility effluent monitoring plan is the first annual report. It shall ensure long-range integrity of the effluent monitoring systems by requiring an update whenever a new process or operation introduces new hazardous materials or significant radioactive materials. This document must be reviewed annually even if there are no operational changes, and it must be updated as a minimum every three years. The primary purpose of the N Reactor Facility Effluent Monitoring Plan (FEMP), during standby, is to ensure that the radioactive effluents are properly monitored and evaluated for compliance with the applicable DOE orders and regulatory agencies at the federal, state, and local levels. A secondary purpose of the FEMP is to ensure that hazardous wastes are not released, in liquid effluents, to the environment even though the potential to do so is extremely low. The FEMP is to provide a monitoring system that collects representative samples in accordance with industry standards, performs analyses within stringent quality control (QC) requirements, and evaluates the data through the use of comparative analysis with the standards and acceptable environmental models.

1064 (WHC-EP-0479) Facility effluent monitoring plan for the tank farms facilities. Crummel, G.M. (Westinghouse Hanford Co., Richland, WA (United States)); Gustavson, R.D.; Kenoyer, J.L.; Moeller, M.P. Westinghouse

Hanford Co., Richland, WA (United States). Nov 1991. 147p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92008629. Source: OSTI; NTIS; INIS; GPO Dep.

A facility effluent monitoring plan is required by the US Department of Energy in DOE Order 5400.1 for any operations that involve hazardous materials and radioactive substances that could impact employee or public safety or the environment. This document is prepared using the specific guidelines identified in A Guide for Preparing Hanford Site Facility Effluent Monitoring Plans, WHC-EP-0438. This facility effluent monitoring plan assesses effluent monitoring systems and evaluates whether they are adequate to ensure the public health and safety as specified in applicable federal, state, and local requirements. This facility effluent monitoring plan is the first annual report. It shall ensure long-range integrity of the effluent monitoring systems by requiring an update whenever a new process or operation introduces new hazardous materials or significant radioactive materials. This document must be reviewed annually even if there are no operational changes, and it must be updated as a minimum three years. A variety of liquid wastes are generated in processing treatment, and disposal operations throughout the Hanford Site. The Tank Farms Project serves a major role in Hanford Site waste management activities as the temporary repository for these wastes. Stored wastes include hazardous components regulated under the Resource Conservation and Recovery Act of 1976 (RCRA) and as by-product material regulated under the Atomic Energy Act of 1954. A total of 177 single- and double-shell tanks (SST and DST) have been constructed in the 200 East and 200 West Areas of the Hanford Site. These facilities were constructed to various designs from 1943 to 1986. The Tank Farms Project is comprised of these tanks along with various transfer, receiving, and treatment facilities.

1065 (WHC-EP-0480) Facility Effluent Monitoring Plan for the 222-S Laboratory. Robinson, A.V. (Science Applications International Corp., San Diego, CA (United States)). Westinghouse Hanford Co., Richland, WA (United States). Nov 1991. 107p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92008548. Source: OSTI; NTIS; INIS; GPO Dep.

A facility effluent monitoring plan is required by the US Department of Energy in DOE Order 5400.1 for any operations that involve hazardous materials and radioactive substances that could impact employee or public safety or the environment. This document is prepared using the specific guidelines identified in A Guide for Preparing Hanford Site Facility Effluent Monitoring Plans, WHC-EP-0438. This facility effluent monitoring plan assesses effluent monitoring systems against applicable federal, state, and local requirements. This facility effluent monitoring plan is the first annual report. It shall ensure long-range integrity of the effluent monitoring systems by requiring an update whenever a new process or operation introduces new hazardous materials or significant radioactive materials. The current operation of the 222-S facilities includes the provision of analytical and radiological chemistry services in support of Hanford Site processing plants. The emphasis is on waste management, chemical processing, environmental monitoring effluent programs at B Plant, the Uranium Oxide Plant, Tank Farms, the 242-A Evaporator, the Waste Encapsulation and Storage Facility, the Plutonium-Uranium Extraction Facility, the Plutonium Finishing Plant, process development/impact activities, and essential materials. The laboratory also supplies

analytical services in support of ongoing waste tank characterization.

1066 (WHC-EP-0480-1) Facility effluent monitoring plan for the 222-S Laboratory. Nickels, J.M.; Warwick, G.J. Westinghouse Hanford Co., Richland, WA (United States). Nov 1992. 114p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93016351. Source: OSTI; NTIS; INIS; GPO Dep.

A facility effluent monitoring plan is required by the US Department of Energy in DOE Order 5400.1 for any operations that involve hazardous materials and radioactive substances that could impact employee or public safety or the environment. A facility effluent monitoring plan determination was performed during Calendar Year 1991 and the evaluation requires the need for a facility effluent monitoring plan. This document is prepared using the specific guidelines identified in A Guide for Preparing Hanford Site Facility Effluent Monitoring Plans, WHC-EP-0438-1. This facility effluent monitoring plan assesses effluent monitoring systems and evaluates whether they are adequate to ensure the public health and safety as specified in applicable Federal, State, and local requirements. This facility effluent monitoring plan shall ensure long-range integrity of the effluent monitoring systems by requiring an update whenever a new process or operation introduces new hazardous materials or significant radioactive materials. This document must be reviewed annually even if there are no operational changes, and it must be updated, as a minimum, every three years.

1067 (WHC-EP-0481) Facility effluent monitoring plan for the T Plant. Nickels, J.M. (Westinghouse Hanford Co., Richland, WA (United States)); Bolls, R.E.; Moeller, M.P. Westinghouse Hanford Co., Richland, WA (United States). Oct 1991. 134p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92008569. Source: OSTI; NTIS; INIS; GPO Dep.

A facility effluent monitoring plan is required by the US Department of Energy in DOE Order 5400.1 for any operations that involve hazardous materials and radioactive substances that could impact employee or public safety or the environment. This document is prepared using the specific guidelines identified in A Guide for Preparing Hanford Site Facility Effluent Monitoring Plans, WHC-EP-0438. This facility effluent monitoring plan assesses effluent monitoring systems and evaluates whether they are adequate to ensure the public health and safety as specified in applicable federal, state, and local requirements. This facility effluent monitoring plan is the first annual report. It shall ensure long-range integrity of the effluent monitoring systems by requiring an update whenever a new process or operation introduces new hazardous materials or significant radioactive materials. Although World War II-era plutonium extraction equipment has been removed, there are still chemicals and radioactive substances in the buildings because of experiments, the decontamination process, or chemical storage. T Plant has a system of monitoring devices and sampling programs to meet applicable regulations and DOE orders. These regulations and orders have been established to protect the health and safety of employees, the general public, and the environment.

1068 (WHC-EP-0496) Westinghouse Hanford Company waste minimization and pollution prevention awareness program plan. Craig, P.A.; Nichols, D.H.; Lindsey, D.W. Westinghouse Hanford Co., Richland, WA (United

States). Aug 1991. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92002110. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this plan is to establish the Westinghouse Hanford Company's Waste Minimization Program. The plan specifies activities and methods that will be employed to reduce the quantity and toxicity of waste generated at Westinghouse Hanford Company (Westinghouse Hanford). It is designed to satisfy the US Department of Energy (DOE) and other legal requirements that are discussed in Subsection C of the section. The Pollution Prevention Awareness Program is included with the Waste Minimization Program as permitted by DOE Order 5400.1 (DOE 1988a). This plan is based on the Hanford Site Waste Minimization and Pollution Prevention Awareness Program Plan, which directs DOE Field Office, Richland contractors to develop and maintain a waste minimization program. This waste minimization program is an organized, comprehensive, and continual effort to systematically reduce waste generation. The Westinghouse Hanford Waste Minimization Program is designed to prevent or minimize pollutant releases to all environmental media from all aspects of Westinghouse Hanford operations and offers increased protection of public health and the environment. 14 refs., 2 figs., 1 tab.

1069 (WHC-EP-0497) Facility effluent monitoring plan for K Area Fuel Storage Basins. Watson, D.J. (Westinghouse Hanford Co., Richland, WA (United States)); Brendel, D.F.; Shields, K.D. Westinghouse Hanford Co., Richland, WA (United States). Nov 1991. 194p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92008568. Source: OSTI; NTIS; INIS; GPO Dep.

A facility effluent monitoring plan is required by the US Department of Energy in DOE Order 5400.1 for any operations that involve hazardous materials and radioactive substances that could impact employee or public safety or the environment. This document is prepared using the specific guidelines identified in A Guide for Preparing Hanford Site Facility Effluent Monitoring Plans, WHC-EP-0438. This facility effluent monitoring plan assesses effluent monitoring systems and evaluates whether they are adequate to ensure the public health and safety as specified in applicable federal, state, and local requirements. This facility effluent monitoring plan is the first annual report. It shall ensure long-range integrity of the effluent monitoring systems by requiring an update whenever a new process or operation introduces new hazardous materials or significant radioactive materials. This document must be reviewed annually even if there are no operational changes, and it must be updated as a minimum every three years.

1070 (WHC-EP-0509) Facility effluent monitoring plan for the 300 Area Fuels Fabrication Facility. Nickels, J.M. (Westinghouse Hanford Co., Richland, WA (United States)); Brendel, D.F. Westinghouse Hanford Co., Richland, WA (United States). Nov 1991. 138p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92008628. Source: OSTI; NTIS; INIS; GPO Dep.

A facility effluent monitoring plan is required by the US Department of Energy in DOE Order 5400.1 for any operations that involve hazardous materials and radioactive substances that could impact employee or public safety or the environment. This document is prepared using the specific guidelines identified in A Guide for Preparing Hanford Site Facility Effluent Monitoring Plans, WHC-EP-0438. This

facility effluent monitoring plan assesses effluent monitoring systems and evaluates whether they are adequate to ensure the public health and safety as specified in applicable federal, state, and local requirements. This facility effluent monitoring plan is the first annual report. It shall ensure long-range integrity of the effluent monitoring system by requiring an update whenever a new process or operation introduces new hazardous materials or significant radioactive materials. This document must be reviewed annually even if there are no operational changes, and it must be updated as a minimum every three years. The Fuel Fabrication Facility in the Hanford 300 Area supported the production reactors from the 1940's until they were shut down in 1987. Prior to 1987 the Fuel Fabrication Facility released both airborne and liquid radioactive effluents. In January 1987 the emission of airborne radioactive effluents ceased with the shutdown of the fuels facility. The release of liquid radioactive effluents have continued although decreasing significantly from 1987 to 1990.

1071 (WHC-EP-0514) Underground storage tank waste characterization needs assessment workshop. Westinghouse Hanford Co., Richland, WA (United States); Bovay Northwest, Inc., Richland, WA (United States). Jun 1992. 104p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-9106248--: Department of Energy national underground storage tank waste characterization needs assessment workshop, Hanford, WA (United States), 25-27 Jun 1991). Order Number DE92018162. Source: OSTI; NTIS; INIS; GPO Dep.

The National Underground Storage Tank Characterization Needs Assessment Workshop (Tank Waste Characterization Workshop) was convened on June 25-27, 1991 in Richland, Washington. This workshop was held to address the technology development needs for characterizing tank wastes at five US Department of Energy (DOE) sites across the country. These five DOE sites include Hanford, Fernald, the Idaho National Engineering Laboratory, Oak Ridge National Laboratory, and the Savannah River Site.

1072 (WHC-EP-0522) Hanford Waste Vitrification Plant Project Waste Form Qualification Program Plan. Randklev, E.H. Westinghouse Hanford Co., Richland, WA (United States). Jun 1993. 146p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93018736. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy has created a waste acceptance process to help guide the overall program for the disposal of high-level nuclear waste in a federal repository. This Waste Form Qualification Program Plan describes the hierarchy of strategies used by the Hanford Waste Vitrification Plant Project to satisfy the waste form qualification obligations of that waste acceptance process. A description of the functional relationship of the participants contributing to completing this objective is provided. The major activities, products, providers, and associated scheduling for implementing the strategies also are presented.

1073 (WHC-EP-0533) Integrated sampling and analysis plan for samples measuring >10 mrem/hour. Haller, C.S. Westinghouse Hanford Co., Richland, WA (United States). Mar 1992. 70p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92011288. Source: OSTI; NTIS; INIS; GPO Dep.

This integrated sampling and analysis plan was prepared to assist in planning and scheduling of Hanford Site sampling and analytical activities for all waste characterization samples that measure greater than 10 mrem/hour. This report also satisfies the requirements of the renegotiated Interim Milestone M-10-05 of the Hanford Federal Facility Agreement and Consent Order (the Tri-Party Agreement). For purposes of comparing the various analytical needs with the Hanford Site laboratory capabilities, the analytical requirements of the various programs were normalized by converting required laboratory effort for each type of sample to a common unit of work, the standard analytical equivalency unit (AEU). The AEU approximates the amount of laboratory resources required to perform an extensive suite of analyses on five core segments individually plus one additional suite of analyses on a composite sample derived from a mixture of the five core segments and prepare a validated RCRA-type data package.

1074 (WHC-EP-0533-Draft) Integrated sampling and analysis plan for samples measuring >10 mrem/hour. Westinghouse Hanford Co., Richland, WA (United States). Feb 1992. 72p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92011456. Source: OSTI; NTIS; GPO Dep.

This integrated sampling and analysis plan was prepared to assist in planning and scheduling of Hanford Site sampling and analytical activities for all waste characterization samples that measure greater than 10 mrem/hour. Greater than 10 mrem/hour samples are defined as "characterization samples" with expected surface dose rates in excess of 10 mrem/hour. Programs that were included in the assessment of "current and projected sampling and analytical needs" are as follows: single-shell tank (SST) waste characterization, waste tank safety issue resolution (assumes waste characterization analyses are performed on same samples as safety resolution analyses), 242-A evaporator feed characterization, grout feed characterization, grout vault core sampling, N and K basin sludge characterization and cleanout, soil remediation programs, SST interim stabilization and isolation, and Hanford Waste Vitrification Plant technology development.

1075 (WHC-EP-0537) Fiscal year 1992 program plan for evaluation and remediation of the generation and release of flammable gases in Hanford Site waste tanks. Johnson, G.D. Westinghouse Hanford Co., Richland, WA (United States). Jan 1992. 85p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92008383. Source: OSTI; NTIS; INIS; GPO Dep.

The Waste Tank Flammable Gas Stabilization Program was established in 1990 to provide for resolution of a major safety issue identified for 23 of the high-level waste tanks at the Hanford Site. This safety issue involves flammable gas mixtures, consisting mainly of hydrogen, nitrous oxide, and nitrogen, that are generated and periodically released in concentrations that exceed the lower flammability limit. Initial activities of the program have been directed at Tank 241-SY-101 because it exhibits the largest risk. The purpose of this document is to provide a brief description of the FY 1992 priorities, logic, work breakdown structure (WBS) and task descriptions for the Waste Tank Flammable Gas Stabilization Program. A major change for FY 1992 involves the core sampling and sample analyses. All activities associated with these tasks will be conducted under the Tank Waste Characterization Program (1N4). Resource requirements for

the Waste Tank Flammable Gas Stabilization Program for fiscal years beyond 1992 are given in the Waste Tank Safety Program Overview Plant (Gasper 1991).

1076 (WHC-EP-0567) 1992 Solid waste reference forecast summary. Duncan, D.R. (Westinghouse Hanford Co., Richland, WA (United States)); Blackburn, C.L.; Kaae, P.S.; Beverlin, K.J.; Garrett, S.M.K.; Stiles, D.L. Westinghouse Hanford Co., Richland, WA (United States). Jun 1992. 106p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92040414. Source: OSTI; NTIS; INIS; GPO Dep.

The report provides a planning-basis forecast which quantifies the volumes of newly generated solid low-level waste, low-level mixed waste, transuranic waste, transuranic mixed waste, and non-radioactive hazardous wastes to be generated or received at the US Department of Energy's Hanford Site during the period spanning FY-1992 through FY-2021. The objective of the report is to present a documented set of data which may be used consistently for both short- and long-term planning for solid waste treatment, storage, and disposal (TSD) activities. In addition to estimating the 30-year waste volume, this forecast delineates the physical characteristics of these wastes, identifies the types of containers that will be used to ship the waste, and discusses the hazardous constituents of mixed and hazardous wastes. In addition, this forecast documents the assumptions used by the major waste generators to prepare their estimates, identifies potential impacts to the current planning basis, discusses data certainty, and addresses data completeness.

1077 (WHC-EP-0567-1) 1993 Solid Waste Reference Forecast Summary. Valero, O.J. (Westinghouse Hanford Co., Richland, WA (United States)); Blackburn, C.L.; Kaae, P.S.; Armacost, L.L.; Garrett, S.M.K. Westinghouse Hanford Co., Richland, WA (United States); Pacific Northwest Lab., Richland, WA (United States). Aug 1993. 118p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93019494. Source: OSTI; NTIS; INIS; GPO Dep.

This report, which updates WHC-EP-0567, 1992 Solid Waste Reference Forecast Summary, (WHC 1992) forecasts the volumes of solid wastes to be generated or received at the US Department of Energy Hanford Site during the 30-year period from FY 1993 through FY 2022. The data used in this document were collected from Westinghouse Hanford Company forecasts as well as from surveys of waste generators at other US Department of Energy sites who are now shipping or plan to ship solid wastes to the Hanford Site for disposal. These wastes include low-level and low-level mixed waste, transuranic and transuranic mixed waste, and nonradioactive hazardous waste.

1078 (WHC-EP-0570) The distillation and incineration of 132,000 liters (35,000 gallons) of mixed-waste hexone solvents from Hanford's REDOX Plant. Rasmussen, O.R.; Cowan, R.J.; Heine, W.F. Westinghouse Hanford Co., Richland, WA (United States). Sep 1992. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93001752. Source: OSTI; NTIS; GPO Dep.

The Westinghouse Hanford Company has successfully decontaminated 132,000 t (35,000 gal) of radioactive hazardous waste solvents and destroyed the solvents by commercial incineration. The solvents, a mixture of hexone (methyl isobutyl ketone), kerosene, and tributyl phosphate were the extractants in the Reduction Oxidation nuclear fuel

reprocessing plant in the 1960's and were stored in carbon-steel underground tanks since the plant shut down in 1967. Westinghouse Hanford Company decontaminated the solvent in a distillation system specially designed to accumulate the radioactive distillation tars in sacrificial vessels for disposal. The distillate, essentially Free of radionuclides except for tritium, was shipped in 19,000-L (5,000-gallon) tank trailer loads to a licensed and permitted commercial incinerator that used the solvents' fuel value to produce electric power in a co-generation plant. This successful recovery operation made beneficial use of a material that once posed a significant environmental risk at the Hanford Site. The project was made possible through technology demonstration funding provided by the US Department of Energy's Office of Technology Development and its predecessor, the Hazardous Waste Remedial Action Program.

1079 (WHC-EP-0573) Westinghouse Hanford Company environmental surveillance annual report: Calendar year 1991. Schmidt, J.W.; Johnson, A.R.; McKinney, S.M.; Perkins, C.J.; Webb, C.R. Westinghouse Hanford Co., Richland, WA (United States). Jul 1992. 378p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93001668. Source: OSTI; NTIS; INIS; GPO Dep.

This document presents the results of near-facility operational environmental monitoring in 1991 of the 100, 200/600, and 300/400 Areas of the Hanford Site, in south-central Washington State, as performed by Westinghouse Hanford Company. These activities are conducted to assess and to control the impacts of operations on the workers and the local environment and to monitor diffuse sources. Surveillance activities include sampling and analyses of ambient air, surface water, groundwater, sediments, soil, and biota. Also, external radiation measurements and radiological surveys are taken at waste disposal sites, radiologically controlled areas, and roads.

1080 (WHC-EP-0573-1) Westinghouse Hanford Company operational environmental monitoring annual report, CY 1992. Schmidt, J.W.; Johnson, A.R.; McKinney, S.M.; Perkins, C.J. Westinghouse Hanford Co., Richland, WA (United States). Jul 1993. 347p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94003328. Source: OSTI; NTIS; INIS; GPO Dep.

This document presents the results of the Westinghouse Hanford Company near-facility operational environmental monitoring for 1992 in the 100, 200/600, and 300/400 Areas of the Hanford Site, in south-central Washington State in 1992. Surveillance activities included sampling and analyses of ambient air, surface water, groundwater, sediments, soil, and biota. Also, external radiation measurements and radiological surveys were taken at waste disposal sites, radiologically controlled areas, and roads. These activities were conducted to assess and to control the impacts of nuclear facilities and waste sites on the workers and the local environment. Additionally, diffuse sources were monitored to determine compliance with Federal, State, and/or local regulations. In general, although impacts from nuclear facilities are still seen on the Hanford Site and are slightly elevated when compared to offsite, these impacts are less than in previous years.

1081 (WHC-EP-0574) Fiscal year 1992 photographic inspection of corrosion of waste drums contained in the

Z-9 storage module. Cheney, M.A.; Duncan, D.R. Westinghouse Hanford Co., Richland, WA (United States). Aug 1992. 32p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92040493. Source: OSTI; NTIS; GPO Dep.

Transuranic (TRU) waste has been stored at the Hanford Site since the beginning of the defense materials production mission. In 1970, the US Atomic Energy Commission (AEC) issued "Immediate Action Directive 0511-211" directing AEC sites to package and store TRU wastes to be readily retrievable as contamination-free packages for a minimum of 20 yr. The Hanford Site implemented this directive and placed TRU wastes in packages and storage configurations intended to be retrievable 20 yr after emplacement. The TRU waste packages consisted primarily of steel drums or boxes made of fiberglass-reinforced polyester, metal, plywood, or concrete. A program within the Solid/Liquid Waste Remediation Division has been initiated to assess the scope of retrieval of the retrievable stored TRU waste. This characterization program is described in WHC-EP-0223, *Stored, Contact-Handled Transuranic Waste Characterization at the Hanford Site*. In 1988 a series of photographs were taken to determine the condition of the drums. The purpose of that investigation was to determine the changes of the drums in the Z-9 storage module since 1983 and to determine the ability of the drums to meet the 20-yr storage lifetime. The results of this investigation were, except in a few locations, that little degradation had occurred between 1981 and 1988. It was recommended that in five years another investigation take place. This report is written to fulfill that recommendation.

1082 (WHC-EP-0577) Alternative pretreatment technologies for removal of transuranium elements from selected Hanford Site wastes: Strategic systems engineering waste pretreatment technology. Westinghouse Hanford Co., Richland, WA (United States). Jan 1993. 112p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93009428. Source: OSTI; NTIS; INIS; GPO Dep.

Removal of transuranic (TRU) elements is a key and important part of various candidate Options for pretreatment of certain US Department of Energy (DOE) Hanford Site wastes, in double-shell tanks (DSTs) and single-shell tanks (SSTs) (Grygiel et al. 1991). The transuranium extraction (TRUEX) process, a recently developed liquid-liquid extraction process, is currently specified for removal of TRU elements from nitric acid (HNO_3) solutions of various DST and SST wastes. This report has been prepared as an initial response to external reviewer concerns about the choice of optimum technology removing TRU elements from, acidified Hanford Site wastes. It provides an objective evaluation of the present knowledge of the TRUEX-CMPO process chemistry and experience as well as a summary of conditions and results of bench-scale TRUEX-CMPO process tests with actual Hanford Site waste and other wastes. This report, it is hoped, will achieve the following primary goals. Provide a timely and authoritative basis for further comparison of the TRUEX-CMPO² process to alternative technologies for removal of TRU elements from Hanford Site DST and SST wastes. Serve as a guide to further bench-scale and, where warranted, pilot plant-scale tests with actual and simulated wastes to fill in gaps in our knowledge of both the TRUEX-CMPO process and alternative TRU element removal processes.

1083 (WHC-EP-0581) Examination of representative drum from 618-9 Burial Ground. Duncan, D.R. (Westinghouse Hanford Co., Richland, WA (United States)); Bunnell, L.R. Westinghouse Hanford Co., Richland, WA (United States). Oct 1992. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93004488. Source: OSTI; NTIS; INIS; GPO Dep.

The work described in this report was conducted in pursuance of Task E of the Pacific Northwest Laboratory Solid Waste Technology Support Program for Westinghouse Hanford Company. Task E calls for a determination of the corrosion rate of low-carbon steels under typical Hanford Site conditions. To meet this objective, Pacific Northwest Laboratory examined one intact drum that was judged to be representative of the largely intact drums excavated at the 618-9 Burial Ground located west of the 300 Area at the Hanford Site. Six samples were examined to characterize the drum, its composition, and its corrosion and corrosion products. The drum, which was found empty, was constructed of low-carbon steel. Its surface appeared relatively sound. The drum metal varied in thickness, but the minimum thickness in the samples was near 0.020 in. The corrosion corresponds to approximately 25 to 35 mils of metal loss, roughly a 1 mil/yr corrosion rate. Corrosion products were goethite and maghymite, expected products of iron buried in soil. Apparently, the drum leaked some time ago, but the cause of the leakage is unknown because records of the drums and their burial are limited. The drum was empty when found, and it is possible that it could have failed by pitting rather than by general corrosion. A pitting rate of about 3.5 mils/yr would have caused loss of drum integrity in the time since burial.

1084 (WHC-EP-0599) The role of aging in resolving the ferrocyanide safety issue. Babad, H.; Meacham, J.E.; Simpson, B.C.; Cash, R.J. Westinghouse Hanford Co., Richland, WA (United States). Aug 1993. 38p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93040338. Source: OSTI; NTIS; INIS; GPO Dep.

A chemical process called aging, in which stored ferrocyanide waste could be dissolved and dispersed among waste tanks, or destroyed by radiolysis and hydrolysis, has been proposed at the Hanford Site. This paper summarizes the results of applied research, characterization, and modeling activities on Hanford Site ferrocyanide waste material that support the existence of a chemical aging mechanism. Test results from waste simulants and actual waste tank materials are presented and compared with theoretical estimates. Chemical and energetic behavior of the materials are the key indicators of destruction or dispersion. Screening experiments on vendor-prepared sodium nickel ferrocyanide and the initial results from core sampling support the concept that aging of ferrocyanide is taking place in the waste tanks at the Hanford Site. This report defines the concept of waste aging and explains the role that aging could play in resolving the Hanford Site ferrocyanide safety issue.

1085 (WHC-EP-0603) Reactive and unstable chemicals in transuranic retrievable waste at the Hanford Site: A review of available data. Westinghouse Hanford Co., Richland, WA (United States). Dec 1992. 111p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93009474. Source: OSTI; NTIS; INIS; GPO Dep.

Since 1970, transuranic (TRU) waste at the Hanford Site has been placed in retrievable storage pending final disposal. This waste is to be retrieved, processed at the Waste Receiving and Processing Facility (WRAP), and shipped to the Waste Isolation Pilot Plant (WIPP) near Carlsbad, New Mexico, for final disposal. The occurrence of reactive and/or unstable (R/U) constituents in TRU waste containers is a great safety concern during all phases of the retrieval, temporary storage, and processing operations. This study was undertaken to identify those TRU waste containers that might contain R/U substances. This report is a result of this data review and is organized into four major areas. The first section provides background information on R/U substances: The second section is the actual review of the four information sources for R/U substances. The third section presents a summary of the R/U substances found in the information sources, the hazards they represent, and the mitigating effects that waste packaging and long term storage may cause. The fourth section provides an outline of the steps required to address and manage the hazards of R/U substances during retrieval, storage and processing at WRAP.

1086 (WHC-EP-0621) Characterization of past and present solid waste streams from the plutonium finishing plant. Duncan, D.R. (Westinghouse Hanford Co., Richland, WA (United States)); Mayancsik, B.A.; Pottmeyer, J.A.; Vejvoda, E.J.; Reddick, J.A.; Sheldon, K.M.; Weyns, M.I. Westinghouse Hanford Co., Richland, WA (United States). Feb 1993. 487p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93014186. Source: OSTI; NTIS; INIS; GPO Dep.

During the next two decades the transuranic (TRU) wastes now stored in the burial trenches and storage facilities at the Hanford Site are to be retrieved, processed at the Waste Receiving and Processing (WRAP) Facility, and shipped to the Waste Isolation Pilot Plant (WIPP) near Carlsbad, New Mexico for final disposal. Over 50% of the TRU waste to be retrieved for shipment to the WIPP has been generated at the Plutonium Finishing Plant (PFP), also known as the Plutonium Processing and Storage Facility and Z Plant. The purpose of this report is to characterize the radioactive solid waste generated by the PFP since its construction in 1947 using process knowledge, existing records, and history-obtained from interviews. The PFP is currently operated by Westinghouse Hanford Company (WHC) for the US Department of Energy (DOE).

1087 (WHC-EP-0623) Multi-Purpose Storage Complex description. Nyman, D.H. Westinghouse Hanford Co., Richland, WA (United States). Jan 1993. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93011297. Source: OSTI; NTIS; INIS; GPO Dep.

The Multi-Purpose Storage Complex will provide interim storage of radioactive material (irradiated fuel, cesium/strontium capsules, plutonium residuals, canisters of vitrified high-level waste glass, and other radioactive material) at the Hanford Site near Richland, Washington. A Storage Preparation and Shipping Facility is included that will have the capability to stabilize failed metal fuel, segregate high-level solid waste, and package/repackage any of the materials for interim storage/final disposal or subsequent processing. Current technology, both domestic and foreign, will be adapted with the expectation that no new technology will be required. This cost-effective approach will use fuel casks,

transport systems, and/or modular vaults that have been licensed in the United States. The complex will have a central control room, and appropriate safeguards and security measures will be incorporated. A specific design objective will be to minimize the amount of secondary waste.

1088 (WHC-EP-0626) Material-not-categorized-as-waste survey for 1992. Jacobsen, P.H. Westinghouse Hanford Co., Richland, WA (United States). Jul 1993. 59p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93019492. Source: OSTI; NTIS; INIS; GPO Dep.

In October 1992, the US Department of Energy, Richland Field Office (RL) requested that Westinghouse Hanford Company (WHC) respond to a letter from EM-331 asking for completion of a survey of items in storage but not categorized as waste (Roberts 1992). The letter contained an attachment with instructions on how to fill out the attached form and what to exclude from the survey (Appendix A). This report is a summary of the information from the response issued to RL. This report primarily is for use in estimating future waste volumes that may have been overlooked because of the nature of their classification as material not categorized as waste (MNCAW) (i.e., not yet declared Waste).

1089 (WHC-EP-0629) Pretreatment Technology Plan. Barker, S.A. (Westinghouse Hanford Co., Richland, WA (US)); Thornhill, C.K.; Holton, L.K. Jr. Westinghouse Hanford Co., Richland, WA (United States). Mar 1993. 138p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93018061. Source: OSTI; NTIS; INIS; GPO Dep.

This technology plan presents a strategy for the identification, evaluation, and development of technologies for the pretreatment of radioactive wastes stored in underground storage tanks at the Hanford Site. This strategy includes deployment of facilities and process development schedules to support the other program elements. This document also presents schedule information for alternative pretreatment systems: (1) the reference pretreatment technology development system, (2) an enhanced pretreatment technology development system, and (3) alternative pretreatment technology development systems.

1090 (WHC-EP-0631) Ferrocyanide waste simulant characterization. Jeppson, D.W.; Wong, J.J. Westinghouse Hanford Co., Richland, WA (United States). Jan 1993. 403p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93014616. Source: OSTI; NTIS; INIS; GPO Dep.

Ferrocyanide waste simulants were prepared and characterized to help assess safety concerns associated with the ferrocyanide sludges stored in underground single-shell waste tanks at the Hanford Site. Simulants were prepared to represent the variety of ferrocyanide sludges stored in the storage tanks. Physical properties, chemical compositions, and thermodynamic properties of the simulants were determined. The simulants, as produced, were shown to not sustain propagating reactions when subjected to a strong ignition source. Additional testing and evaluations are recommended to assess safety concerns associated with postulated ferrocyanide sludge dry-out and exposure to external ignition sources.

1091 (WHC-EP-0635) Assay development status report for total cyanide. Simpson, B.C. (Westinghouse Hanford Co., Richland, WA (United States)); Jones, T.E.; Pool, K.H. Westinghouse Hanford Co., Richland, WA (United

States). Feb 1993. 60p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93014628. Source: OSTI; NTIS; INIS; GPO Dep.

A validated cyanide assay that is applicable to a variety of tank waste matrices is necessary to resolve certain waste tank safety issues and for purposes of overall waste characterization. The target for this effort is an assay with an applicable range of greater than 1,000 ppm (0.10 wt%) total cyanide and a confidence level greater than 80%. Figure 1 illustrates the operating regime of the proposed cyanide assay method. The Assay Development Status Report for Total Cyanide will summarize the past experience with cyanide analyses on-tank waste matrices and will rate the status of the analytical methods used to assay total cyanide (CN^- ion) in the tank waste matrices as acceptable or unacceptable. This paper will also briefly describe the current efforts for improving analytical resolution of the assays and the attempts at speciation.

1092 (WHC-EP-0636) Evaluation of existing Hanford buildings for the storage of solid wastes. Carlson, M.C.; Hodgson, R.D.; Sabin, J.C. Westinghouse Hanford Co., Richland, WA (United States). May 1993. 54p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94011450. Source: OSTI; NTIS; INIS; GPO Dep.

Existing storage space at the Hanford Site for solid low-level mixed waste (LLMW) will be filled up by 1997. Westinghouse Hanford Company (WHC) has initiated the project funding cycle for additional storage space to assure that new facilities are available when needed. In the course of considering the funding request, the US Department of Energy (DOE) has asked WHC to identify and review any existing Hanford Site facilities that could be modified and used as an alternative to constructing the proposed W-112 Project. This report documents the results of that review. In summary, no buildings exist at the Hanford Site that can be utilized for storage of solid LLMW on a cost-effective basis when compared to new construction. The nearest approach to an economically sensible conversion would involve upgrade of 100,000 ft² of space in the 2101-M Building in the 200 East Area. Here, modified storage space is estimated to cost about \$106 per ft² while new construction will cost about \$50 per ft². Construction costs for the waste storage portion of the W-112 Project are comparable with W-016 Project actual costs, with escalation considered. Details of the cost evaluation for this building and for other selected candidate facilities are presented in this report. All comparisons presented address the potential decontamination and decommissioning (D&D) cost avoidances realized by using existing facilities.

1093 (WHC-EP-0642) Waste Separations and Pretreatment Workshop report. Cruse, J.M. (Westinghouse Hanford Co., Richland, WA (United States)); Harrington, R.A.; Quadrel, M.J. Westinghouse Hanford Co., Richland, WA (United States). Jan 1994. 182p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-9302174-; Waste separations and pretreatment workshop, Salt Lake City, UT (United States), 3-5 Feb 1993). Order Number DE94009786. Source: OSTI; NTIS; INIS; GPO Dep.

This document provides the minutes from the Waste Separations and Pretreatment Workshop sponsored by the Underground Storage Tank-Integrated Demonstration in Salt Lake City, Utah, February 3-5, 1993. The Efficient Separations and Processing-Integrated Program and the Hanford

Site Tank Waste Remediation System were joint participants. This document provides the detailed minutes, including responses to questions asked, an attendance list, reproductions of the workshop presentations, and a revised chart showing technology development activities.

1094 (WHC-EP-0643) Tank characterization report for single-shell tank 241-U-110. Brown, T.M.; Jensen, L. Westinghouse Hanford Co., Richland, WA (United States). Apr 1993. 204p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93016222. Source: OSTI; NTIS; INIS; GPO Dep.

This report investigates the nature of the waste in tank U-110 using historical and current information. When characterizing tank waste, several important properties are considered. First, the physical characteristics of the waste are presented, including waste appearance, density, and size of waste particles. The existence of any exotherms in the tank that may present a safety concern is investigated. Finally, the radiological and chemical composition of the tank are presented.

1095 (WHC-EP-0643-Rev.1) Tank characterization report for single-shell tank 241-U-110: Revision 1. Brown, T.M.; Jensen, L. Westinghouse Hanford Co., Richland, WA (United States). Sep 1993. 240p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94002354. Source: OSTI; NTIS; INIS; GPO Dep.

Tank 241-U-110 (U-110) is a Hanford Site waste tank that was most recently sampled in November and December 1989. Analysis of the samples obtained from tank U-110 was conducted to support the characterization of the contents of this tank and to support Hanford Federal Facility Agreement and Consent Order milestone M-10-00 (Ecology, et al. 1992). Because of incomplete recovery of the waste during sampling, there may be bias in the results of this characterization report.

1096 (WHC-EP-0646) Characterization of past and present solid waste streams from the Plutonium-Uranium Extraction Plant. Pottmeyer, J.A. (Los Alamos Technical Associates, Inc., NM (US)); Weyns, M.I.; Lorenzo, D.S.; Vejvoda, E.J.; Duncan, D.R. Westinghouse Hanford Co., Richland, WA (United States). Apr 1993. 436p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93016829. Source: OSTI; NTIS; INIS; GPO Dep.

During the next two decades the transuranic wastes, now stored in the burial trenches and storage facilities at the Hanford Site, are to be retrieved, processed at the Waste Receiving and Processing Facility, and shipped to the Waste Isolation Pilot Plant near Carlsbad, New Mexico for final disposal. Over 7% of the transuranic waste to be retrieved for shipment to the Waste Isolation Pilot Plant has been generated at the Plutonium-Uranium Extraction (PUREX) Plant. The purpose of this report is to characterize the radioactive solid wastes generated by PUREX using process knowledge, existing records, and oral history interviews. The PUREX Plant is currently operated by the Westinghouse Hanford Company for the US Department of Energy and is now in standby status while being prepared for permanent shutdown. The PUREX Plant is a collection of facilities that has been used primarily to separate plutonium for nuclear weapons from spent fuel that had been irradiated in the Hanford Site's defense reactors. Originally designed to reprocess aluminum-clad uranium fuel, the plant was

modified to reprocess zirconium alloy clad fuel elements from the Hanford Site's N Reactor. PUREX has provided plutonium for research reactor development, safety programs, and defense. In addition, the PUREX was used to recover slightly enriched uranium for recycling into fuel for use in reactors that generate electricity and plutonium. Section 2.0 provides further details of the PUREX's physical plant and its operations. The PUREX Plant functions that generate solid waste are as follows: processing operations, laboratory analyses and supporting activities. The types and estimated quantities of waste resulting from these activities are discussed in detail.

1097 (WHC-EP-0650) Permanent isolation surface barrier: Functional performance. Wing, N.R. Westinghouse Hanford Co., Richland, WA (United States). Oct 1993. 96p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94003095. Source: OSTI; NTIS; INIS; GPO Dep.

This document presents the functional performance parameters for permanent isolation surface barriers. Permanent isolation surface barriers have been proposed for use at the Hanford Site (and elsewhere) to isolate and dispose of certain types of waste in place. Much of the waste that would be disposed of using in-place isolation techniques is located in subsurface structures, such as solid waste burial grounds, tanks, vaults, and cribs. Unless protected in some way, the wastes could be transported to the accessible environment via transport pathways, such as water infiltration, biointrusion, wind and water erosion, human interference, and/or gaseous release.

1098 (WHC-EP-0655-Draft) Parametric study of radionuclide characterization - Low-level waste: Draft. Amir, S.J. Westinghouse Hanford Co., Richland, WA (United States). Apr 1993. 88p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93014140. Source: OSTI; NTIS; INIS; GPO Dep.

The criteria and guidance given in this addendum specifically address the classification of low-level waste at the Hanford Reservation into Category 1, Category 3, and Greater Than Category 3 (GTC3). These categories are developed based on the performance assessment (PA) being conducted for the Hanford Site. The radionuclides and their concentration for each category are listed in the revised Table 1-1 (Attachment 1). The information to classify the waste for US Department of Transportation (DOT) and to classify Transuranic (TRU)/Non-TRU, Contact Handled (CH)/Remote Handled (RH) waste is given in WHC-EP-0063-3 (WHC 1991).

1099 (WHC-EP-0659) Characterization of past and present solid waste streams from 231-Z. Pottmeyer, J.A. (Los Alamos Technical Associates, Inc., NM (US)); DeLorenzo, D.S.; Weyns-Rollosen, M.I.; Berkwitz, D.E.; Vejvoda, E.J.; Duncan, D.R. Westinghouse Hanford Co., Richland, WA (United States). Jun 1993. 191p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93016826. Source: OSTI; NTIS; INIS; GPO Dep.

During the next two decades the transuranic (TRU) wastes now stored in the burial trenches and storage facilities at the Hanford Site are to be retrieved, processed at the Waste Receiving and Processing Facility, and shipped to the Waste Isolation Pilot Plant near Carlsbad, New Mexico for final disposal. Over 8% of the TRU waste to be retrieved for shipment to the Waste Isolation Pilot Plant has been

generated at the Plutonium Metallurgy Laboratory (231-Z) Facility. The purpose of this report is to characterize the radioactive solid wastes generated by 231-Z using process knowledge, existing records and oral history interviews. Since 1944 research and development programs utilizing plutonium have been conducted at 231-Z in the fields of physical metallurgy, property determination, alloy development, and process development. The following are sources of solid waste generation at the 231-Z Facility: (1) General Weapons Development Program, (2) process waste from gloveboxes, (3) numerous classified research and development programs, (4) advanced decontamination and decommissioning technologies, including sectioning, vibratory finishing, electropolishing, solution process, and small bench-scale work, (5) general laboratory procedures, (6) foundry area, (7) housekeeping activities, and (8) four cleanout campaigns. All solid wastes originating at 231-Z were packaged for onsite-offsite storage or disposal. Waste packaging and reporting requirements have undergone significant changes throughout the history of 231-Z. Current and historical procedures are provided in Section 4.0. Information on the radioactive wastes generated at 231-Z can be found in a number of documents and databases, most importantly the Solid Waste Information and Tracking System database and Solid Waste Burial Records. Facility personnel also provide excellent information about past waste generation and the procedures used to handle that waste. Section 5.0 was compiled using these sources.

1100 (WHC-EP-0660) Nondestructive testing methods for 55-gallon, waste storage drums. Ferris, R.H. (Pacific Northwest Lab., Richland, WA (United States)); Hildebrand, B.P.; Hockey, R.L.; Riechers, D.M.; Spanner, J.C.; Duncan, D.R. Westinghouse Hanford Co., Richland, WA (United States). Jun 1993. 83p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93019130. Source: OSTI; NTIS; INIS; GPO Dep.

The Westinghouse Hanford Company (WHC) authorized Pacific Northwest Laboratory (PNL) to conduct a feasibility study to identify promising nondestructive testing (NDT) methods for detecting general and localized (both pitting and pinhole) corrosion in the 55-gal drums that are used to store solid waste materials at the Hanford Site. This document presents results obtained during a literature survey, identifies the relevant reference materials that were reviewed, provides a technical description of the methods that were evaluated, describes the laboratory tests that were conducted and their results, identifies the most promising candidate methods along with the rationale for these selections, and includes a work plan for recommended follow-on activities. This report contains a brief overview and technical description for each of the following NDT methods: magnetic testing techniques; eddy current testing; shearography; ultrasonic testing; radiographic computed tomography; thermography; and leak testing with acoustic detection.

1101 (WHC-EP-0672) Radioactive waste shipments to Hanford Retrievable Storage from the General Electric Vallecitos Nuclear Center, Pleasanton, California. Vejvoda, E.J. (Los Alamos Technical Associates, Inc., NM (United States)); Pottmeyer, J.A.; DeLorenzo, D.S.; Weyns-Rollosen, M.I.; Duncan, D.R. Westinghouse Hanford Co., Richland, WA (United States). Oct 1993. 298p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94003467. Source: OSTI; NTIS; INIS; GPO Dep.

During the next two decades the transuranic (TRU) wastes now stored in the burial trenches and storage facilities at the Hanford Site are to be retrieved, processed at the Waste Receiving and Processing Facility, and shipped to the Waste Isolation Pilot Plant near Carlsbad, New Mexico for final disposal. Approximately 3.8% of the TRU waste to be retrieved for shipment to WIPP was generated at the General Electric (GE) Vallecitos Nuclear Center (VNC) in Pleasanton, California and shipped to the Hanford Site for storage. The purpose of this report is to characterize these radioactive solid wastes using process knowledge, existing records, and oral history interviews. The waste was generated almost exclusively from the activities, of the Plutonium Fuels Development Laboratory and the Plutonium Analytical Laboratory. Section 2.0 provides further details of the VNC physical plant, facility operations, facility history, and current status. The solid radioactive wastes were associated with two US Atomic Energy Commission/US Department of Energy reactor programs – the Fast Ceramic Reactor (FCR) program, and the Fast Flux Test Reactor (FFTR) program. These programs involved the fabrication and testing of fuel assemblies that utilized plutonium in an oxide form. The types and estimated quantities of waste resulting from these programs are discussed in detail in Section 3.0. A detailed discussion of the packaging and handling procedures used for the VNC radioactive wastes shipped to the Hanford Site is provided in Section 4.0. Section 5.0 provides an in-depth look at this waste including the following: weight and volume of the waste, container types and numbers, physical description of the waste, radiological components, hazardous constituents, and current storage/disposal locations.

1102 (WHC-EP-0682) Hazardous Materials Management and Emergency Response training Center needs assessment. McGinnis, K.A. (Westinghouse Hanford Co., Richland, WA (United States)); Bolton, P.A.; Robinson, R.K. Westinghouse Hanford Co., Richland, WA (United States). Sep 1993. 58p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94001156. Source: OSTI; NTIS; INIS; GPO Dep.

For the Hanford Site to provide high-quality training using simulated job-site situations to prepare the 4,000 Site workers and 500 emergency responders for known and unknown hazards a Hazardous Materials Management and Emergency Response Training Center is needed. The center will focus on providing classroom lecture as well as hands-on, realistic training. The establishment of the center will create a partnership among the US Department of Energy; its contractors; labor; local, state, and tribal governments; and Xavier and Tulane Universities of Louisiana. This report presents the background, history, need, benefits, and associated costs of the proposed center.

1103 (WHC-EP-0683) Adiabatic calorimetry (RSST and VSP) tests with sodium acetate. Kirch, N.W. Westinghouse Hanford Co., Richland, WA (United States). Sep 1993. 31p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94003493. Source: OSTI; NTIS; INIS; GPO Dep.

As requested in the subject reference, adiabatic calorimetry (RSST and VSP) tests have been performed with sodium acetate covering TOC concentrations from 3 to 7% with the following results: Exothermic activity noted around 200°C. Propagating reaction initiated at about 300°C. Required TOC concentration for propagation estimated at about 6 w% (dry mixture) or about 20 w% sodium acetate. Heat of reaction estimated to be 3.7 MJ per kg of sodium acetate (based

on VSP test with 3 w% TOC and using a dry mixture specific heat of 1000 J kg⁻¹ K⁻¹). Based upon the above results we estimate that a moisture content in excess of 14 w% would prevent a propagating reaction of a stoichiometric mixture of fuel and oxidizer (~38 w% sodium acetate and ~62 w% sodium nitrate). Assuming that the fuel can be treated as sodium acetate equivalent, and considering that the moisture content in the organic containing waste generally is believed to be in excess of 14 w%, it follows that the possibility of propagating reactions in the Hanford waste tanks can be ruled out.

1104 (WHC-EP-0686) Explosion testing for the container venting system. Cashdollar, K.L. (Department of the Interior, Washington, DC (United States)); Green, G.M.; Thomas, R.A.; Demiter, J.A. Westinghouse Hanford Co., Richland, WA (United States). 30 Sep 1993. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94003488. Source: OSTI; NTIS; INIS; GPO Dep.

As part of the study of the hazards of inspecting nuclear waste stored at the Hanford Site, the US Department of Energy and Westinghouse Hanford Company have developed a container venting system to sample the gases that may be present in various metal drums and other containers. In support of this work, the US Bureau of Mines has studied the probability of ignition while drilling into drums and other containers that may contain flammable gas mixtures. The Westinghouse Hanford Company drilling procedure was simulated by tests conducted in the Bureau's 8-liter chamber, using the same type of pneumatic drill that will be used at the Hanford Site. There were no ignitions of near-stoichiometric hydrogen-air or methane-air mixtures during the drilling tests. The temperatures of the drill bits and lids were measured by an infrared video camera during the drilling tests. These measured temperatures are significantly lower than the ~500°C autoignition temperature of uniformly heated hydrogen-air or the ~600°C autoignition temperature of uniformly heated methane-air. The temperatures are substantially lower than the 750°C ignition temperature of hydrogen-air and 1,220°C temperature of methane-air when heated by a 1-m-diameter wire.

1105 (WHC-EP-0697) Acid digestion demonstration (WeDID). Crippen, M.D. Westinghouse Hanford Co., Richland, WA (United States). Nov 1993. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94005422. Source: OSTI; NTIS; GPO Dep.

Acid digestion process development began at the Hanford Site in 1972 with a beaker of laboratory acid and progressed through laboratory and pilot-scale development culminating in the Radioactive Acid Digestion Test Unit (RADTU). The RADTU was operational from 1977 through 1982 and processed over 5,000 kg of synthetic and combustible waste forms from Hanford Site operations. It routinely reacted plastics, wood, paper, cloth, ion-exchange resins, metals, and solvents. Operation of RADTU routinely gave volume reductions of 100:1 for most plastics and other combustibles. The residue was inert and was disposed of both as generated and after application of other immobilization techniques, such as calcination, addition to glass, and cement addition. The system was designed to accommodate offgas surges from highly reactive nitrated organics and successfully demonstrated that capability. The system was designed and operated under very stringent safety standards. The Weapons Destruction Integrated Demonstration

(WeDID) program required a technology that could dispose of an assortment of weapon components, such as complex electronics, neutron generators, thermal batteries, plastics, cases, cables, and others. A program objective was to recycle and reuse materials wherever possible, but many unique components would need to be rendered inactive, inert, and suitable for disposal under current environmental laws. Acid digestion technology was a key candidate for treating many of the above components; it provided accepted technology for treatment of chemicals and elements that have posed disposal difficulties designated by the US Environmental Protection Agency (EPA).

1106 (WHC-EP-0719) Radioactive waste shipments to Hanford retrievable storage from Babcock and Wilcox, Leechburg, Pennsylvania. Duncan, D.R. Westinghouse Hanford Co., Richland, WA (United States). 14 Feb 1994. 158p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94009754. Source: OSTI; NTIS; INIS; GPO Dep.

This report characterizes, as far as possible, the solid radioactive wastes generated by Babcock and Wilcox's Park Township Plutonium Facility near Leechburg, Pennsylvania that were sent to retrievable storage at the Hanford Site. Solid waste as defined in this document is any containerized or self-contained material that has been declared waste. The objective is a description of characteristics of solid wastes that are or will be managed by the Restoration and Upgrades Program; gaseous or liquid effluents are discussed only at a summary level. This characterization is of particular interest in the planning of transuranic (TRU) waste retrieval operations, including the Waste Receiving and Processing (WRAP) Facility, because Babcock and Wilcox generated greater than 2.5 percent of the total volume of TRU waste currently stored at the Hanford Site.

1107 (WHC-EP-0737) The chemistry of tributyl phosphate at elevated temperatures in the Plutonium Finishing Plant Process Vessels. Barney, G.S.; Cooper, T.D. Westinghouse Hanford Co., Richland, WA (United States). [1994]. 60p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94012399. Source: OSTI; NTIS; INIS; GPO Dep.

Potentially violent chemical reactions of the tributyl phosphate solvent used by the Plutonium Finishing Plant at the Hanford Site were investigated. There is a small probability that a significant quantity of this solvent could be accidental transferred to heated process vessels and react there with nitric acid or plutonium nitrate also present in the solvent extraction process. The results of laboratory studies of the reactions show that exothermic oxidation of tributyl phosphate by either nitric acid or actinide nitrates is slow at temperatures expected in the heated vessels. Less than four percent of the tributyl phosphate will be oxidized in these vented vessels at temperatures between 125°C and 250°C because the oxidant will be lost from the vessels by vaporization or decomposition before the tributyl phosphate can be extensively oxidized. The net amounts of heat generated by oxidation with concentrated nitric acid and with thorium nitrate (a stand-in for plutonium nitrate) were determined to be about -150 and -220 joules per gram of tributyl phosphate initially present, respectively. This is not enough heat to cause violent reactions in the vessels. Pyrolysis of the tributyl phosphate occurred in these mixtures at temperatures of 110°C to 270°C and produced mainly 1-butene gas, water, and pyrophosphoric acid. Butene gas generation is slow at expected process vessel temperatures, but the

rate is faster at higher temperatures. At 252°C the rate of butene gas generated was 0.33 g butene/min/g of tributyl phosphate present. The measured heat absorbed by the pyrolysis reaction was 228 J/g of tributyl phosphate initially present (or 14.5 kcal/mole of tributyl phosphate). Release of flammable butene gas into process areas where it could ignite appears to be the most serious safety consideration for the Plutonium Finishing Plant.

1108 (WHC-EP-0747) Final report of the TWRS Plant Implementation Team to review potential reactive component in tank 241-T-111 and methane in tank 241-SY-101 gas release event. Engelman, D.B. Westinghouse Hanford Co., Richland, WA (United States). Feb 1994. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94012400. Source: OSTI; NTIS; INIS; GPO Dep.

This is the final report of the results of a Tank Waste Remediation Systems Plant Implementation Team chartered by TWRS Operations, in response to a potential Unreviewed Safety Question (USQ) due to the discovery of a reactive component in waste tank 241-T-111 (T-111). Tank T-111, a non-Watch List single-shell tank, has no historical evidence of any potential safety problems. Core samples from tank T-111 were taken in 1991 and analyzed in 1992. The presence of uncharacterized exotherms was identified in the first three segments of two cores and reported to tank farm management in November 1993.

1109 (WHC-EP-0757) Technology Evaluation Workshop Report for Tank Waste Chemical Characterization. Eberlein, S.J. Westinghouse Hanford Co., Richland, WA (United States). Apr 1994. 114p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94010887. Source: OSTI; NTIS; INIS; GPO Dep.

A Tank Waste Chemical Characterization Technology Evaluation Workshop was held August 24-26, 1993. The workshop was intended to identify and evaluate technologies appropriate for the in situ and hot cell characterization of the chemical composition of Hanford waste tank materials. The participants were asked to identify technologies that show applicability to the needs and good prospects for deployment in the hot cell or tanks. They were also asked to identify the tasks required to pursue the development of specific technologies to deployment readiness. This report describes the findings of the workshop. Three focus areas were identified for detailed discussion: (1) elemental analysis, (2) molecular analysis, and (3) gas analysis. The technologies were restricted to those which do not require sample preparation. Attachment 1 contains the final workshop agenda and a complete list of attendees. An information package (Attachment 2) was provided to all participants in advance to provide information about the Hanford tank environment, needs, current characterization practices, potential deployment approaches, and the evaluation procedure. The participants also received a summary of potential technologies (Attachment 3). The workshop opened with a plenary session, describing the background and issues in more detail. Copies of these presentations are contained in Attachments 4, 5 and 6. This session was followed by breakout sessions in each of the three focus areas. The workshop closed with a plenary session where each focus group presented its findings. This report summarizes the findings of each of the focus groups. The evaluation criteria and information about specific technologies are tabulated at the end

of each section in the report. The detailed notes from each focus group are contained in Attachments 7, 8 and 9.

1110 (WHC-MR-0259) Hanford Waste Vitrification Plant project Preliminary Safety Analysis Report comment response records. Herborn, D.I.; Campbell, L.M. Westinghouse Hanford Co., Richland, WA (United States). Jun 1991. 833p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91016781. Source: OSTI; NTIS; INIS; GPO Dep.

The initial draft version of the Hanford Waste Vitrification Plant (HWVP) Preliminary Safety Analysis Report (PSAR) was issued for review and comment on July 17, 1989, and was designated as Revision A. Following resolution of comments arising from the Revision A review, the PSAR was revised as a final draft. This version, which was designated as HWVP PSAR, Revision B, was issued for review and comment on July 16, 1990. The PSAR was again revised as Revision O following the resolution of the Revision B comments. The HWVP PSAR, Revision O, was approved by Westinghouse Hanford Company (Westinghouse Hanford) on May 21, 1991, and issued as WHC-EP-0250, Hanford Waste Vitrification Plant Preliminary Safety Analysis Report to the Department of Energy-Richland Operations Office (DOE-RL). While Westinghouse Hanford organizations were reviewing the drafts of the HWVP PSAR (i.e., Revisions A and B), a parallel review was being performed by the DOE-RL on both versions. This supporting document provides a summary of the PSAR Comment Response Databases for the Westinghouse Hanford and DOE-RL reviews of HWVP PSAR, Revisions A and B. This document also provides copies of all the closed-out Review Comment Records (RCR) submitted by these organizations. 8 refs., 1 fig., 2 tabs.

1111 (WHC-MR-0289) Documentation of Hanford Site Independent review of the Hanford Waste Vitrification Plant Preliminary Safety Analysis Report. Herborn, D.I. Westinghouse Hanford Co., Richland, WA (United States). Oct 1991. 45p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92003021. Source: OSTI; NTIS; INIS; GPO Dep.

The requirements for Westinghouse Hanford independent review of the Preliminary Safety Analysis Report (PSAR) are contained in Section 1.0, Subsection 4.3 of WCH-CM-4-46. Specifically, this manual requires the following: (1) Formal functional reviews of the HWVP PSAR by the future operating organization (HWVP Operations), and the independent review organizations (HWVP and Environmental Safety Assurance, Environmental Assurance, and Quality Assurance); and (2) Review and approval of the HWVP PSAR by the Tank Waste Disposal (TWD) Subcouncil of the Safety and Environmental Advisory Council (SEAC), which provides independent advice to the Westinghouse Hanford President and executives on matters of safety and environmental protection. 7 refs.

1112 (WHC-MR-0289-Rev.1) Documentation of Hanford Site Independent review of the Hanford Waste Vitrification Plant preliminary safety analysis report: Revision 1. Herborn, D.I. Westinghouse Hanford Co., Richland, WA (United States). Dec 1991. 82p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92004569. Source: OSTI; NTIS; GPO Dep.

Westinghouse Hanford Company (Westinghouse Hanford) is the Integrating Contractor for the Hanford Waste Vitrification Plant (HWVP) Project, and as such is responsible for preparation of the HWVP Preliminary Safety Analysis Report (PSAR). The HWVP PSAR was prepared pursuant to the requirements for safety analyses contained in the US Department of Energy (DOE) Orders 4700.1, Project Management System (DOE 1987); 5480.5, Safety of Nuclear Facilities (DOE 1986a); 5481.1B, Safety Analysis and Review System (DOE 1986b); and 6430.1A, General Design Criteria (DOE 1989). This manual describes the overall Westinghouse Hanford safety analysis process in terms of requirements for safety analyses, responsibilities of the various contributing organizations, and required reviews and approvals.

1113 (WHC-MR-0289-Rev.2) Documentation of Hanford Site Independent review of the Hanford Waste Vitrification Plant Preliminary Safety Analysis Report: Revision 2. Herborn, D.I. Westinghouse Hanford Co., Richland, WA (United States). Oct 1992. 106p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93005898. Source: OSTI; NTIS; INIS; GPO Dep.

This manual describes the overall WHC safety analysis process in terms of requirements for safety analyses, responsibilities of the various contributing organizations, and required reviews and approvals for the Hanford Waste Vitrification Plant.

1114 (WHC-MR-0289-Rev.3) Documentation of Hanford Site Independent review of the Hanford Waste Vitrification Plant Preliminary Safety Analysis Report: Revision 3. Herborn, D.I. Westinghouse Hanford Co., Richland, WA (United States). Nov 1993. 298p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94009388. Source: OSTI; NTIS; INIS; GPO Dep.

Westinghouse Hanford Company (WHC) is the Integrating Contractor for the Hanford Waste Vitrification Plant (HWVP) Project, and as such is responsible for preparation of the HWVP Preliminary Safety Analysis Report (PSAR). The HWVP PSAR was prepared pursuant to the requirements for safety analyses contained in US Department of Energy (DOE) Orders 4700.1, Project Management System (DOE 1987); 5480.5, Safety of Nuclear Facilities (DOE 1986a); 5481.1B, Safety Analysis and Review System (DOE 1986b) which was superseded by DOE order 5480-23, Nuclear Safety Analysis Reports, for nuclear facilities effective April 30, 1992 (DOE 1992); and 6430.1A, General Design Criteria (DOE 1989). The WHC procedures that, in large part, implement these DOE requirements are contained in WHC-CM-4-46, Nonreactor Facility Safety Analysis Manual. This manual describes the overall WHC safety analysis process in terms of requirements for safety analyses, responsibilities of the various contributing organizations, and required reviews and approvals.

1115 (WHC-MR-0375) Identification of crystals in Hanford nuclear waste using polarized light microscopy. Herting, D.L. Westinghouse Hanford Co., Richland, WA (United States). Mar 1992. 52p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92014413. Source: OSTI; NTIS; INIS; GPO Dep.

The use of polarized light microscopy for identifying crystals encountered in Westinghouse Hanford Company

chemical studies is described. Identifying characteristics and full-color photographs are presented for crystals commonly found in Hanford Site nuclear waste, including sodium nitrate, sodium aluminate, sodium phosphate, sodium fluoride, ammonium heptafluorozirconate, sodium sulfate, sodium carbonate, and ammonium nitrate. These characteristics are described in terms of birefringence, extinction position, interference figure, sign of elongation, optic sign, and crystal morphology. Background information on crystal optics is presented so that these traits can be understood by the nonmicroscopist. Detailed operational instructions are given so that the novice microscope user can make the proper adjustments of the instrument to search for and observe the identifying features of the crystals.

1116 (WHC-MR-0388) Compilation of historical information of 300 Area facilities and activities. Gerber, M.S. Westinghouse Hanford Co., Richland, WA (United States). Dec 1992. 309p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93006526. Source: OSTI; NTIS; INIS; GPO Dep.

This document is a compilation of historical information of the 300 Area activities and facilities since the beginning. The 300 Area is shown as it looked in 1945, and also a more recent (1985) look at the 300 Area is provided.

1117 (WHC-MR-0398) Hanford Waste Vitrification Plant technical background document for toxics best available control technology demonstration. Westinghouse Hanford Co., Richland, WA (United States); Ebasco Environmental, Richland, WA (United States). Oct 1992. 181p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93004983. Source: OSTI; NTIS; INIS; GPO Dep.

This document provides information on toxic air pollutant emissions to support the Notice of Construction for the proposed Hanford Waste Vitrification Plant (HWVP) to be built at the Department of Energy Hanford Site near Richland, Washington. Because approval must be received prior to initiating construction of the facility, state and federal Clean Air Act Notices of construction are being prepared along with necessary support documentation.

1118 (WHC-MR-0416) Miscellaneous information regarding operation and inventory of 618-11 Burial Ground. Webb, C.R. Westinghouse Hanford Co., Richland, WA (United States). Jun 1993. 94p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93017799. Source: OSTI; NTIS; GPO Dep.

Engineering drawings for this project are identified as CAPE-3065. Inquiries may be directed to: Office of Scientific and Technical Information, P.O. Box 62, Oak Ridge, TN 37831 (United States).

This report is a compilation of inventories and radiation surveys taken for the 618-11 Burial Ground at Hanford. This report deals with waste management activities at the facility during the early to mid-1960s.

1119 (WHC-MR-0423) Westinghouse Hanford Company package testing capabilities. Hummer, J.H.; Mercado, M.S. Westinghouse Hanford Co., Richland, WA (United States). Jul 1993. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93019974. Source: OSTI; NTIS; INIS; GPO Dep.

The Department of Energy's Hanford Site is a 1,450-km² (560-mi²) installation located in southeastern Washington State. Established in 1943 as a plutonium production facility, Hanford's role has evolved into one of environmental restoration and remediation. Many of these environmental restoration and remediation activities involve transportation of radioactive/hazardous materials. Packagings used for the transportation of radioactive/hazardous materials must be capable of meeting certain normal transport and hypothetical accident performance criteria. Evaluations of performance to these criteria typically involve a combination of analysis and testing. Required tests may include the free drop, puncture, penetration, compression, thermal, heat, cold, vibration, water spray, water immersion, reduced pressure, and increased pressure tests. The purpose of this paper is to outline the Hanford capabilities for performing each of these tests.

1120 (WHC-MR-0435) The Hanford Site: An anthology of early histories. Gerber, M.S. Westinghouse Hanford Co., Richland, WA (United States). Oct 1993. 58p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94005973. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses the following topics: Memories of War: Pearl Harbor and the Genesis of the Hanford Site; safety has always been promoted at the Hanford Site; women have an important place in Hanford Site history; the boom and bust cycle: A 50-year historical overview of the economic impacts of Hanford Site Operations on the Tri-Cities, Washington; Hanford's early reactors were crucial to the site's history; T-Plant made chemical engineering history; the UO₃ plant has a long history of service. PUREX Plant: the Hanford Site's Historic Workhorse. PUREX Plant Waste Management was a complex challenge; and early Hanford Site codes and jargon.

1121 (WHC-MR-0437) A brief history of the PUREX and UO₃ facilities. Gerber, M.S. Westinghouse Hanford Co., Richland, WA (United States). Nov 1993. 70p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94004825. Source: OSTI; NTIS; INIS; GPO Dep.

The Plutonium-Uranium Extraction (PUREX) Plant, conceived during the early Cold War years, was a vehicle to increase significantly US nuclear weapons production capacity. The original PUREX Plant was a concrete rectangle 1,005 feet long and 61.5 feet wide. The shielding capacity of the concrete was designed so that personnel in non-regulated service areas would not receive radiation in excess of 0.1 millirem per hour. This report discusses the design of the PUREX Plant, the production chronology, projects and equipment changes, equipment decontamination and reuse, waste management, and contamination events that have occurred during the operation of the plant. Additionally, the development and history of the Uranium Trioxide Plant are also covered.

1122 (WHC-MR-0440) Multiple missions: The 300 Area in Hanford Site history. Gerber, M.S. Westinghouse Hanford Co., Richland, WA (United States). Sep 1993. 64p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94005425. Source: OSTI; NTIS; INIS; GPO Dep.

This report provides an historical overview of the role of the 300 Area buildings at the Hanford Reservation. Topics covered are: Early fuel fabrication at the Hanford site (313 and 314 Buildings); N reactor fuel fabrication in the 300

Area; 305 test pile was Hanford's first operating reactor; Early process improvement chemical research (321 and 3706 Buildings); Major 1952 and 1953 expansions in the 300 area (325 and 329 Buildings); Early 300 area facilities constructed to support reactor development (326 and 327 Buildings); Hanford site ventures with the peaceful atom (309, 308 and 318 Buildings); Modern 300 Area Buildings; Significant miscellaneous buildings in the 300 area; 300 Area process waste handling and disposal.

1123 (WHC-MR-0451) Characterization of the sodium void reactivity effect for advanced liquid metal reactor fuels. Kessler, S.F. Westinghouse Hanford Co., Richland, WA (United States). Dec 1993. 250p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94005487. Source: OSTI; NTIS; INIS; GPO Dep.

Thesis submitted to University of Washington.

This report discusses the problems of a large positive sodium void reactivity effect in liquid metal reactors which have received increased attention following the accident at Chernobyl, a light water reactor with a positive coolant void coefficient. While the probability of voiding sodium is small, a large positive sodium void reactivity effect is, in many minds, unacceptable. Analyses were performed on models of an advanced liquid metal reactors to determine the effects fuel type have on the sodium void reactivity effect. Three fuel types were considered; metal, oxide, and nitride. Calculations were performed using three-dimensional, multi-group diffusion theory. Two programs were developed to aid the analyses. One calculated the capture-to-fission ratio and the other calculated reaction rates of selected materials. A one-group equation was derived to determine a theoretical basis for the sodium void reactivity effect. An option was presented for a shortened core having a near-zero sodium-void worth. The effect on the sodium void reactivity effect of using actinides as fuel is also considered.

1124 (WHC-MR-0456) Orientation to pollution prevention for facility design. Raney, E.A. (Westinghouse Hanford Co., Richland, WA (United States)); Whitehead, J.K.; Encke, D.B.; Dorsey, J.A. Westinghouse Hanford Co., Richland, WA (United States). Jan 1994. 113p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94010355. Source: OSTI; NTIS; GPO Dep.

This material was developed to assist engineers in incorporating pollution prevention into the design of new or modified facilities within the U.S. Department of Energy (DOE). The material demonstrates how the design of a facility can affect the generation of waste throughout a facility's entire life and it offers guidance on how to prevent the generation of waste during design. Contents include: Orientation to pollution prevention for facility design training course booklet; Pollution prevention design guideline; Orientation to pollution prevention for facility design lesson plan; Training participant survey and pretest; and Training facilitator's guide and schedule.

1125 (WHC-SA-0648) Cathodic protection system operating experience for underground piping at the Hanford Site. Carlos, W.C. Westinghouse Hanford Co., Richland, WA (United States). Feb 1992. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92008378. Source: OSTI; NTIS; INIS; GPO Dep.

Cathodic protection has been used on underground radioactive waste lines at the Hanford Site for more than 40 years. Studies were performed at the time the cathodic protection system was installed. This document reviews some of the historical studies and describes the old cathodic protection system. In addition, it describes the new system, a typical cathodic protection installation, relates improvements of the new system over the old system and some operating experience with the new system, and present recommendations for improvements.

1126 (WHC-SA-0818) Facility-specific waste minimization plans at Westinghouse Hanford Company. Craig, P.A. Westinghouse Hanford Co., Richland, WA (United States). Jun 1990. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-900631-2: International conference on pollution prevention: clean technologies and clean products—the environmental challenge of the 1990's, Washington, DC (United States), 10-13 Jun 1990). Order Number DE90015376. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A waste minimization program is required by public law and federal and state regulations for hazardous waste generators and treatment, storage, and disposal facilities. The US Department of Energy (DOE) has directed its contractors to develop an effective strategy to minimize the generation of hazardous, radioactive, and mixed wastes at the Hanford Site in compliance with state and federal regulations. Since Westinghouse Hanford Company (Westinghouse Hanford) has a large and diversified operation, a key component of the Westinghouse Hanford waste minimization program is facility-specific waste minimization plans which document present and future activities to reduce the volume and toxicity of waste generated. Preparation and implementation of these plans will demonstrate facility compliance to Westinghouse Hanford and DOE requirements, as well as state and federal regulations. The plans include both the goals and the activities for their achievement and provide a basis for evaluation. Preparation of the plans is divided into two phases. The first phase involves writing the "general" plan which describes the facility operations, the types of waste produced, and the administrative controls used by the facility to ensure waste minimization. The second phase involves a detailed characterization of each waste stream. This characterization includes baselining the quantity of waste generated, brainstorming possible options to minimize waste, and documenting other factors such as cost and environmental and safety issues involved with the generation of the waste. This section is ever-changing as more information is obtained and as the waste minimization program evolves. 2 figs.

1127 (WHC-SA-0825) Hanford Waste Vitrification Plant: The project and process systems. Swenson, L.D.; Miller, W.C.; Smith, R.A. Westinghouse Hanford Co., Richland, WA (United States). Jun 1990. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-900608-49: American Nuclear Society (ANS) annual meeting, Nashville, TN (United States), 10-14 Jun 1990). Order Number DE90014341. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Construction of the Hanford Waste Vitrification Plant (HWVP) Project is scheduled to start on the Hanford Reservation in southeastern Washington State in 1991. The Project will immobilize liquid high-level and transuranic (TRU) defense wastes stored there and permit ultimate

disposal of the waste in the nation's commercial deep geological repository. This document discusses the project and process systems. The HWVP represents the third phase of the US Department of Energy (DOE) activities that are focused on the permanent disposal of high-level radioactive waste, building on the experience of the Defense Waste Processing Facility (DWPF) at the Savannah River Site, South Carolina, and of the Waste Valley Demonstration Project (WVDP), New York.

1128 (WHC-SA-0826) (Alpha,n) reactions in vitrified waste. Goldberg, H.J. Westinghouse Hanford Co., Richland, WA (United States). May 1990. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-9009116-3: Spectrum '90: radioactive waste technologies, decontamination, decommissioning and hazardous wastes, Knoxville, TN (United States), 30 Sep - 4 Oct 1990). Order Number DE90011520. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A package consisting of radioactive wastes immobilized in a glass matrix must have adequate shielding in order to be handled safely. In addition to the gamma radiation from the decay of the fission products and the neutron radiation from the spontaneous fission of any actinides present, the effects of alpha-emitting radionuclides must be considered. These alpha particles will interact with the light elements present in the matrix and give rise to neutron and gamma radiation over and above that arising from the waste directly. The main thrust of this paper is to calculate the (alpha,n) contribution to the neutron flux and spectrum. 5 refs., 2 tabs.

1129 (WHC-SA-0872) Structural integrity assessment of concrete slabs by nondestructive examination and Fourier transform-infrared methods. Rebagay, T.V.; Dodd, D.A. Westinghouse Hanford Co., Richland, WA (United States). Jul 1990. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-9007109-2: Rocky Mountain analytical conference, Denver, CO (United States), 30 Jul 1990). Order Number DE90017233. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A nitric acid spill occurred in a chemical preparation room causing reaction of the concrete floor with the acid. To assess the structural integrity of the reacted concrete and to define the extent of needed repairs, a nondestructive evaluation (NDE) using pulse echo method and a Fourier transform infrared (FT-IR) spectrometric method was employed. 5 figs.

1130 (WHC-SA-0873) Mix ratio measurements of pozzolanic blends by Fourier transform infrared-attenuated total reflectance method. Rebagay, T.V.; Dodd, D.A. Westinghouse Hanford Co., Richland, WA (United States). Jul 1992. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-9208172-1: Rocky Mountain conference on analytical chemistry and applied spectroscopy, Denver, CO (United States), 2-6 Aug 1992). Order Number DE93001663. Source: OSTI; NTIS; INIS; GPO Dep.

The disposal of low-level radioactive liquid wastes at the Hanford Site near Richland, Washington, involves mixing the wastes with pozzolanic grout-forming solid blends. Checking the quality of each blend component and its mix ratio will ensure processibility of the blend and the long-term performance of the resulting waste grout. In earlier work at Hanford laboratories, Fourier transform infrared-transmission method (FTIR-TR) using KBr pellet was

applied successfully in the analysis of blends consisting of cement, fly ash, and clays. This method involves time-consuming sample preparation resulting in slow turnaround for repetitive sampling. Because reflection methods do not require elaborate sample preparation, they have the potential to reduce turnaround analysis time. Neat samples may be examined making these methods attractive for quality control. This study investigates the capability of Fourier transform infrared-attenuated total reflectance method (FTIR-ATR) to analyze pozzolanic blends.

1131 (WHC-SA-0935) Selected in-tank property measurement methods for Hanford Site single-shell tanks. Morris, K.L.H.; Shattuck, A.F.; Covert, W.A. Westinghouse Hanford Co., Richland, WA (United States). Sep 1990. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-901101-40: American Nuclear Society (ANS) winter meeting, Washington, DC (United States), 11-16 Nov 1990). Order Number DE91001283. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The Westinghouse Hanford Company operates the Hanford Site in Washington State for the US Department of Energy. As part of an agreement between the US Department of Energy, the US Environmental Protection Agency, and the Washington State Department of Ecology, Westinghouse Hanford Company has undertaken to clean up the underground tanks located on the Site. These tanks store various radioactive and hazardous wastes produced from chemical processes to refine spent nuclear fuel into defense materials. As part of the cleanup process, equipment must be developed to remove the waste. To design this equipment, the waste must be characterized by its mechanical properties and simulated waste must be made to emulate these properties for equipment testing. A survey of available remote (in-tank) and laboratory techniques was undertaken and the resulting plan to gather all the necessary information involves a three-step approach: laboratory measurements, laboratory measurements on historical synthetic waste mixtures, and in-tank measurements. A list of mechanical properties to be gathered is also included. 3 refs., 3 figs., 2 tabs.

1132 (WHC-SA-0939) Versatility and innovations for a new mission at the Hanford Site. Friar, S.L. Westinghouse Hanford Co., Richland, WA (United States). Oct 1990. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-901101-62: American Nuclear Society (ANS) winter meeting, Washington, DC (United States), 11-16 Nov 1990). Order Number DE91004557. Source: OSTI; NTIS; INIS; GPO Dep.

The B Plant located at the Hanford Site in southeastern Washington State is a nuclear processing plant that was constructed in 1945. Over the last 45 years the plant mission has changed three times. This has been possible because of the versatility of the remote operating mode of B Plant. In order to accommodate mission changes, the plant was required to make major modifications in cell processing equipment. Many of these modifications were accomplished remotely. During each mission, the process had to be modified as individual campaigns were completed and new campaigns begun. The B Plant is now in an upgrade mode with two new missions that will support the facility into the 21st century. These upgrades are possible with the versatility of the 75-ton capacity bridge crane and the layout of the processing cells. These upgrades will include two new processes (i.e., Neutralized Current Acid Waste [NCAW] and

Transuranic Extraction [TRUEX]). The NCAW process will use approximately 10 existing cells at B Plant. This will require the design and fabrication of approximately 60 new jumpers and a new ion exchange column. The plant will also add new pumps and agitators to support this process. The TRUEX process changes will be more comprehensive in scope.

1133 (WHC-SA-0963) Materials evaluation for a transuranic processing facility. Barker, S.A., Schwenk, E.B. (Westinghouse Hanford Co., Richland, WA (USA)); Divine, J.R. (Westinghouse Hanford Co., Richland, WA (United States)). Nov 1990. 35p. Sponsored by USDOE, Washington, DC (USA). DOE Contract AC06-87RL10930. (CONF-901101-84: American Nuclear Society (ANS) winter meeting, Washington, DC (United States), 11-16 Nov 1990). Order Number DE91011056. Source: OSTI; NTIS; INIS; GPO Dep.

The Westinghouse Hanford Company, with the assistance of the Pacific Northwest Laboratory, is developing a transuranium extraction process for preheating double-shell tank wastes at the Hanford Site to reduce the volume of transuranic waste being sent to a repository. The bench-scale transuranium extraction process development is reaching a stage where a pilot plant design has begun for the construction of a facility in the existing B Plant. Because of the potential corrosivity of neutralized cladding removal waste process streams, existing embedded piping alloys in B Plant are being evaluated and "new" alloys are being selected for the full-scale plant screening corrosion tests. Once the waste is acidified with HNO_3 , some of the process streams that are high in F^- and low in Al and Zr can produce corrosion rates exceeding 30,000 mil/yr in austenitic alloys. Initial results are reported concerning the applicability of existing plant materials to withstand expected process solutions and conditions to help determine the feasibility of locating the plant at the selected facility. In addition, process changes are presented that should make the process solutions less corrosive to the existing materials. Experimental work confirms that Hastelloy B is unsatisfactory for the expected process solutions; type 304L, 347 and 309S stainless steels are satisfactory for service at room temperature and 60°C, if process stream complexing is performed. Inconel 625 was satisfactory for all solutions. 17 refs., 5 figs., 8 tabs.

1134 (WHC-SA-0975) Quantitative measurements of fly ash, slag, and cement in limestone-based blends by Fourier transform infrared-attenuated total reflectance method. Rebagay, T.V.; Dodd, D.A.; Claghorn, R.D.; Voogd, J.A. (Westinghouse Hanford Co., Richland, WA (United States)). Feb 1991. 20p. Sponsored by USDOE, Washington, DC (USA). DOE Contract AC06-87RL10930. (CONF-910311-2: 42. Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy, Chicago, IL (United States), 4-8 Mar 1991). Order Number DE91011062. Source: OSTI; NTIS; INIS; GPO Dep.

The disposal of the low-level radioactive liquids involves mixing the liquid waste with pozzolanic blend to form grout. Since the long-term performance of the grout depends on the composition of the blend, a rapid and reliable quantitative method to monitor blend compositions is needed. Earlier studies by Westinghouse Hanford Company demonstrated the utility of a Fourier transform infrared-attenuated total reflectance method for the analysis of cement blends. A sequential spectral subtraction technique was used to analyze the blend; however, its reproducibility depends on the

operator's skill to perform spectral subtractions. A partial-least-squares (PLS) algorithm has replaced spectral subtraction. The PLS method is a statistical quantitative method suitable for analysis of multicomponent systems. Calibration blends are prepared by mixing the blend components in various proportions following a carefully designed calibration model. For the model, limestone content ranges from 30-50 wt%; blast furnace slag from 18-38 wt%; fly ash from 18-38 wt%; and cement from 0-16 wt%. Use of the large concentration range will enhance the chance that the calibration will be useful when target concentration change. The ability of the PLS method to predict limestone, slag, fly ash, and cement values in test blends was assessed. The prediction step of the PLS algorithm required only a few seconds to analyze the test spectra. The best and worst results for each component of the blends calculated by this method are shown in tables. The standard error of prediction of the true value is <2 wt% for limestone, <4 wt% for both fly ash and blast furnace slag, and <10 wt% for cement. 2 refs., 8 figs., 7 tabs.

1135 (WHC-SA-1000) Permitting of the Hanford Waste Vitrification Plant. LaRue, J.H. (Westinghouse Hanford Co., Richland, WA (USA)); Cross, S.L. (Westinghouse Hanford Co., Richland, WA (United States)). Feb 1991. 9p. Sponsored by USDOE, Washington, DC (USA). DOE Contract AC06-87RL10930. (CONF-910270-27: Waste management '91, Tucson, AZ (United States), 24 Feb - 1 Mar 1991). Order Number DE91009215. Source: OSTI; NTIS; INIS; GPO Dep.

The Hanford Waste Vitrification Plant will be constructed to treat the high-level fraction of the radioactive liquid waste stored in tanks at the Hanford Site. Normal permitting practices under the Washington State Dangerous Waste Regulations require a facility to apply for and receive a final facility permit based on a completed design prior to the start of facility construction. However, the enormity and complexity of a project the size of the Hanford Waste Vitrification Plant dictates that construction begin before design is complete. An innovative permitting strategy has been developed to initiate timely construction of the Hanford Waste Vitrification Plant while providing the Washington State Department of Ecology with the necessary regulatory oversight. This strategy calls for a "multi-stage" permitting process, a process in which permits will be issued at various stages of facility design, construction, and operation. This process will also include Washington State Department of Ecology staff participation in the review of draft drawings and specifications, monthly meetings with the US Department of Energy, and onsite inspections. The concept of permitting the Hanford Waste Vitrification Plant at various stages in the design and construction process is a novel approach to the normal regulatory procedure of a single final permit. This approach will allow the Hanford Waste Vitrification Plant Project to stay on schedule while still maintaining the regulatory agency's oversight role. 6 refs., 5 figs.

1136 (WHC-SA-1001) Waste minimization at the Department of Energy's Hanford Site. Lindsey, D.W.; Craig, P.A.; Nichols, D.H. (Westinghouse Hanford Co., Richland, WA (United States)). Jan 1991. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-910270-14: Waste management '91, Tucson, AZ (United States), 24 Feb - 1 Mar 1991). Order Number DE91007974. Source: OSTI; NTIS; INIS; GPO Dep.

This paper provides an overview of waste minimization activities at the Hanford Site. The paper briefly looks at the

activities and types of wastes generated at the Hanford Site and provides a summary of the program to implement sitewide waste minimization. Several case histories are presented to highlight sources of the waste minimization successes at the Hanford Site to date. Also, recently initiated programs that hold promise for significantly reducing future waste generation are identified. 4 figs.

1137 (WHC-SA-1005) Removal of dissolved and suspended radionuclides from Hanford Waste Vitrification Plant liquid wastes. Sharp, S.D. (Fluor Daniel, Inc., Irvine, CA (USA)); Nankani, F.D.; Bray, L.A.; Eakin, D.E.; Larson, D.E. Westinghouse Hanford Co., Richland, WA (United States). Dec 1990. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930 ; AC06-76RL01830. (CONF-910435-44: 2. annual American Nuclear Society (ANS) international high level radioactive waste management conference, Las Vegas, NV (United States), 28 Apr - 3 May 1991). Order Number DE91007174. Source: OSTI; NTIS; INIS; GPO Dep.

It was determined during Preliminary Design of the Hanford Waste Vitrification Plant that certain intermediate process liquid waste streams should be decontaminated in a way that would permit the purge of dissolved chemical species from the process recycle shop. This capability is needed to ensure proper control of product glass chemical composition and to avoid excessive corrosion of process equipment. This paper discusses the process design of a system that will remove both radioactive particulates and certain dissolved fission products from process liquid waste streams. Supporting data obtained from literature sources as well as from laboratory- and pilot-scale tests are presented. 3 refs., 1 fig., 3 tabs.

1138 (WHC-SA-1008) Dynamic analysis of a postulated hydrogen burn in a waste storage tank. Moore, C.J.; Dyrness, A.D.; Julyk, L.J.; Fox, G.L.; Green, D.J. Westinghouse Hanford Co., Richland, WA (United States). Jan 1991. 17p. Sponsored by USDOE, Washington, DC (USA). DOE Contract AC06-87RL10930. (CONF-910602-21: 1991 American Society of Mechanical Engineers (ASME) pressure vessels and piping conference, San Diego, CA (United States), 23-28 Jun 1991). Order Number DE91010109. Source: OSTI; NTIS; INIS; GPO Dep.

The scope of this paper includes the determination of the structural response of a tank subjected to beyond-design-basis postulated hydrogen burn events. The load definition includes characterization of two burn mixtures, one consistent with a burn above the crust and the other consistent with a burn below the crust. Two burn times are postulated, a best-estimate one second burn time and an upper-bound 10 ms burn time approaching a detonation condition. Three burn scenarios are considered. The first scenario assumes that ignition occurs above the crust in the freeboard dome region of the tank. A second scenario assumes that ignition occurs below the crust, but the crust is assumed to breakup upon ignition; hence the burn process incorporates the above-crust gas mixture. This scenario accounts for potential crust material impact loads on the dome. The third scenario, which incorporates the below-crust gas mixture, is an idealized representation of an intact crust. In the finite-element representation the crust behaves like a piston which compresses the air mixture in the dome, and, where the crust contacts the dome, impact forces are generated. 5 refs., 23 figs., 2 tabs.

1139 (WHC-SA-1019) Justification for reporting negative value counting results as an alternative to minimum detectable activity. Troyer, G.L.; Brown, R.C.; Jones, R.A. Westinghouse Hanford Co., Richland, WA (United States). Mar 1991. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-910422-4: International topical conference on methods and applications of radioanalytical chemistry II (MARC-2), Kona, HI (United States), 21-27 Apr 1991). Order Number DE91018165. Source: OSTI; NTIS; GPO Dep.

Proper measurements of sample radioactivity require removal of background activity as a final step in generating an analytical result. When the sample response is within the standard deviation of the background activity, results often are reported as less than detectable or at a minimum detectable activity (MDA) value. Using the MDA creates a truncated distribution or censored data situation. Where a sample point has repeated measurements a bias is introduced. Further, real results can have analytical error statements. These error statements are lost when a MDA is reported. Investigation of a large number of net counting data for low activity sample points suggests that reporting negative results can provide more information than merely truncating to the MDA when results are near background activities. Four cases are examined: method performance, determination of low level activities, general background stability, and quality of results. 10 refs., 5 figs., 1 tab.

1140 (WHC-SA-1020) Mixed waste management at the Hanford Site. Roberts, R.J.; Jasen, W.G. Westinghouse Hanford Co., Richland, WA (United States). Jan 1991. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-911040-4: International waste management conference, Seoul (Korea, Republic of), 21-26 Oct 1991). Order Number DE91010834. Source: OSTI; NTIS; INIS; GPO Dep.

Various types of waste have been generated during the 50-year history of the Hanford Site. Regulatory changes in the last 20 years have provided the emphasis for better management of these wastes. Interpretations of the Atomic Energy Act (AEA) and the Resource Conservation and Recovery Act (RCRA) have led to the definition of a group of wastes called radioactive mixed wastes (RMW). As a result of the radioactive and hazardous properties of these wastes, special projects have been initiated for the management of RMW. This paper addresses the management of solid RMW. The management of bulk liquid RMW will not be described. 7 refs., 4 figs.

1141 (WHC-SA-1044) Assessment of high-temperature thermal processes to treat mixed waste at the Hanford Site. Broomfield, B.J.; Fort, L.A. Westinghouse Hanford Co., Richland, WA (United States). May 1991. 22p. Sponsored by USDOE, Washington, DC (USA). DOE Contract AC06-87RL10930. (CONF-910559-6: 10. annual international incineration conference: environmental concerns and controls, Knoxville, TN (United States), 13-17 May 1991). Order Number DE91014645. Source: OSTI; NTIS; INIS; GPO Dep.

This paper summarizes a study to evaluate thermal technologies for the treatment of Hanford Site radioactive and mixed wastes. Capital and operating costs of the alternate technologies were estimated and compared to the shred/grout operation currently planned for implementation. Results show a potential life cycle cost savings of \$1,400,000,000 could be realized by use of a treatment

technology that minimizes waste volume and yields to a stable waste form. The primary objective of this study was to evaluate technologies for the treatment of Hanford Site low-level, mixed solid wastes to meet regulatory criteria for disposal. To obtain a comprehensive perspective for performing this evaluation, the waste management requirements from cradle to grave were considered, including waste sampling and analysis, sorting, segregation, size reduction, treatment, posttreatment of residuals to meet disposal criteria, shipping, and final disposal. The costs and benefits of the alternate treatment technology (ies) were then to be compared to the shred/grout system currently planned for implementation in the WRAP Facility. Wastes considered in the studies included all mixed, TRU, Class 3 and "Greater than Class 3" LLW, and nonradioactive hazardous waste. 15 refs., 12 figs., 2 tabs.

1142 (WHC-SA-1092) Shipping encapsulated CS-137 sources as special and normal form. Robbins, E.D. (Westinghouse Hanford Co., Richland, WA (USA)); Carlson, D. Westinghouse Hanford Co., Richland, WA (United States). Jan 1991. 12p. Sponsored by USDOE, Washington, DC (USA). DOE Contract AC06-87RL10930. (CONF-910270-41: Waste management '91, Tucson, AZ (United States), 24 Feb - 1 mar 1991). Order Number DE91010107. Source: OSTI; NTIS; INIS; GPO Dep.

In June 1988, a Cesium-137 irradiation source, located in a commercial irradiation facility water basin near Atlanta, Georgia, began to leak. Because of the failure of this source, the decision was made to transport it and all similar sources back to their place of manufacture at the Hanford Site in southeastern Washington State. As this shipping campaign progressed, many challenges were encountered, and the process of underwater loading, dewatering, and drying the transportation packages went through a significant evolution. The loading methods and drying standards that resulted may reflect a trend in underwater packaging requirements for this type of material. 3 figs.

1143 (WHC-SA-1166) Toxicity assessment of Hanford Site wastes by bacterial bioluminescence. Rebagay, T.V.; Dodd, D.A.; Voogd, J.A. Westinghouse Hanford Co., Richland, WA (United States). Sep 1991. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-9110105-1: 18. annual meeting of the Federation of Analytical Chemistry and Spectroscopists and the 30th Pacific conference on chemistry and spectroscopy, Anaheim, CA (United States), 6-11 Oct 1991). Order Number DE92002232. Source: OSTI; NTIS; INIS; GPO Dep.

This paper examines the toxicity of the nonradioactive component of low-level wastes stored in tanks on the Hanford reservation. The use of a faster, cheaper bioassay to replace the 96 hour fish acute toxicity test is examined. The new bioassay is based on loss of bioluminescence of *Photobacter phosphoreum* (commonly called Microtox) following exposure to toxic materials. This bioassay is calibrated and compares well to the standard fish acute toxicity test for characterization of Hanford Wastes. 4 refs., 11 figs., 11 tabs. (MHB)

1144 (WHC-SA-1167) Future changes in the transporting of hazardous materials and wastes. Votaw, E.F.; Winters, W.A. Westinghouse Hanford Co., Richland, WA (United States). May 1991. 17p. Sponsored by USDOE, Washington, DC (USA). DOE Contract AC06-87RL10930. (CONF-910659-21: 84. annual meeting and exhibition of

the Air and Waste Management Association (AWMA), Vancouver (Canada), 16-21 Jun 1991). Order Number DE91013240. Source: OSTI; NTIS; GPO Dep.

During the last 10 yr, the U.S. Department of Transportation (DOT), the U.S. Environmental Protection Agency (EPA), and the Occupational Health and Safety Administration (OSHA) have enacted major rulemakings design to protect the health and safety of employees and the general public to more effectively preserve our environment. These rulemakings require, at a minimum, that personnel handling and transporting hazardous materials (including hazardous wastes) be (1) trained to do their jobs in a safe manner and in compliance with the regulations, and (2) knowledgeable of applicable personal protection and emergency response procedures. Recently, the DOT has enacted several new requirements and is proposing many rulemakings that will have major impact on operations where hazardous materials and wastes are managed or transported. The DOT Dockets HM-126F and HM-181 are two pieces of legislation that will have a major effect on shippers and carriers of hazardous materials and wastes. The transportation safety regulations that are being revised will require a complete overhaul of existing training programs. The effect of these rulemakings will be felt nationwide. The hazardous material and waste transportation regulatory changes being witnessed today are significant in impact and are setting the stage for the way business will be conducted throughout the 1990's and in the years beyond. 30 refs.

1145 (WHC-SA-1240) Recycle stream impacts on feed treatment flowsheets and glass formulation for the Hanford Waste Vitrification Plant. Watrous, R.A. (Westinghouse Hanford Co., Richland, WA (United States)); Kruger, O.L.; Hirma, P.; Perez, J.M. Jr. Westinghouse Hanford Co., Richland, WA (United States). May 1991. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-9104256-2: Symposium on nuclear waste management, Cincinnati, OH (United States), 28 Apr - 2 may 1991). Order Number DE91016731. Source: OSTI; NTIS; INIS; GPO Dep.

The Hanford Waste Vitrification Plant (HWVP) is being designed to vitrify high-level radioactive wastes stored at the Hanford Site. A vitrification flowsheet was developed to ensure low-level effluent streams will be sufficiently low in transuranic and beta/gamma activity to allow disposal as a solidified grout in near-surface burial vaults. To achieve this goal, the process was designed to separate high-activity components from offgas treatment and decontamination waste streams, thereby creating a recycle stream that must be combined with the plant feed. A methodology was developed for evaluation of recycle stream impacts on glass formulation, melter operability, and the ability of a single composition frit to accommodate shifts in the recycle flowsheet. Reasonable variations in recycle stream additions can be accommodated by proper selection of the frit composition. A glass waste loading of 28 wt % for pretreated neutralized current acid waste, which could be the first HWVP feed, is acceptable based on this study. 2 refs., 8 figs., 2 tabs.

1146 (WHC-SA-1318) Disposal of failed melters from defense waste vitrification facilities. Brackenbury, P.J. (Westinghouse Hanford Co., Richland, WA (United States)); King, J.; Norman, E.C. Westinghouse Hanford Co., Richland, WA (United States). Jan 1992. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-920430-59: 3. international high

level radioactive waste management (IHLRWM) conference, Las Vegas, NV (United States), 12-16 Apr 1992). Order Number DE92008084. Source: OSTI; NTIS; INIS; GPO Dep.

Currently, high-level radioactive waste forms from the US Department of Energy (DOE) defense programs at the Savannah River Site (SRS) and the Hanford Site are stored in large underground carbon steel tanks at the respective sites. Vitrification is the key technology applicable to the disposal of these high-level nuclear waste forms. Combining these waste forms with glass-forming media to create borosilicate glass will ensure safe, long-term disposal in the nation's geologic repository. Vitrification of these waste forms will be performed using large, slurry-fed melters at the Defense Waste Processing Facility (DWPF) at the SRS, and the Hanford Waste Vitrification Plant (HWVP) at the Hanford Site. As the focal point of both the DWPF and HWVP, the melter has a finite lifetime and must be replaced every 2 to 3 yr. The plant staff must interrupt their operations to effect the changeout. After removal from the main process canyon, the containerized melters will be placed into a concrete vault located on the vitrification plant site where the melter will await further processing. At SRS and the Hanford Site, new facilities are not available but must be provided to accomplish the next steps in the process of disposal: size reduction, segregation, and containerization of the various waste forms in preparation for shipment of each to their appropriate destinations. Removing the failed melters from the Vitrification Building, packaging, intra-area transport, and onsite vault storage are described.

1147 (WHC-SA-1322) The Department of Energy Performance Assessment Task Team. Wood, D.E. Westinghouse Hanford Co., Richland, WA (United States). Feb 1992. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-920307-77: Waste management '92, Tucson, AZ (United States), 1-5 Mar 1992). Order Number DE92014963. Source: OSTI; NTIS; GPO Dep.

Activities of the Performance Assessment Task Team are presented. The Team was established by the US Department of Energy-Headquarters (DOE-HQ) to integrate the activities of the sites that are preparing performance assessments (PA) for low-level waste disposal facilities. Members are included from the six US Department of Energy (DOE) sites that are currently disposing of waste, as well as representatives from DOE-HQ, the DOE Peer Review Panel, and the US Nuclear Regulatory Commission. The purpose is to recommend policy and guidance to DOE-HQ on issues that impact the PAs, including release scenarios and parameters. The intent is to make the methods as consistent as is reasonable across the DOE complex, while allowing for site-specific and facility-specific differences. The Team has reached agreement on specific recommendations for several issues, ranging from the use of passive controls to requirements for software testing and control. Discussion continues on the more complex issues, ranging from the simulation time used in the PA to methods for considering intruder protection. Initial comparisons of results from intruder scenarios showed several orders of magnitude variation. However, substantial agreement was achieved for common inputs after a detailed examination of codes and parameters revealed the reasons for differences.

1148 (WHC-SA-1350) Strategy for management of investigation-derived waste. Russell, L.E. (Westinghouse Hanford Co., Richland, WA (United States)); Hopkins, G.G.;

Smith, E.H.; Innis, P.S.; Stewart, R.K. Westinghouse Hanford Co., Richland, WA (United States). Jan 1992. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-920307-26: Waste management '92, Tucson, AZ (United States), 1-5 Mar 1992). Order Number DE92008377. Source: OSTI; NTIS; INIS; GPO Dep.

The paper outlines the strategy for handling and storing investigation-derived waste within a given operable unit until a waste unit-specific Record of Decision can be issued. To date, the Strategy for Management of Investigation-Derived Waste has not been finalized. However, formal approval by the US Environmental Protection Agency is expected soon and will result in implementation of the management strategy at waste sites in which they have been identified as the lead regulatory agency. Negotiations with the Washington State Department of Ecology are ongoing. At the time of this writing, it is uncertain what the Washington State Department of Ecology's position will be regarding investigation-derived waste. Both the US Environmental Protection Agency and the US Department of Energy believe the Strategy for Management of Investigation-Derived Waste to be protective of human health and the environment and to be a cost-effective method of dealing with the investigation-derived waste.

1149 (WHC-SA-1365) Status of performance assessment studies for the disposal of low-level radioactive waste in the 218-W-5 Burial Ground, 200 West Area, Hanford Site. Wood, M.I. Westinghouse Hanford Co., Richland, WA (United States). Feb 1992. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-920307-70: Waste management '92, Tucson, AZ (United States), 1-5 Mar 1992). Order Number DE92010708. Source: OSTI; NTIS; INIS; GPO Dep.

A performance assessment analysis is being performed at the Hanford Site to support the disposal of low-level waste. The analysis is required to achieve compliance with US Department of Energy Order 5820.2A, which states that a performance assessment analysis be submitted and approved for a particular disposal facility. Performance objectives defined in the order and other informal guidance are used to define the types of analyses and associated data collection tasks that must be completed to produce a satisfactory analysis. In this paper, the types of tasks being conducted at the Hanford Site are discussed and progress made in different areas is summarized.

1150 (WHC-SA-1396) Radioactive material packaging performance testing. Romano, T. Westinghouse Hanford Co., Richland, WA (United States). Jun 1992. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-920631-20: American Society of Mechanical Engineers (ASME) pressure vessels and piping conference, New Orleans, LA (United States), 21-25 Jun 1992). Order Number DE92012656. Source: OSTI; NTIS; INIS; GPO Dep.

In an effort to provide uniform packaging of hazardous material on an international level, recommendations for the transport of dangerous goods have been developed by the United Nations. These recommendations are performance oriented and contrast with a large number of packaging specifications in the US Department of Transportation's hazard materials regulations. This dual system presents problems when international shipments enter the US Department of Transportation's system. Faced with the question of continuing a dual system or aligning with the international system, the Research and Special Programs

Administration of the US Department of Transportation responded with Docket HM-181. This began the transition toward the international transportation system. Following close behind is Docket HM-169A, which addressed low specific activity radioactive material packaging. This paper will discuss the differences between performance-oriented and specification packaging, the transition toward performance-oriented packaging by the US Department of Transportation, and performance-oriented testing of radioactive material packaging by Westinghouse Hanford Company. Dockets HM-181 and HM-169A will be discussed along with Type A (low activity) and Type B (high activity) radioactive material packaging evaluations.

1151 (WHC-SA-1416) Environmental aspect of solid waste technology. Jasen, W.G.; Roberts, R.J. Westinghouse Hanford Co., Richland, WA (United States). Sep 1992. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-9209108-3: 3. annual meeting of USSR Nuclear Society: future of nuclear technology, St. Petersburg (Russian Federation), 14-18 Sep 1992). Order Number DE93004495. Source: OSTI; NTIS; INIS; GPO Dep.

Various types of waste have been generated during the 50-year history of the Hanford Site. This paper describes a system for the treatment, storage, and disposal of solid radioactive waste. Waste disposal criteria must be met before landfilling or disposing of a waste. In Washington State, the disposal criteria for RMW are very strict. Few RMWs currently meet the disposal criteria; therefore, these wastes must be stored until treatment is available to condition the waste for disposal. The Central Waste Complex (CWC) is designed to provide interim and long-term storage of RMW. When completed, the CWC will have the capacity to store more than 75,000 55-gal drums of waste.

1152 (WHC-SA-1418) Design basis personnel exposure estimates for the Hanford Waste Vitrification Plant. Brown, R.C.; Iwatate, D.F. Westinghouse Hanford Co., Richland, WA (United States). Jun 1992. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-920617-13: Annual meeting of the Health Physics Society, Columbus, OH (United States), 21-25 Jun 1992). Order Number DE92019777. Source: OSTI; NTIS; INIS; GPO Dep.

The Hanford Waste Vitrification Plant (HWVP) is undergoing design and will be constructed at the Hanford Site near Richland, Washington. This facility will vitrify pretreated, Hanford Site defense, liquid high-level and transuranic wastes into borosilicate glass. Molten glass will be poured into stainless steel canisters for eventual interment at a geologic repository. The facility is designed for remote operation and maintenance.

1153 (WHC-SA-1423) Managing Hanford Site solid waste through strict acceptance criteria. Jasen, W.G.; Pierce, R.D.; Willis, N.P. Westinghouse Hanford Co., Richland, WA (United States). Feb 1993. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930205-65: Waste management '93, Tucson, AZ (United States), 28 Feb - 4 Mar 1993). Order Number DE93014190. Source: OSTI; NTIS; INIS; GPO Dep.

Various types of waste have been generated during the 50-year history of the Hanford Site. Regulatory changes in the last 20 years have provided the emphasis for better management of these wastes. Interpretations of the Atomic

Energy Act of 1954 (AEA) and the Resource Conservation and Recovery Act of 1976 (RCRA) have led to the definition of a group of wastes called radioactive mixed wastes (RMW). As a result of the radioactive and hazardous properties of these wastes, strict management programs have been implemented for the management of these wastes. Solid waste management is accomplished through a systems performance approach to waste management that used best-demonstrated available technology (BDAT) and best management practices. The solid waste program at the Hanford Site strives to integrate all aspects of management relative to the treatment, storage and disposal (TSD) of solid waste. Often there are many competing and important needs. It is a difficult task to balance these needs in a manner that is both equitable and productive. Management science is used to help the process of making decisions. Tools used to support the decision making process include five-year planning, cost estimating, resource allocation, performance assessment, waste volume forecasts, input/output models, and waste acceptance criteria. The purpose of this document is to describe how one of these tools, waste acceptance criteria, has helped the Hanford Site manage solid wastes.

1154 (WHC-SA-1426) Application of United States Department of Transportation regulations to hazardous material and waste shipments on the Hanford Site. Burnside, M.E. Westinghouse Hanford Co., Richland, WA (United States). Jan 1992. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-920307-24: Waste management '92, Tucson, AZ (United States), 1-5 Mar 1992). Order Number DE92008382. Source: OSTI; NTIS; INIS; GPO Dep.

All hazardous material and waste transported over roadways open to the public must be in compliance with the US Department of Transportation (DOT) regulations. The DOT states that the hazardous material regulations (HMR) also apply to government-owned, contractor-operated (GOCO) transportation operations over any US Department of Energy (DOE) site roadway where the public has free and unrestricted access. Hazardous material and waste in packages that do not meet DOE regulations must be transported on DOE site roadways in a manner that excludes the public and nonessential workers. At the DOE Richland Field Office (the Hanford Site), hazardous material and waste movements that do not meet DOE requirements are transported over public access roadways during off-peak hours with the roadways barricaded. These movements are accomplished using a transportation plan that involves the DOE, DOE contractors, and private utilities who operate on or near the Hanford Site. This method, which is used at the Hanford Site to comply with DOE regulations onsite, can be communicated to other DOE sites to provide a basis for achieving consistency in similar transportation operations.

1155 (WHC-SA-1427) The Hanford Waste Vitrification Plant Project Technology Exchange program. Woodcock, G.; Westphal, L.O. Westinghouse Hanford Co., Richland, WA (United States). Jan 1992. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-920606-10: American Nuclear Society annual meeting, Boston, MA (United States), 7-12 Jun 1992). Order Number DE92008081. Source: OSTI; NTIS; INIS; GPO Dep.

The status of the Hanford Waste Vitrification Plant (HWVP) Project is discussed, with its relationship to other waste vitrification efforts in the United States and abroad.

The focus of this paper is on the benefits of the Technical Exchange program as a vehicle for making scientific, technical, and engineering data developed at a given site available to all organizations with interest in waste vitrification.

1156 (WHC-SA-1431) Is radioactive mixed waste packaging and transportation really a problem. McCall, D.L.; Calihan, T.W. III. Westinghouse Hanford Co., Richland, WA (United States). Jan 1992. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-920307-76: Waste management '92, Tucson, AZ (United States), 1-5 Mar 1992). Order Number DE92014960. Source: OSTI; NTIS; INIS; GPO Dep.

Recently, there has been significant concern expressed in the nuclear community over the packaging and transportation of radioactive mixed waste under US Department of Transportation regulation. This concern has grown more intense over the last 5 to 10 years. Generators and regulators have realized that much of the waste shipped as "low-level radioactive waste" was in fact "radioactive mixed waste" and that these wastes pose unique transportation and disposal problems. Radioactive mixed wastes must, therefore, be correctly identified and classed for shipment. It must also be packaged, marked, labeled, and otherwise prepared to ensure safe transportation and meet applicable storage and disposal requirements, when established. This paper discusses regulations applicable to the packaging and transportation of radioactive mixed waste and identifies effective methods that waste shippers can adopt to meet the current transportation requirements. This paper will include a characterization and description of the waste, authorized packaging, and hazard communication requirements during transportation. Case studies will be used to assist generators in understanding mixed waste shipment requirements and clarify the requirements necessary to establish a waste shipment program. Although management and disposal of radioactive mixed waste is clearly a critical issue, packaging and transportation of these waste materials is well defined in existing US Department of Transportation hazardous material regulations.

1157 (WHC-SA-1434) Hanford defense waste separation options. Wolfe, B.A.; Barton, W.B.; Sutherland, D.G. Westinghouse Hanford Co., Richland, WA (United States). Dec 1991. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-920430-56: 3. international high level radioactive waste management (IHLRWM) conference, Las Vegas, NV (United States), 12-16 Apr 1992). Order Number DE92007724. Source: OSTI; NTIS; GPO Dep.

The Hanford Site, located in south-central Washington, is a Department of Energy (DOE) installation that began production of nuclear materials for national defense during World War II. Since that time, Hanford has dedicated its resources to defense nuclear materials production, research, and defense nuclear waste management. These activities have generated tank wastes in the form of liquid, slurry, sludge, and salt cake; encapsulated cesium and strontium; dry solid waste; and contaminated soil. Five years later the ROD, resulting from DOE/EIS-0113, defined the disposal requirements for DST waste and strontium-cesium capsules: (1) completion and operation of waste pretreatment facilities, (2) vitrification of HLW into a borosilicate glass form for ultimate disposal in a geological repository, (3) solidification of LLW as grout for permanent disposal in near-surface vaults

at the Hanford Site, and (4) continued storage of encapsulated strontium and cesium until a geologic repository is ready to receive them.

1158 (WHC-SA-1450) Application of service examinations to transuranic waste container integrity at the Hanford Site. Duncan, D.R.; Burbank, D.A.; Anderson, B.C.; Demiter, J.A. Westinghouse Hanford Co., Richland, WA (United States). Oct 1992. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-921119-2: American Society for Testing and Materials (ASTM) symposium on application of accelerated corrosion tests to life prediction of materials, Miami, FL (United States), 16-17 Nov 1992). Order Number DE93004487. Source: OSTI; NTIS; INIS; GPO Dep.

Transuranic waste containers in retrievable storage trenches at the Hanford Site and their storage environment are described. The containers are of various types, predominantly steel 0.21-M3 (55-gal) drums and boxes of many different sizes and materials. The storage environment is direct soil burial and aboveground storage under plastic tarps with earth on top of the tarps. Available data from several transuranic waste storage sites are summarized and degradation rates are projected for containers in storage at the Hanford Site.

1159 (WHC-SA-1463) Demonstrating industrial-scale technology for decontaminating and destroying radioactive mixed-waste solvents. Rasmussen, O.R.; Heine, W.F. Westinghouse Hanford Co., Richland, WA (United States). Mar 1992. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-920466-15: Engineering and technology conference on waste management and environmental restoration, San Juan (Puerto Rico), 9-11 Apr 1992). Order Number DE92014217. Source: OSTI; NTIS; INIS; GPO Dep.

The Westinghouse Hanford Company (Westinghouse Hanford) recently decontaminated 24,000 gal of radioactive hazardous waste solvents and is in the final phase of destroying the solvents by incineration. The solvent, a mixture of hexone (methyl isobutyl ketone), kerosene, and tributyl phosphate was the extractant in a nuclear fuel reprocessing plant in the 1960's and was stored in carbon-steel underground tanks since the plant shut down in 1967. Westinghouse Hanford decontaminated the solvent in a distillation system specially designed to accumulate the radioactive distillation tars in sacrificial vessels for disposal. The distillate, essentially free of radionuclides except for tritium, was shipped in 5000-gal tank trailer loads to a licensed and permitted commercial incinerator that uses the solvents' fuel value to produce electric power in a co-generation plant. This successful recovery operation makes beneficial use of a material that once posed a significant environmental risk at the Hanford Site. The project was made possible through technology demonstration funding provided by the US Department of Energy's (DOE) Office of Technology Development and its predecessor, the Hazardous Waste Remedial Action Program (HAZWRAP).

1160 (WHC-SA-1465) Accelerated cleanup of mixed waste units on the Hanford Site, Richland, Washington. Erickson, J.K.; Johnson, W.L.; Wintczak, T.M. Westinghouse Hanford Co., Richland, WA (United States). Jan 1992. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-920307-27: Waste management '92, Tucson, AZ (United States),

1-5 Mar 1992). Order Number DE92006870. Source: OSTI; NTIS; INIS; GPO Dep.

This report provides a basic description of the Expedited Response Action Program currently being implemented at the Hanford Site. Included is reference to the applicable regulations regarding the program's implementation. The first three expedited response actions (a burial ground exhumation and drum removal project, a sediment removal and consolidation project, and a soil vapor extraction and treatment project) are discussed in detail in the form of case studies.

1161 (WHC-SA-1504) Hanford's RMW thermal treatment Initiative. Place, B.G.; Riddelle, J.G. Westinghouse Hanford Co., Richland, WA (United States). Mar 1992. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-920527-9: 1992 incineration conference, Albuquerque, NM (United States), 11-15 May 1992). Order Number DE92019884. Source: OSTI; NTIS; INIS; GPO Dep.

This paper presents an overview of present an overview of present Westinghouse Hanford company (Westinghouse Hanford) engineering activities related to the implementation of a program for the thermal treatment of the Hanford Site radioactive mixed waste (RMW). Topics discussed include a site-specific engineering study, the commercialization of thermal treatment, and thermal treatment of some of the Hanford Site RMW at other US Department of energy (DOE) sites.

1162 (WHC-SA-1505) Solar radiation control coatings reduce maximum temperatures in exposed storage drums. Ripley, C.C.; Kibbe, D.R. Westinghouse Hanford Co., Richland, WA (United States). Mar 1992. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-9203153-1: 8. international conference on thermal insulations, San Francisco, CA (United States), 9-11 Mar 1992). Order Number DE92014214. Source: OSTI; NTIS; INIS; GPO Dep.

Waste drums stored outdoors for long periods have been developed swelling and pinhole leaks. Changes within the contents of the drum may cause deterioration; one possible cause of such changes is an elevated storage temperature. Test results of the effect of six different exterior surface finishes on the interior temperatures of drums during solar exposure are presented. The peak interior temperatures of the exposed drums were reduced by $\geq 40^\circ\text{F}$ through the use of selected solar radiation control coatings.

1163 (WHC-SA-1520) Separation of actinide ions from radioactive waste solutions using extraction chromatography. Barney, G.S.; Cowan, R.G. Westinghouse Hanford Co., Richland, WA (United States). Mar 1992. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-920444-29: 203. American Chemical Society (ACS) national meeting, San Francisco, CA (United States), 5-10 Apr 1992). Order Number DE92015818. Source: OSTI; NTIS; INIS; GPO Dep.

Americium, plutonium, and uranium ions were successfully removed from acidic waste solutions using several types of extraction chromatographic resins. These resins might be applied to convert the bulk of transuranic (TRU) wastes, which contain actinides, to low-level radioactive wastes. Because disposal of low-level wastes is much less expensive than TRU wastes, economic incentives exist for actinide removal. Both batch equilibrium extraction measurements and column elution measurements were used to

evaluate the effectiveness of the resins for actinide removal. Resins containing adsorbed octyl (phenyl)-N,N-diisobutylcarbamoylmethylphosphine oxide (CMPO) were the most effective in removing americium from the solutions. Plutonium and uranium were more readily extracted than americium. Higher acid concentrations lowered actinide extraction by the resins due to competition between HNO_3 and actinide nitrates for the extractant. As expected, high nitrate concentrations improved extraction. Iron (a major component of much TRU wastes) lowered americium extraction due to competition for the extractant. Column extraction measurements showed that actinide extraction by the resins is rapid. Near equilibrium conditions exist in the columns at useful flow rates.

1164 (WHC-SA-1525) Hanford Site high-level waste management: Grout and vitrification processes. Nickels, J.M. Westinghouse Hanford Co., Richland, WA (United States). May 1992. 75p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-9206189-1: Nuclear waste management conference: citizen ambassador delegation to Soviet Union, No City Given (Russian Federation), 13-27 Jun 1992). Order Number DE92015835. Source: OSTI; NTIS; INIS; GPO Dep.

Radioactive and hazardous waste resulting from various processing operations conducted on the Hanford Site is currently stored in single- and double-shell tanks. Single-shell tanks are an older design no longer used, while double-shell tanks are a newer design containing most of the dangerous waste inventory on site. Two newly advanced technological developments and solutions for processing the existing and future double-shell tank waste are presented: the Grout Treatment Facility and the Hanford Waste Vitrification Plant. Currently treatment of the single-shell tank wastes is not part of the facility mission. However, soon these facilities will be designed to accommodate single-shell tank waste, with modifications. Preliminary evaluations on the design and operation of the two waste management facilities (Grout and Vitrification) indicate potential hazards, which are described in this document. An initial evaluation on the thoron releases from the double-shell tanks is presented; engineering studies and preliminary results are discussed. Studies continue to determine estimated thoron releases from facilities on the Hanford Site.

1165 (WHC-SA-1541) Hanford Waste Vitrification Plant process description and plant status. Stegen, G.E.; Swenson, L.D. Westinghouse Hanford Co., Richland, WA (United States). Apr 1992. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-920851-25: Spectrum '92: nuclear and hazardous waste management international topical meeting, Boise, ID (United States), 23-27 Aug 1992). Order Number DE92014961. Source: OSTI; NTIS; GPO Dep.

Westinghouse Hanford Company in Richland, Washington, has integrating contractor responsibility for development, design, construction, and operation of the Hanford Waste Vitrification Plant (HWVP). The HWVP will be built for the US Department of Energy (DOE) to vitrify liquid high-level and transuranic (TRU) waste produced by defense activities at the Hanford Site. Start of construction is scheduled for 1992. Hot startup is scheduled for December 1999. Process design, project status, and requirements related to feed flexibility, interfaces with existing Hanford Site facilities, and other site-specific requirements are discussed in this paper.

1166 (WHC-SA-1544) Hanford Waste Vitrification Project Building limited scope risk assessment. Braun, D.J.; Lindberg, S.E.; Reardon, M.F.; Wilson, G.P. Westinghouse Hanford Co., Richland, WA (United States). Oct 1992. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930116-45: Probabilistic safety assessment international topical meeting (PSA 93), Clearwater Beach, FL (United States), 27-29 Jan 1993). Order Number DE93011357. Source: OSTI; NTIS; INIS; GPO Dep.

A limited scope risk assessment was performed on the preliminary design of a high-level waste interim storage facility. The Canister Storage Building (CSB) facility will be built to support remediation at the US Department of Energy Hanford Site in Washington State. The CSB will be part of the support facilities for a high level Hanford Waste Vitrification Plant (HWVP). The limited scope risk assessment is based on a preliminary design which uses forced air circulation systems to move air through the building vault. The current building design calls for natural circulation to move air through the building vault.

1167 (WHC-SA-1551) Nondestructive assay of boxed radioactive waste. Gilles, W.P.; Roberts, R.J.; Jasen, W.G. Westinghouse Hanford Co., Richland, WA (United States). Dec 1992. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930906-6: '93 international conference on nuclear waste management and environmental remediation, Prague (Czech Republic), 5-11 Sep 1993). Order Number DE93009430. Source: OSTI; NTIS; INIS; GPO Dep.

This paper describes the problems related to the nondestructive assay (NDA) of boxed radioactive waste at the Hanford Site and how Westinghouse Hanford company (WHC) is solving the problems. The waste form and radionuclide content are described. The characteristics of the combined neutron and gamma-based measurement system are described.

1168 (WHC-SA-1555) Current status of liquid scintillation at Westinghouse Hanford Company. Barnett, J.M.; Jones, R.A.; Barney, G.S.; Kurtz, J.E.; Colbert, E.M.; Catlow, S.A.; Hetzer, D.C. Westinghouse Hanford Co., Richland, WA (United States). Sep 1992. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-9209261-2: International conference on advances in liquid scintillation, Vienna (Austria), 14-18 Sep 1992). Order Number DE93004494. Source: OSTI; NTIS; INIS; GPO Dep.

We present herein an overview of the current applications of liquid scintillation counting performed at Westinghouse Hanford Company. our goal is to ascertain, with the greatest reliability possible, the activity contained in a sample. We measure samples for unconditional release criteria. Additionally, we are testing experimental processes to determine the effectiveness of the removal of transuranics from liquids by precounting and postcounting spiked solutions. We use a variety of methods to count soils, oils, mixed waste, water samples, and other organic and inorganic materials. Some methods require a wet chemistry separation while other methods may be mixed directly with a cocktail and counted. We do not present any separation methods. We make a concerted effort to discuss each of the several isotopes and gross activities that are of concern at the Hanford Site. We try to use only environment-friendly cocktails. We use several different liquid scintillation spectrometers because the Hanford Site contains many facilities.

1169 (WHC-SA-1565) In situ electrochemical characterization of grouted radioactive waste. Kruger, A.A. (Westinghouse Hanford Co., Richland, WA (United States)); Gu, J.; Tomkiewicz, M. Westinghouse Hanford Co., Richland, WA (United States). Nov 1992. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-921101-43: 16. Materials Research Society (MRS) fall meeting, Boston, MA (United States), 30 Nov - 5 dec 1992). Order Number DE93004995. Source: OSTI; NTIS; INIS; GPO Dep.

This work is based upon the notion that a grid of electrodes will be incorporated in the slurry of radioactive waste and grout-forming solids. These electrodes will remain in the hardened grout and will serve to monitor the ionic concentration of the liquids contained within the matrix, the structure integrity of the matrix, and the rates of out diffusion of the electrolytes. Initially we are investigating four techniques: (1) ionic conductivity, (2) electrochemical potential, (3) cyclic voltammetry, and (4) impedance measurements. The results will be correlated with present quality verification methods, which include recovering samples and following the Toxicity Characteristic Leach Procedure (or other such accepted standard tests).

1170 (WHC-SA-1574) International performance-oriented packaging standards adopted in the United States: Status and impact reports. McCall, D.L. Westinghouse Hanford Co., Richland, WA (United States). Jun 1992. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-920905-36: PATRAM '92: 10th international symposium on the packaging and transportation of radioactive materials, Yokohama (Japan), 13-18 Sep 1992). Order Number DE93001478. Source: OSTI; NTIS; INIS; GPO Dep.

On January 1, 1991, the US Department of Transportation (DOT) initiated a transition to adopting a modified version of current international standards for packaging and transporting hazardous materials and hazardous wastes. This transition permits a 5-year phase-in period that will impact all phases of hazardous material transportation including material classification and description, packaging for shipment, and hazard communication standards. These changes are being enacted through the DOT Federal Docket HM-181, "Performance-Oriented Packaging Standards." These regulatory standards will have dramatic impact on nearly 5 billion tons of hazardous materials transported within the United States each year. This paper summarizes the principle elements of the new DOT regulations, the latest implementation schedule, impacts on US shipping activities, and discusses outstanding issues that remain to be solved through the next 5 years.

1171 (WHC-SA-1585) Remote visual examination system for characterization of waste sites. Sumsion, M.L. Westinghouse Hanford Co., Richland, WA (United States). Jul 1992. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-9207102-67: Institute of Nuclear Materials Management (INMM) annual meeting, Orlando, FL (United States), 19-22 Jul 1992). Order Number DE92040571. Source: OSTI; NTIS; GPO Dep.

A remote visual examination system for characterizing waste sites is a versatile color television system capable of acquiring information in high-radiation or hazardous areas. The system can characterize waste in piping runs up to 1500 ft long with diameters of 2 inches and up. Complementary information such as temperature, grade, radiation dose,

anomaly location and hazardous gas level can all be monitored simultaneously with the visual images. The system can be converted for tank or vault examinations. Large cost savings and enhanced personnel safety may be realized by using this system. Excavation time and money can be saved and nondestructive evaluation of piping systems and tanks can be performed.

1172 (WHC-SA-1608) Radioactive mixed waste disposal. Jasen, W.G.; Erpenbeck, E.G. Westinghouse Hanford Co., Richland, WA (United States). Feb 1993. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930906-4: '93 international conference on nuclear waste management and environmental remediation, Prague (Czech Republic), 5-11 Sep 1993). Order Number DE93009425. Source: OSTI; NTIS; INIS; GPO Dep.

Various types of waste have been generated during the 50-year history of the Hanford Site. Regulatory changes in the last 20 years have provided the emphasis for better management of these wastes. Interpretations of the Atomic Energy Act of 1954 (AEA), the Resource Conservation and Recovery Act of 1976 (RCRA), and the Hazardous and Solid Waste Amendments (HSWA) have led to the definition of radioactive mixed wastes (RMW). The radioactive and hazardous properties of these wastes have resulted in the initiation of special projects for the management of these wastes. Other solid wastes at the Hanford Site include low-level wastes, transuranic (TRU), and nonradioactive hazardous wastes. This paper describes a system for the treatment, storage, and disposal (TSD) of solid radioactive waste.

1173 (WHC-SA-1609) Mobile inspection and repackaging unit. Whitney, G.A.; Roberts, R.J. Westinghouse Hanford Co., Richland, WA (United States). Dec 1992. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930906-5: '93 international conference on nuclear waste management and environmental remediation, Prague (Czech Republic), 5-11 Sep 1993). Order Number DE93009431. Source: OSTI; NTIS; INIS; GPO Dep.

Storage of large volumes of radioactive mixed waste (RMW) and transuranic waste generated over the past 20 years at the Hanford Site has resulted in various waste management challenges. Presently disposal capacity for this waste type does not exist. The waste will be stored until processing facilities can be completed to provide treatment and final disposal. Because of the complexity of these wastes, special projects have been initiated to properly manage them. This paper addresses one such project. The goal of this project is to develop a mobile solid waste inspection and repackaging facility for solid RMW and transuranic waste.

1174 (WHC-SA-1630) In situ electrochemical characterization of grouted radioactive waste. Gu, Jingyan (Brooklyn Coll., NY (United States). Dept. of Physics); Shen, Wu-Mian; Tomkiewicz, Micha; Kruger, A.A. Westinghouse Hanford Co., Richland, WA (United States). Apr 1993. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930906-9: '93 international conference on nuclear waste management and environmental remediation, Prague (Czech Republic), 5-11 Sep 1993). Order Number DE93014505. Source: OSTI; NTIS; INIS; GPO Dep.

At the Hanford Site, twenty-eight double-shell tanks (DST) and one hundred and forty nine single-shell tanks (SST) are

used for storage of radioactive liquid and sludge wastes and sat cake. A fundamental goal of the Westinghouse Hanford Company is to end the current storage practice for liquid wastes and to permanently dispose of the waste. The Hanford Defense Waste Environmental Impact Statement and subsequent record of decision has identified a cement-based waste form for disposal of DST low-level liquid waste. The low level radioactive fractions of these wastes will be immobilized in a cementitious grout at the Hanford Grout Processing Facility and disposed of in concrete vaults of the Grout Disposal Facility. Prior to closing each vault, postcuring verification will show that the final product meets the performance requirements. Any long term disposal system of radioactive waste will require monitoring to warn against structural deterioration and/or leach of the radioactive or hazardous components into the environment. We are investigating the possibility of monitoring the degree of immobilization of the waste by embedding a grid of long-lasting electrodes in grout. This work describes our ongoing attempts to understand the physics and chemistry of charge carriers in the grout under various load conditions.

1175 (WHC-SA-1662) Laboratory screening of low-level mixed waste forms. Greenhalgh, W.O. Westinghouse Hanford Co., Richland, WA (United States). Jan 1993. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930205-35: Waste management '93, Tucson, AZ (United States), 28 Feb - 4 Mar 1993). Order Number DE93009429. Source: OSTI; NTIS; INIS; GPO Dep.

The Hanford Site is preparing for the future remediation of single-shell waste storage tanks. The present plan for the double-shell storage tanks is to dispose of the low-level waste in grout and the high-level waste in glass. There is no formal plan for disposal of the single-shell tank wastes. Disposal methods and waste forms are being reviewed and studied before preparing a plan for the single-shell tank materials. To support preparation of the plan, low-level mixed waste forms have been screened in the laboratory as potential candidate stabilization forms for the single-shell tank waste residues.

1176 (WHC-SA-1667) Radioactive mixed waste storage. Hennig, J.M. (USDOE Richland Operations Office, WA (United States)); Jasen, W.G.; Hamilton, W.H. Westinghouse Hanford Co., Richland, WA (United States). Aug 1992. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-921137-9: 14. low-level radioactive waste management conference, Phoenix, AZ (United States), 18-20 Nov 1992). Order Number DE93004508. Source: OSTI; NTIS; INIS; GPO Dep.

Various types of waste have been generated during the 50-year history of the Hanford Site. Regulatory changes in the last 20 years have provided the emphasis for better management of these wastes. Interpretations of the Atomic Energy Act of 1954 (AEA) (reference 1) and the Resource Conservation and Recovery Act of 1976 (RCRA) (reference 2) have led to the definition of a group of wastes called radioactive mixed wastes (RMW). As a result of the radioactive and hazardous properties of these wastes, special projects have been initiated for the management of RMW. This paper addresses the storage of solid RMW. The management of bulk liquid RMW will not be described.

1177 (WHC-SA-1680) Application of remote Raman screening to processing of mixed wastes in drums. Crawford, B.A.; Jewett, J.R.; Parker, K.E.; Petersen, C.A.

Westinghouse Hanford Co., Richland, WA (United States). Feb 1993. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930205-15: Waste management '93, Tucson, AZ (United States), 28 Feb - 4 mar 1993). Order Number DE93008163. Source: OSTI; NTIS; INIS; GPO Dep.

Disposal of transuranic and low-level drum waste involves decisions based on transportation restrictions, Waste Isolation Pilot Project - Waste Acceptance Criteria, and regulation resulting from the Resource Conservation and Recovery Act of 1976 and the Washington State Department of Ecology. To support the decisions made concerning final disposition of these wastes, characterization protocols must be established that ultimately aid in defining the environmental impact. Under current methods, intensive and expensive laboratory analyses are requested to support these decisions. Alternative screening analyses have been investigated to support characterization and reduce costs and sample turn-around times. One promising screening technique involves application of remote Raman spectroscopy for identification of unknown salts, sludges, and solids in wastes. Raman spectroscopy when used with real-time radiography and visual documentation expands the information base available for making real-time decisions for treatment of diverse drummed radioactive solid waste in a waste processing facility. Fourier Transform Raman spectroscopy has been successfully employed to identify oxidizing reagent waste solutions disposed on vermiculite. In addition, it has been proven that low concentrations of material in binary salt mixtures can be detected by using fiber optic remote Fourier Transform Raman spectroscopy. Development of an extensive solid waste library is a key element in the deployment of this technology in the process environment of solid waste drums and barrels.

1178 (WHC-SA-1698) Safety analysis and inventory control of transuranic and low-level waste in common storage. Porten, D.R.; Bonner, A.L.; Joyce, J.P. Westinghouse Hanford Co., Richland, WA (United States). Jan 1993. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930204-2: '93 meeting on waste management, Tucson, AZ (United States), 28 Feb - 4 mar 1993). Order Number DE93011282. Source: OSTI; NTIS; INIS; GPO Dep.

This paper describes a methodology developed for the inventory control of low-level waste (LLW) and transuranic (TRU) waste, when both are stored in the same location, and both contribute to an inventory constrained by safety considerations. Development of the method arose from the necessity to make safety analysis calculations for the addition of LLW, in quantities greater than existing inventory limits would allow when stored with TRU waste, in the Hanford Central Waste Complex (CWC)-Ensuring that the dose consequences of credible releases are maintained at low-hazard limits or less, was used to allow greater than Type A quantities of LLW into the CWC. Basically, what happens is the original limited amount of TRU allowed is reduced by some equivalent amount of LLW introduced. The total quantity of TRU, and LLW in excess of Type A quantities, must be administratively maintained via curie equivalency Factors to ensure operation as a low-hazard Facility. The "equivalency" between TRU and LLW proposed here is specific only to the CWC, but the methodology can be used for other specific applications, such as TRU and LLW storage or handling facilities where inventory limits must be enforced or where a simplified inventory system is required.

1179 (WHC-SA-1708) Low-level waste disposal - Grout issue and alternative waste form technology. Epstein, J.L. (Westinghouse Hanford Co., Richland, WA (United States)); Westski, J.H. Jr. Westinghouse Hanford Co., Richland, WA (United States). Feb 1993. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930205-69: Waste management '93, Tucson, AZ (United States), 28 Feb - 4 mar 1993). Order Number DE93014485. Source: OSTI; NTIS; INIS; GPO Dep.

Based on the Record of Decision (1) for the Hanford Defense Waste Environmental Impact Statement (HDW-EIS) (2), the US Department of Energy (DOE) is planning to dispose of the low-level fraction of double-shell tank (DST) waste by solidifying the liquid waste as a cement-based grout placed in near-surface, reinforced, lined concrete vaults at the Hanford Site. In 1989, the Hanford Grout Disposal Program (HGDP) completed a full-scale demonstration campaign by successfully grouting 3,800 cubic meters (1 million gallons) of low radioactivity, nonhazardous, phosphate/sulfate waste (PSW), mainly decontamination solution from N Reactor. The HGDP is now preparing for restart of the facility to grout a higher level activity, mixed waste double-shell slurry feed (DSSF). This greater radionuclide and hazardous waste content has resulted in a number of issues confronting the disposal system and the program. This paper will present a brief summary of the Grout Treatment Facility's components and features and will provide a status of the HGDP, concentrating on the major issues and challenges resulting from the higher radionuclide and hazardous content of the waste. The following major issues will be discussed: Formulation (cementitious mix) development; the Performance Assessment (PA) (3) to show compliance of the disposal system to long-term environmental protection objectives; and the impacts of grouting on waste volume projections and tank space needs.

1180 (WHC-SA-1713) Separation processes for high-level radioactive waste treatment. Sutherland, D.G. Westinghouse Hanford Co., Richland, WA (United States). Nov 1992. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-9203138-3: Engineering Foundation conference on dispersion and aggregation, Palm Coast, FL (United States), 15-20 Mar 1992). Order Number DE93004510. Source: OSTI; NTIS; INIS; GPO Dep.

During World War II, production of nuclear materials in the United States for national defense, high-level waste (HLW) was generated as a byproduct. Since that time, further quantities of HLW radionuclides have been generated by continued nuclear materials production, research, and the commercial nuclear power program. In this paper HLW is defined as the highly radioactive material resulting from the processing of spent nuclear fuel. The HLW is the liquid waste generated during the recovery of uranium and plutonium in a fuel processing plant that generally contains more than 99% of the nonvolatile fission products produced during reactor operation. Since this paper deals with waste separation processes, spent reactor fuel elements that have not been dissolved and further processed are excluded.

1181 (WHC-SA-1722) Simulation of the cleanup of the Hanford Site. Ludowise, J.D.; Allen, G.K. Westinghouse Hanford Co., Richland, WA (United States). Dec 1992. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930395-1: Computer simulation in waste management and environmental

sciences, Washington, DC (United States), 29 Mar - 1 Apr 1993). Order Number DE93006907. Source: OSTI; NTIS; INIS; GPO Dep.

The Hanford Site is a 1,450-km² (560-mi²) tract of semi-arid land in southeastern Washington State. Nuclear materials for the nation's defense programs were manufactured at the Hanford Site for more than 40 years. The waste generated by these activities has been treated, stored, or disposed of in a variety of ways. The Hanford Site strategic analysis provides a general comparison analysis tool to guide selection and future modification of the integrated Site cleanup plan. A key element of the Hanford strategic analysis is a material flow model that tracks 80 individual feed elements containing 60 components of interest through 50 functional processing blocks in 12 different configurations. The material flow model was developed for parametric analyses using separation factors and parameters specific to individual feeds. The model was constructed so that the effects of individual feed streams can be traced through a flowsheet, and the performance parameters of each functional block can be varied independently. The material flow model has five major elements: input database, process flow diagrams, sequential modular process simulation, output database, and output summing program.

1182 (WHC-SA-1729) The impact of safety analyses on the design of the Hanford Waste Vitrification Plant. Koppenaal, T.J. (WasteChem Corp., Irvine, CA (United States)); Yee, A.K.; Reisdorf, J.B.; Hall, B.W. Westinghouse Hanford Co., Richland, WA (United States). Apr 1993. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930408-80: 10. international high-level radioactive waste management conference, Las Vegas, NV (United States), 25-29 Apr 1993). Order Number DE93016478. Source: OSTI; NTIS; INIS; GPO Dep.

Accident analyses are being performed to evaluate and document the safety of the Hanford Waste Vitrification Plant (HWVP). The safety of the HWVP is assessed by evaluating worst-case accident scenarios and determining the dose to offsite and onsite receptors. Air dispersion modeling is done with the GENII computer code. Three accidents are summarized in this paper, and their effects on the safety and the design of the HWVP are demonstrated.

1183 (WHC-SA-1731) Hanford Waste Vitrification Plant project overview and status. Smets, J.L. (Fluor Daniel, Inc., Irvine, CA (United States)); Swenson, L.D. Westinghouse Hanford Co., Richland, WA (United States). Jan 1993. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930408-63: 10. international high-level radioactive waste management conference, Las Vegas, NV (United States), 25-29 Apr 1993). Order Number DE93011252. Source: OSTI; NTIS; INIS; GPO Dep.

The Hanford Waste vitrification Plant (HWVP) is being constructed at the US Department of Energy's Hanford Site in Richland, Washington. Engineering and design are being accomplished by Fluor Daniel, Inc. in Irvine, California. Technical input is furnished by Westinghouse Hanford Company and construction management services by UE&C-Catalytic Inc.

1184 (WHC-SA-1733) The Hanford Waste Vitrification Plant shielding design: A historical perspective. Fortsch, M. (Fluor Daniel, Inc., Las Vegas, NV (United States)); Negin, C. Westinghouse Hanford Co., Richland,

WA (United States). Jan 1993. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930408-64: 10. international high-level radioactive waste management conference, Las Vegas, NV (United States), 25-29 Apr 1993). Order Number DE93011280. Source: OSTI; NTIS; INIS; GPO Dep.

The shielding design Of the Hanford Waste Vitrification Plant (HWVP) has been underway for many years and is continuing. During its progress, there have been improvements in various calculational methods that provided practical guidance to the overall design activities and established the shielding requirements for the facility. This paper demonstrates how these changing and improving methods were implemented. It also historically describes the development of the methods themselves.

1185 (WHC-SA-1734) Installation and routing of critical embedments at the Hanford Waste Vitrification Plant. Van Katwijk, C. (Westinghouse Hanford Co., Richland, WA (United States)); Keenan, R.M.; Watts, C. Westinghouse Hanford Co., Richland, WA (United States). Jan 1993. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93011940. Source: OSTI; NTIS; INIS; GPO Dep.

The Hanford Waste Vitrification Plant (HWVP) is being designed by Fluor Daniel. Waste Chem Corporation is providing specialized expertise as Fluor Daniel's major subcontractor for vitrification and remote systems technologies. Westinghouse Hanford Company (Westinghouse Hanford) is the Project Integration manager and Business manager, and as the plant operator it provides technical direction to the Architect/Engineer team and constructor on behalf of the US Department of Energy, Richland Field Office. The Hot Cell portion of HWVP Vitrification Building contains very congested piping systems in the walls that penetrate in to the cells to nozzles for remote piping jumper assemblies. These nozzles require very tight tolerances to ensure a leak-tight fit to the jumpers. An approach has been developed that minimizes the time and expense of installing these nozzles in the wall to tight construction tolerances. This approach is called the Ganged Embed Plate (GEP) design.

1186 (WHC-SA-1738) Mechanical design of the storage tubes in the Hanford Waste Vitrification Plant Canister Storage Building. Janicek, G.P. (Westinghouse Hanford Co., Richland, WA (United States)); Mullally, J.A.; Divona, C.J.; Fages, R. Westinghouse Hanford Co., Richland, WA (United States). Jan 1993. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930408-66: 10. international high-level radioactive waste management conference, Las Vegas, NV (United States), 25-29 Apr 1993). Order Number DE93011278. Source: OSTI; NTIS; INIS; GPO Dep.

High-level waste canisters from the Hanford Waste Vitrification Plant will be stored in an adjacent facility called the Canister Storage Building. The canisters are stored vertically in an array the tubes within the shielded vault area of the Canister Storage Building. The following discussion addresses the mechanical design of the storage tubes, the shield floor plugs that confine the waste within the tubes, the impact absorber system used to ensure that the canisters are not breached during an unintentional fall, and the installation and testing of components.

1187 (WHC-SA-1741) Effluent Treatment Facility: Challenged to meet environmental restoration. Goetsch, S. (JGC Corp., Tokyo (Japan)); Day, J.E.; Rickenbach, K.D.;

Kelly, J.W. Westinghouse Hanford Co., Richland, WA (United States). Nov 1992. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-9211167-1: International low-level waste conference, Baltimore, MD (United States), 9-12 Nov 1992). Order Number DE93005889. Source: OSTI; NTIS; INIS; GPO Dep.

The Effluent Treatment Facility (ETF) located in the center of the Hanford Site is designed to receive liquid effluents from several of onsite sources, process them to eliminate hazardous and radioactive materials, and then discharge in compliance with applicable laws in a suitable location. The design incorporates several technologies selected as the best demonstrated available technology (BDAT) for their particular purpose in the context of the wastes to be treated. These technologies include the following: Filtration; Ultraviolet (UV) oxidation of organic materials; Staged pH adjustment; CO₂ removal (degasification); Reverse osmosis; Ion exchange; Forced circulation evaporation; Thin-film drying. In addition to these process technologies, the facility design includes semi-automated waste packaging systems, and an advanced integrated monitoring and process control system.

1188 (WHC-SA-1756) Radioactive waste characterization. Amir, S.J. Westinghouse Hanford Co., Richland, WA (United States). Dec 1992. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-921137-8: 14. low-level radioactive waste management conference, Phoenix, AZ (United States), 18-20 Nov 1992). Order Number DE93004518. Source: OSTI; NTIS; INIS; GPO Dep.

Westinghouse Hanford Company manages certain solid waste treatment, storage, and disposal facilities on the Hanford Site for the US Department of Energy, Richland Field Office. These facilities include radioactive solid waste disposal sites, radioactive solid waste storage areas, and hazardous waste treatment, storage, and/or disposal facilities. The Hanford Solid Waste Acceptance Criteria, WHC-EP-0063-3, (WHC 1991) defines the criteria that must be met by waste generators for solid waste to be accepted by Westinghouse Hanford Company for treatment, storage, and/or disposal. One of the acceptance criteria deals with the inventory of radionuclides in the waste. Solid radioactive waste generators are required to characterize waste streams with sufficient accuracy to properly document the types and quantities of radionuclides. This paper will deal with these requirements and their technical and regulatory basis. This paper will consider the published data on radionuclides, the detection methods for radioactive isotopes, and the cost of radioanalytical services to quantify specific radionuclides. Low-level waste generators and site operators may find information in this paper to be helpful in characterizing waste for safe disposal in accordance with environmental regulations.

1189 (WHC-SA-1772) Low specific activity and surface-contaminated objects determinations key to managing low-level wastes. McCall, D.L. Westinghouse Hanford Co., Richland, WA (United States). Jan 1993. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930205-61: Waste management '93, Tucson, AZ (United States), 28 Feb - 4 Mar 1993). Order Number DE93011275. Source: OSTI; NTIS; INIS; GPO Dep.

Today's nuclear industry should be concerned that some waste shippers are improperly classifying low-level waste as

low specific activity radioactive material for packaging and transportation to waste disposal facilities. If low-level waste is improperly classified, wrong packaging systems may be used, communication standards may not be met, and safety problems may be created. This paper discusses US Department of Transportation (DOT) criteria used for classifying LLW as LSA materials or as SCOS. Waste management procedures to ensure that nuclear facilities use defining criteria correctly when preparing waste for shipment and disposal also are discussed.

1190 (WHC-SA-1773) Description of a Multipurpose Processing and Storage Complex for the Hanford Site's radioactive material. Nyman, D.H. (Westinghouse Hanford Co., Richland, WA (United States)); Wolfe, B.A.; Hoertkorn, T.R. Westinghouse Hanford Co., Richland, WA (United States). May 1993. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930749-2: 34. annual meeting of the Institute of Nuclear Materials Management, Scottsdale, AZ (United States), 18-21 Jul 1993). Order Number DE93016475. Source: OSTI; NTIS; INIS; GPO Dep.

The mission of the US Department of Energy's (DOE) Hanford Site has changed from defense nuclear materials production to that of waste management/disposal and environmental restoration. The Multipurpose Processing and Storage Complex (MPSC) is being designed to process discarded waste tank internal hardware contaminated with mixed wastes, failed melters from the vitrification plant, and other Hanford Site high-level solid waste. The MPSC also will provide interim storage of other radioactive materials (irradiated fuel, canisters of vitrified high-level waste [HLW], special nuclear material [SNM], and other designated radioactive materials).

1191 (WHC-SA-1788) Design of the Waste Receiving and Processing Module 2A Facility. Lamberd, D.L. Westinghouse Hanford Co., Richland, WA (United States). Mar 1993. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930873-5: 2. international mixed waste symposium, Baltimore, MD (United States), 17-20 Aug 1993). Order Number DE93012611. Source: OSTI; NTIS; INIS; GPO Dep.

Westinghouse Hanford Company has determined that a facility is required for the treatment of mixed low-level waste at the Hanford Site. The mission of that facility will be to receive, process/treat, package, certify, and ship the contact-handled, mixed low-level waste that must be handled by Hanford Site to permanent disposal. Preconceptual and conceptual design studies were performed by United Engineers and Constructors, and a conceptual design report was issued. This report presents a summary of the conceptual design for a facility that will meet the mission established.

1192 (WHC-SA-1789) An approach for sampling solid heterogeneous waste at the Hanford Site waste receiving and processing and solid waste projects. Sexton, R.A. Westinghouse Hanford Co., Richland, WA (United States). Mar 1993. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930873-10: 2. international mixed waste symposium, Baltimore, MD (United States), 17-20 Aug 1993). Order Number DE93013002. Source: OSTI; NTIS; INIS; GPO Dep.

This paper addresses the problem of obtaining meaningful data from samples of solid heterogeneous waste while maintaining sample rates as low as practical. The Waste

Receiving and Processing Facility, Module 1, at the Hanford Site in south-central Washington State will process mostly heterogeneous solid wastes. The presence of hazardous materials is documented for some packages and unknown for others. Waste characterization is needed to segregate the waste, meet waste acceptance and shipping requirements, and meet facility permitting requirements. Sampling and analysis are expensive, and no amount of sampling will produce absolute certainty of waste contents. A sampling strategy is proposed that provides acceptable confidence with achievable sampling rates.

1193 (WHC-SA-1795) Low-level radioactive mixed waste land disposal facility – Permanent disposal. Erpenbeck, E.G.; Jasen, W.G. Westinghouse Hanford Co., Richland, WA (United States). Mar 1993. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930873-14: 2. international mixed waste symposium, Baltimore, MD (United States), 17-20 Aug 1993). Order Number DE93012616. Source: OSTI; NTIS; INIS; GPO Dep.

Radioactive mixed waste (RMW) disposal at US Department of Energy (DOE) facilities is subject to the Resource Conservation and Recovery Act of 1976 (RCRA) and the Hazardous and Solid Waste Amendments of 1984 (HSWA). Westinghouse Hanford Company, in Richland, Washington, has completed the design of a radioactive mixed waste land disposal facility, which is based on the best available technology compliant with RCRA. When completed, this facility will provide permanent disposal of solid RMW, after treatment, in accordance with the Land Disposal Restrictions. The facility includes a double clay and geosynthetic liner with a leachate collection system to minimize potential leakage of radioactive or hazardous constituents from the landfill. The two clay liners will be capable of achieving a permeability of less than 1×10^{-7} cm/s. The two clay liners, along with the two high density polyethylene (HDPE) liners and the leachate collection and removal system, provide a more than conservative, physical containment of any potential radioactive and/or hazardous contamination.

1194 (WHC-SA-1796) Characterization of mixed wastes resulting from fuel fabrication at the Hanford Site: Use of historical research. Gerber, M.S. Westinghouse Hanford Co., Richland, WA (United States). Mar 1993. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930396-1: Waste management '93, Tucson, AZ (United States), 1-5 Mar 1993). Order Number DE93006905. Source: OSTI; NTIS; INIS; GPO Dep.

Fuel fabrication activities took place in the 300 Area of the Hanford Site in eastern Washington State continuously between 1943 and 1987. Methods and techniques of fuel manufacture changed over the years, thus changing the components of the waste streams associated with the processes. Additionally, the national imperatives of World War II and the Cold War caused waste volumes to grow enormously, and disposal practices and policies shifted many times. The result today is an extremely complex mixture of waste forms, locations, composition and potential migration pathways. Because the Hanford Site is large, and waste characterization and cleanup must move quickly under schedules set in the Hanford Federal Facility Order and Consent Agreement ("Tri-Party Agreement"), there was a need to understand the fuel fabrication wastes without undertaking exhaustive physical characterization. Also, the Columbia River, the greatest single natural resource of the

Pacific Northwest, flows past the Hanford Site's 300 Area in close proximity to old fuel fabrication and waste disposal sites. Therefore, Westinghouse Hanford Company employed historical research as a key, initial technique in identifying and quantifying known and unknown waste locations, components and source terms.

1195 (WHC-SA-1807) Glass melter assembly for the Hanford Waste Vitrification Plant. Chen, A.E. (Waste Chem Corp., Irvine, CA (US)); Russell, A.; Shah, K.R.; Kalia, J. Westinghouse Hanford Co., Richland, WA (United States). Jan 1993. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930408-82: 10. international high-level radioactive waste management conference, Las Vegas, NV (United States), 25-29 Apr 1993). Order Number DE93018734. Source: OSTI; NTIS; INIS; GPO Dep.

The Hanford Waste Vitrification Plant (HWVP) is designed to solidify high level radioactive waste by converting it into stable borosilicate after mixing with glass frit and water. The heart of this conversion process takes place in the glass melter. The life span of the existing melter is limited by the possible premature failure of the heater assembly, which is not remotely replaceable, in the riser and pour spout. A goal of HWVP Project is to design remotely replaceable riser and pour spout heaters so that the useful life of the melter can be prolonged. The riser pour spout area is accessible only by the canyon crane and impact wrench. It is also congested with supporting frame members, service piping, electrode terminals, canister positioning arm and other various melter components. The visibility is low and the accessibility is limited. The problem is further compounded by the extreme high temperature in the riser core and the electrical conductive nature of the molten glass that flows through it.

1196 (WHC-SA-1808) Two methodologies for computing neutron sources from (α ,n) and spontaneous fission reactions in vitrified waste. Goldberg, H.J.; Morford, R.J. Westinghouse Hanford Co., Richland, WA (United States). Jun 1993. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930746-2: Annual meeting of the Health Physics Society (HPS), Atlanta, GA (United States), 11-15 Jul 1993). Order Number DE93018735. Source: OSTI; NTIS; INIS; GPO Dep.

The disposal of high-level defense waste in a geologic repository necessitates conversion of the waste to a stable form. For this purpose, the Hanford Waste Vitrification Plant (HWVP) will be constructed. In this facility the waste will be converted into 6.3×10^5 cm³ glassified cylinders, 59 cm in diameter and 230 cm in height, which will be placed in steel containers and buried. The waste packages must be adequately shielded to ensure the safety of personnel handling them. To calculate the shielding necessary, the radiation source term must be determined. Although the γ -ray source term does not present a problem, the neutron source term is a concern. Because the glass matrix is composed of light elements, the presence of any α -particle emitting radionuclides in the waste will contribute to the neutron flux. This paper attempts to ascertain the neutron flux and spectrum from (α ,n) reactions and add it to the flux resulting from spontaneous fission.

1197 (WHC-SA-1810) Time and motion simulation of the WRAP Module 1 Facility. Van Zanten, K.D. (United Engineers and Constructors, Inc., Denver, CO (United States)); Weidert, J.R. Westinghouse Hanford Co., Richland,

WA (United States). Feb 1993. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930205-60: Waste management '93, Tucson, AZ (United States), 28 Feb - 4 Mar 1993). Order Number DE93011274. Source: OSTI; NTIS; INIS; GPO Dep.

A Time and Motion simulation model was developed for the Waste Receiving and Processing (WRAP) Module 1 Facility which will be located at the Hanford site. The simulation model was developed using the WITNESS computer program licensed from AT&T ISTEEL. The model simulates the movement of 6,825 drums per year of transuranic (TRU) and low level waste (LLW) through the WRAP 1 Facility. In the WRAP 1 Facility, four main areas were modeled: Receiving, Non-Destructive Examination/Non-Destructive Assay (NDE/NDAs), Waste Process and Shipping. Movement of waste drums through the plant is accomplished with forklifts, roller conveyors, two automated guided vehicles (AGV's), lift tables, jib cranes and pallet transfer carts. In-plant drum storage is provided by an automated storage and retrieval system (ASRS) for palletized drums in the Receiving/Shipping areas, a 12-drum storage carousel in the NDE/NDAs area and a 24-drum storage carousel in the Waste Process area. The process simulation models use a color graphic display of plant operations to show drum (or pallet) movement throughout the plant. Actual speeds of vehicles, conveyors and forklifts are simulated in the model as well as machine cycle times, delay times, and stop times. Vehicle load and unload times, and acceleration and deceleration are included in the model. Distributions for the arrival of trucks delivering pallets or trucks leaving with waste drums or pallets are included in the model. Random numbers for distributions are assigned to determine the effect of variability on plant performance. The simulation program generates a full range of reports that allows users to determine the plant throughput under a wide variety of conditions. Typically a warm-up period is run to allow drums to complete travel through the system until steady "steady-state" operation is achieved. The model is then run at these steady-state conditions for several days, weeks or even years, depending on the complexity of the model.

1198 (WHC-SA-1816) Hanford Site production reactor data pertinent to actinide burning. Toffler, H.; Roblyer, S.P. Westinghouse Hanford Co., Richland, WA (United States). Jun 1993. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930913-21: Global '93: future nuclear systems - emerging fuel cycles and waste disposal options, Seattle, WA (United States), 12-17 Sep 1993). Order Number DE93019129. Source: OSTI; NTIS; INIS; GPO Dep.

During the 44 years of operation, irradiation of special actinides occurred in the Hanford Site production reactors. The data derived from such irradiations could be of value to advanced actinide burners having a thermal neutron spectrum. Recently, such information has become unclassified and, therefore available for public release. This data is discussed in this report.

1199 (WHC-SA-1821) Plasma techniques for reprocessing nuclear wastes. Siciliano, E.R.; Lucoff, D.M.; Omberg, R.P.; Walter, A.E. Westinghouse Hanford Co., Richland, WA (United States). Jun 1993. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930913-43: Global '93: future nuclear systems - emerging fuel cycles and waste disposal options; American Nuclear Society (ANS) winter meeting, Seattle, WA (United States); San Francisco, CA (United

States), 12-17 Sep 1993; 14-18 Nov 1993; CONF-93 Order Number DE93040382. Source: OSTI; INIS; NTIS; GPO Dep.

A newly emerging plasma-based system, currently under development for material dissociation and mass separation applications in the area of high-level radioactive waste treatment, may have possible applications as a central processing unit for spent nuclear fuel reprocessing. Because this system has no moving parts and obtains separations by electromagnetic techniques, it offers a distinct advantage over chemically based separation techniques, in that the total waste volume does not increase. The basic concepts underlying the operation of this plasma-based system are discussed, along with the demonstrated and expected capabilities of this system. Possible fuel reprocessing configurations using this plasma-based technology are also mentioned.

1200 (WHC-SA-1830) The United States Department of Energy process for performance assessment for disposal of low-level radioactive waste. Wood, D.E. (Westinghouse Hanford Co., Richland, WA (United States)); Owens, K.W.; Wilhite, E.L.; Duggan, G.J. Westinghouse Hanford Co., Richland, WA (United States). Feb 1993. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930906-2: '93 international conference on nuclear waste management and environmental remediation, Prague (Czech Republic), 5-11 Sep 1993). Order Number DE93008179. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy (DOE) manages disposal of low-level radioactive waste through the requirements of DOE Order 5820.2A on Radioactive Waste Management. The order specifies long-term performance objectives for permanent disposal, requires a performance assessment to determine compliance with those objectives, and establishes a Peer Review Panel to review those assessments for technical quality and completeness. A Performance Assessment Task Team has been established to provide guidance and recommend policy for implementation and interpretation of the requirements to those preparing the assessments. This paper describes the requirements, the Peer Review Panel, the Performance Assessment Task Team, and their activities to date.

1201 (WHC-SA-1833) Toxic emission control systems for mixed waste storage tanks. Robinson, J.D. (Westinghouse Hanford Co., Richland, WA (United States)); Hansen, G.E. Westinghouse Hanford Co., Richland, WA (United States). Feb 1993. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930396-7: Waste management '93, Tucson, AZ (United States), 1-5 Mar 1993). Order Number DE93008175. Source: OSTI; NTIS; INIS; GPO Dep.

The use of emission control systems on mixed waste storage tanks is a critical issue as characterization and remediation of tanks becomes a leading priority at DOE sites. The current tank ventilation systems, where installed, are designed primarily for the control of radionuclides with no treatment systems incorporated for toxic emissions. Many of the tanks also lack ammonia treatment systems, although ammonia, due to its noxious odor, is controlled in some applications. The need for emission control systems has become apparent by the numerous occurrences of occupational employee exposure and the buildup of toxic and/or flammable materials in the vapor space of tanks. This paper will focus on two alternate systems for the control of toxic emissions, and will provide a discussion of the key issues

which must be addressed for each system. The contents of this paper are the results of two efforts being performed by Engineering-Science, Inc., under the contract to Battelle Environmental Management Operations (EMO), for the Westinghouse Hanford Company. These efforts are for the study, design, fabrication, installation, and testing of new modular exhaust units for the 241-C-103 Tank and for several tanks which are candidates for the Rotary Mode Core Sampling (RMCS) characterization. If one exhaust system can be used in several applications, during high activity and personnel exposure periods, then a tremendous savings to the capital investment needs, the annual operating budget, and decontamination and decommissioning costs can be realized.

1202 (WHC-SA-1866) Hanford Site radioactive mixed waste thermal treatment initiative. Place, B.G.; Riddelle, J.G. Westinghouse Hanford Co., Richland, WA (United States). Mar 1993. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930572-5: 12. annual international symposium on thermal treatment technologies - incineration conference, Knoxville, TN (United States), 3-7 May 1993). Order Number DE93013005. Source: OSTI; NTIS; INIS; GPO Dep.

This paper is a progress report of current Westinghouse Hanford Company engineering activities related to the implementation of a program for the thermal treatment of the Hanford Site radioactive mixed waste. Topics discussed include a site-specific engineering study, the review of private sector capability in thermal treatment, and thermal treatment of some of the Hanford Site radioactive mixed waste at other US Department of Energy sites.

1203 (WHC-SA-1867) Risk management of onsite transportation of nuclear waste. Field, J.G.; Wang, O.S.; Mercado, J.E. Westinghouse Hanford Co., Richland, WA (United States). Mar 1993. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930608-2: Safewaste '93: the final disposal of nuclear waste, Avignon (France), 13-18 Jun 1993). Order Number DE93011352. Source: OSTI; NTIS; INIS; GPO Dep.

The United States Department of Energy (DOE) Hanford Site recently has undergone a significant change in mission. The focus of operations has shifted from plutonium production to environmental restoration. This transition has caused a substantial increase in quantities of nuclear waste and other hazardous materials packaged and transported onsite. In response to the escalating transportation activity, Westinghouse Hanford Company (Westinghouse Hanford), the Hanford Site operations and engineering contractor, is proposing an integrated risk assessment methodology and risk management strategy to enhance the safety of onsite packaging and transportation operations involving nuclear waste. The proposed methodology consists of three integral parts: risk assessment, risk acceptance criteria, and risk minimization. The purpose of the methodology is to ensure that the risk for each ongoing transportation activity is acceptable and to minimize the overall risk for current and future onsite operations.

1204 (WHC-SA-1883) The reduction of packaging waste. Raney, E.A.; McCollom, M.; Hogan, J. Westinghouse Hanford Co., Richland, WA (United States). Apr 1993. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930483-3: 9.

waste minimization and pollution prevention conference, San Francisco, CA (United States), 13-15 Apr 1993). Order Number DE93012619. Source: OSTI; NTIS; GPO Dep.

Nationwide, packaging waste comprises approximately one third of the waste being sent to our solid waste landfills. These wastes range from product and shipping containers made from plastic, glass, wood, and corrugated cardboard to packaging fillers and wraps made from a variety of plastic materials such as shrink wrap and polystyrene peanuts. The amount of packaging waste generated is becoming an important issue for manufacturers, retailers, and consumers. Elimination of packaging not only conserves precious landfill space, it also reduces consumption of raw materials and energy, all of which result in important economic and environmental benefits. At the US Department of Energy-Richland Field Office's (DOE-RL) Hanford Site as well as other DOE sites the generation of packaging waste has added importance. By reducing the amount of packaging waste, DOE also reduces the costs and liabilities associated with waste handling, treatment, storage, and disposal.

1205 (WHC-SA-1902) Pollution prevention/waste minimization guidelines for facility design. Encke, D.B. Westinghouse Hanford Co., Richland, WA (United States). Apr 1993. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930483-13: 9. waste minimization and pollution prevention conference, San Francisco, CA (United States), 13-15 Apr 1993). Order Number DE93017596. Source: OSTI; NTIS; GPO Dep.

The mission of the 560 square mile (1450 sq Km) Hanford site, located in south eastern Washington, was changed from defense production to environmental restoration and waste management in 1989. The Tri-Party Agreement (TPA) signed in 1989 between DOE, EPA and Washington State, agreed to clean up most of the Hanford site within 30 years. To accomplish the clean-up and comply with the schedule established in the TPA, a number of treatment and support facilities will have to be built. While these facilities are designed to treat wastes that have already been generated, the routine operation and maintenance of these facilities will generate their own wastes. With careful planning, new facilities or modifications to existing facilities can be designed in a manner such that little pollution or waste is generated through normal operation and maintenance. The project the author is working on is concerned with avoiding or reducing the generation of new waste by assuring that pollution prevention and waste minimization are considered in the design phase of these facilities.

1206 (WHC-SA-1927) Acute toxicity screening of Hanford Site waste grouts using aquatic invertebrates. Rebagay, T.V.; Dodd, D.A.; Lockrem, L.L.; Powell, W.J.; Voogd, J.A. Westinghouse Hanford Co., Richland, WA (United States). Nov 1993. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-931152-1: 14. annual meeting of the Society of Environmental Toxicology and Chemistry (SETAC), Houston, TX (United States), 14-18 Nov 1993). Order Number DE94004823. Source: OSTI; NTIS; INIS; GPO Dep.

Waste grouts prepared by mixing a simulated nonradioactive liquid waste with a dry solids blend consisting of cement, fly ash, and clay were screened for their acute toxicity using aquatic invertebrates (*D. magna*, *D. pulex*, and *C. dubia*) as test organisms and a fluorogenic substrate (4-methylumbelliferyl b-d galactoside) as the toxic stress indicator. After one hour of exposing juvenile daphnids to

grout extracts of varying concentrations, followed by a 15-minute reaction with the fluorogenic substrate, the degree of in vivo enzymatic inhibition was measured by the number of resulting fluorescent daphnids. The effective concentration at which 50% of the daphnids were adversely affected (EC50) values calculated by probit analysis were 2,877 mg/L, 2,983 mg/L, and 3,174 mg/L for *D. pulex*, *D. magna*, and *C. dubia*, respectively. The results indicated that the grout extracts studied are nonhazardous and not dangerous to daphnids.

1207 (WHC-SA-1928) Co-disposal of mixed waste materials. Phillips, S.J.; Alexander, R.G.; Crane, P.J.; England, J.L.; Kemp, C.J.; Stewart, W.E. Westinghouse Hanford Co., Richland, WA (United States). Aug 1993. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930873-20: 2. international mixed waste symposium, Baltimore, MD (United States), 17-20 Aug 1993). Order Number DE93016347. Source: OSTI; NTIS; INIS; GPO Dep.

Co-disposal of process waste streams with hazardous and radioactive materials in landfills results in large, use-efficiencies waste minimization and considerable cost savings. Wasterock, produced from nuclear and chemical process waste streams, is segregated, treated, tested to ensure regulatory compliance, and then is placed in mixed waste landfills, burial trenches, or existing environmental restoration sites. Large geotechnical unit operations are used to pretreat, stabilize, transport, and emplace wasterock into landfill or equivalent subsurface structures. Prototype system components currently are being developed for demonstration of co-disposal.

1208 (WHC-SA-1935) Environmental restoration waste materials co-disposal. Phillips, S.J. (Westinghouse Hanford Co., Richland, WA (United States)); Alexander, R.G.; England, J.L.; Kirdendall, J.R.; Raney, E.A.; Stewart, W.E.; Dagan, E.B.; Holt, R.G. Westinghouse Hanford Co., Richland, WA (United States). Sep 1993. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-931095-17: Department of Energy environmental remediation conference, Augusta, GA (United States), 24-28 Oct 1993). Order Number DE94001194. Source: OSTI; NTIS; INIS; GPO Dep.

Co-disposal of radioactive and hazardous waste is a highly efficient and cost-saving technology. The technology used for final treatment of soil-washing size fractionization operations is being demonstrated on simulated waste. Treated material (wasterock) is used to stabilize and isolate retired underground waste disposal structures or is used to construct landfills or equivalent surface or subsurface structures. Prototype equipment is under development as well as undergoing standardized testing protocols to prequalify treated waste materials. Polymer and hydraulic cement solidification agents are currently used for geotechnical demonstration activities.

1209 (WHC-SA-2025) Interaction analysis method for the Hanford Waste Vitrification Plant. Grant, P.R. (Fluor Daniel, Inc., Irvine, CA (United States)); Deshotels, R.L.; Van Katwijk, C. Westinghouse Hanford Co., Richland, WA (United States). Aug 1993. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-9310102-26: 4. energy natural phenomena hazards mitigation conference, Atlanta, GA (United States), 19-22 Oct 1993). Order Number DE94001173. Source: OSTI; NTIS; INIS; GPO Dep.

In order to anticipate potential problems as early as possible during the design effort, a method for interaction analysis was developed to meet the specific hazards of the Hanford Waste Vitrification Plant (HWVP). The requirement for interaction analysis is given in DOE Order 6430.1B and DOE-STD-1021-92. The purpose of the interaction analysis is to ensure that non-safety class items will not fail in a manner that will adversely affect the ability of any safety class item to perform its safety function. In the HWVP there are few structures, equipment, or controls that are safety class. In addition to damage due to failure of non-safety class items as a result of natural phenomena, threats to HWVP safety class items include the following: room flooding from firewater, leakage of chemically reactive liquids, high-pressure gas impingement from leaking piping, rocket-type impact from broken pressurized gas cylinders, loss of control of mobile equipment, cryogenic liquid spill, fire, and smoke. The time needed to perform the interaction analysis is minimized by consolidating safety class items into segregated areas. Each area containing safety class items is evaluated, and any potential threat to the safety functions is noted. After relocation of safety class items is considered, items that pose a threat are generally upgraded to eliminate the threat to the safety class items. Upgrading is the preferred option when relocation is not possible. An example will illustrate the method and application in the phased design, procurement, and construction environment of the HWVP.

1210 (WHC-SA-2026) Elevated temperature effects on concrete properties. Grant, P.R. (Fluor Daniel, Inc., Irvine, CA (United States)); Gruber, R.S.; Van Katwijk, C. Westinghouse Hanford Co., Richland, WA (United States). Aug 1993. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94001180. Source: OSTI; NTIS; INIS; GPO Dep.

The design of facilities to process or store radioactive wastes presents many challenging engineering problems. Such facilities must not only provide for safe storage of radioactive wastes but they must also be able to maintain confinement of these materials during and after natural phenomena events. Heat generated by the radioactive decay of the wastes will cause the temperature of the concrete containment structure to increase to a magnitude higher than that found in conventional structures. These elevated temperatures will cause strength-related concrete properties to degrade over time. For concrete temperatures less than 150°F, no reduction in strength is taken and the provisions of ACI 349, which states that higher temperatures are allowed if tests are provided to evaluate the reduction in concrete strength properties, apply. Methods proposed in a Pacific Northwest Laboratory (PNL) report, Modeling of Time-Variant Concrete Properties at Elevated Temperatures, can be used to evaluate the effects of elevated temperatures on concrete properties. Using these modified concrete properties the capacity of a concrete structure, subjected to elevated temperatures, to resist natural phenomena hazards can be determined.

1211 (WHC-SA-2033) Supplement information to PUREX Plant red oil evaluation. Eiholzer, S.M. Westinghouse Hanford Co., Richland, WA (United States). Aug 1993. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94002411. Source: OSTI; NTIS; INIS; GPO Dep.

This supplement provides a set of instrumentation engineering diagrams and a discussion of dip-tube manometry.

1212 (WHC-SA-2078) Characterization of wastes in and around early reactors at the Hanford Site: The use of historical research. Gerber, M.S. Westinghouse Hanford Co., Richland, WA (United States). Oct 1993. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-931095-8: Department of Energy environmental remediation conference, Augusta, GA (United States), 24-28 Oct 1993). Order Number DE94000736. Source: OSTI; NTIS; INIS; GPO Dep.

This paper will present the waste characterization knowledge that has been gained in the first, "Large-Scale Remediation Study" to be performed on the reactor areas (100 Areas) of the Hanford Site. Undertaken throughout the past year, this research project has identified thousands of pieces of buried hardware, as well as the volumes of liquid wastes in burial sites in the reactor areas. The author of this landmark study, Dr. Michele Gerber, will discuss historical research as a safe and cost-effective characterization tool.

1213 (WHC-SA-2094) Process Technical Basis Documentation Diagram for a solid-waste processing facility. Benar, C.J.; Petersen, C.A. Westinghouse Hanford Co., Richland, WA (United States). Feb 1994. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-940225-106: Waste management '94, Tucson, AZ (United States), 27 Feb - 3 mar 1994). Order Number DE94011444. Source: OSTI; NTIS; INIS; GPO Dep.

The Process Technical Basis Documentation Diagram is for a solid-waste processing facility that could be designed to treat, package, and certify contact-handled mixed low-level waste for permanent disposal. The treatment processes include stabilization using cementitious materials and immobilization using a polymer material. The Diagram identifies several engineering/demonstration activities that would confirm the process selection and process design. An independent peer review was conducted at the request of Westinghouse Hanford Company to determine the technical adequacy of the technical approach for waste form development. The peer review panel provided comments and identified documents that it felt were needed in the Diagram as precedence for Title I design. The Diagram is a visual tool to identify traceable documentation of key activities, including those documents suggested by the peer review, and to show how they relate to each other. The Diagram is divided into three sections: (1) the Facility section, which contains documents pertaining to the facility design, (2) the Process Demonstration section, which contains documents pertaining to the process engineering/demonstration work, and (3) the Regulatory section, which contains documents describing the compliance strategy for each acceptance requirement for each feed type, and how this strategy will be implemented.

1214 (WHC-SA-2098) Quantitative and qualitative analysis of some inorganic compounds by Raman spectroscopy. Lombardi, D.R. (Florida State Univ., Tallahassee, FL (United States). Dept. of Chemistry); Wang, C.; Sun, B.; Fountain, A.W. III; Vickers, T.J.; Mann, C.K.; Reich, F.R.; Douglas, J.G.; Kohlasch, F.L. Westinghouse Hanford Co., Richland, WA (United States). Feb 1994. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-940209-3: Pittsburgh conference on analytical chemistry and applied spectroscopy, Chicago, IL (United States), 28 Feb - 4 mar 1994). Order Number DE94009757. Source: OSTI; NTIS; INIS; GPO Dep.

Raman spectra have been measured for several nitrates, nitrites, sulfates, ferrocyanides and ferricyanides, both in the

solid phase and in aqueous solution. Accurate locations of peak maxima are given. Limits of detection for some of the compounds are given for solutions and for solid mixtures in NaNO_3 . Preliminary measurements have been made on core material recovered from the storage tanks on the Hanford Site. Representative spectra are presented, showing that it is possible to observe responses of individual components from measurements made directly on untreated cores using a fiber optic sampling probe.

1215 (WHC-SA-2105) Integrated management of liquid effluents at the Hanford Site. Lindsey, D.W.; Eacker, J.A.; Crane, A.F.; Veneziano, T.B. Westinghouse Hanford Co., Richland, WA (United States). [1994]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-940225-93: Waste management '94, Tucson, AZ (United States), 27 Feb - 3 mar 1994). Order Number DE94009756. Source: OSTI; NTIS; INIS; GPO Dep.

This poster session illustrates the integrated approach that the Hanford Site has taken in managing high-priority liquid effluent streams. These waste waters are produced from a variety of process- and utility-related sources. The Hanford Site approach to management of liquid effluents focuses on eliminating the source, reusing where possible, and treating and disposing of the water that cannot be eliminated or recycled prior to disposal. Thirteen of the high-priority waste water streams have been or will be eliminated by the end of 1995. Some of these streams have been eliminated as the result of shutting down the associated operation. However, the elimination of other streams has been the result of process modifications, equipment substitutions, or recycling. Several of the waste water streams will receive treatment at the individual generating facility before being discharged into a new industrial sewer (the 200 Area Treated Effluent Disposal Facility). The industrial sewer will collect treated streams from various plants in the 200 Areas and dispose of the clean effluent at two uncontaminated new 20,235-square meter (5-acre) ponds permitted by Washington State. Finally, condensate from the 200 Areas tank waste evaporator and waste water from operations in the 300 Area will be treated at two end-of-the-pipe treatment facilities. The 200 Area Effluent Treatment Facility will treat condensate (a Resource Conservation and Recovery Act of 1976 (1)-listed waste) from the tank waste evaporator, thereby allowing the waste to be delisted prior to disposal. The treated effluent will be pumped to a state-approved land disposal site selected to maximize the migration time to the river. This disposal site allows for the decay of tritium, which will be present in the condensate but cannot be removed using current technologies.

1216 (WHC-SA-2108) Trends in actinide processing at Hanford. Harmon, H.D. Westinghouse Hanford Co., Richland, WA (United States). Sep 1993. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94002319. Source: OSTI; NTIS; INIS; GPO Dep.

In 1989, the mission at the Hanford Site began a dramatic and sometimes painful transition. The days of production—as we used to know it—are over. Our mission officially has become waste management and environmental cleanup. This mission change didn't eliminate many jobs—in fact, budgets have grown dramatically to support the new mission. Most all of the same skilled crafts, engineers, and scientists are still required for the new mission. This change has not eliminated the need for actinide processing, but it has certainly

changed the focus that our actinide chemists and process engineers have. The focus used to be on such things as increasing capacity, improving separations efficiency, and product purity. Minimizing waste had become a more important theme in recent years and it is still a very important concept in the waste management and environmental cleanup arena. However, at Hanford, a new set of words dominates the actinide process scene as we work to deal with actinides that still reside in a variety of forms at the Hanford Site. These words are repackage, stabilize, remove, store and dispose. Some key activities in each of these areas are described in this report.

1217 (WHC-SA-2111) Jumper connector analysis. Kanjilal, S.K.; Lindquist, M.R.; Ulbricht, L.E. Westinghouse Hanford Co., Richland, WA (United States). Feb 1994. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-940613-8: 1994 pressure vessels and piping conference, Minneapolis, MN (United States), 19-23 Jun 1994). Order Number DE94010373. Source: OSTI; NTIS; GPO Dep.

Jumper connectors are used for remotely connecting pipe lines containing transfer fluids ranging from hazardous chemicals to other nonhazardous liquids. The jumper connector assembly comprises hooks, hookpins, a block, a nozzle, an operating screw, and a nut. The hooks are tightened against the nozzle flanges by the operating screw that is tightened with a remotely connected torque wrench. Stress analysis for the jumper connector assembly (used extensively on the US Department of Energy's Hanford Site, near Richland, Washington) is performed by using hand calculation and finite-element techniques to determine the stress levels resulting from operating and seismic loads on components of the assembly. The analysis addresses loading conditions such as prestress, seismic, operating, thermal, and leakage. The preload torque-generated forces at which each component reaches its stress limits are presented in a tabulated format. Allowable operating loads for the jumper assembly are provided to prevent leakage of the assembly during operating cycles.

1218 (WHC-SA-2132) Lasers and high-energy light as a decontamination tool for nuclear applications. Flesher, D.J. Westinghouse Hanford Co., Richland, WA (United States). Dec 1993. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-931237-3: LASERS '93: international conference on lasers and applications, Lake Tahoe, NV (United States), 6-10 Dec 1993). Order Number DE94005420. Source: OSTI; NTIS; INIS; GPO Dep.

Light-aided decontamination (LAD) removal of paint and concrete layers is competitive with sand blasting rates. Remote operations, up to 137 m (450 ft), and lower waste volumes can provide cost, safety, and environmental advantages for nuclear facilities.

1219 (WHC-SA-2143) The Transuranic Waste Program's integration and planning activities and the contributions of the TRU partnership. Harms, T.C. (USDOE, Washington, DC (United States)); O'Neal, W.; Petersen, C.A.; McDonald, C.E. Westinghouse Hanford Co., Richland, WA (United States). Feb 1994. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-940225-105: Waste management '94, Tucson, AZ (United States), 27 Feb - 3 Mar 1994). Order Number DE94011445. Source: OSTI; NTIS; INIS; GPO Dep.

The Technical Support Division, EM-351 manages the integration and planning activities of the Transuranic Waste Program. The Transuranic Waste Program manager provides transuranic waste policy, guidance, and issue resolution to Headquarters and the Operations Offices. In addition, the program manager is responsible for developing and implementing an integrated, long-range waste management plan for the transuranic waste system. A steering committee, a core group of support contractors, and numerous interface working groups support the efforts of the program manager. This paper provides an overview of the US Department of Energy's transuranic waste integration activities and a long-range planning process that includes internal and external stakeholder participation. It discusses the contributions and benefits provided by the Transuranic Partnership, most significantly, the integration activities and the body of data collected and assembled by the Partnership.

1220 (WHC-SA-2180) Mixed waste solidification testing on polymer and cement-based waste forms in support of Hanford's WRAP 2A facility. Burbank, D.A. Jr.; Weingardt, K.M. Westinghouse Hanford Co., Richland, WA (United States). Oct 1993. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-9311132-1: American Society of Testing and Materials (ASTM) symposium, Williamsburg, VA (United States), 1-5 Nov 1993). Order Number DE94003492. Source: OSTI; NTIS; INIS; GPO Dep.

A testing program has been conducted by the Westinghouse Hanford Company to confirm the baseline waste form selection for use in Waste Receiving and Processing (WRAP) Module 2A. WRAP Module 2A will provide treatment required to properly dispose of containerized contact-handled, mixed low-level waste at the US Department of Energy Hanford Site in south-central Washington State. Solidification/stabilization has been chosen as the appropriate treatment for this waste. This work is intended to test cement-based, thermosetting polymer, and thermoplastic polymer solidification media to substantiate the technology approach for WRAP Module 2A. Screening tests were performed using the major chemical constituent of each waste type to measure the gross compatibility with the immobilization media and to determine formulations for more detailed testing. Surrogate materials representing each of the eight waste types were prepared in the laboratory. These surrogates were then solidified with the selected immobilization media and subjected to a battery of standard performance tests. Detailed discussion of the laboratory work and results are contained in this report.

1221 (WHC-SA-2300) Testing and evaluation of alternative process systems for immobilizing radioactive mixed particulate waste in cement. Weingardt, K.M.; Weber, J.R. Westinghouse Hanford Co., Richland, WA (United States). Mar 1994. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-940499-9: Federal environmental restoration and waste minimization conference and exhibition, New Orleans, LA (United States), 25-29 Apr 1994). Order Number DE94011448. Source: OSTI; NTIS; INIS; GPO Dep.

Radioactive and Hazardous Mixed Wastes have accumulated at the Department of Energy (DOE) Hanford Site in south-central Washington State. Ongoing operations and planned facilities at Hanford will also contribute to this waste stream. To meet the Resource Conservation and Recovery Act (RCRA) Land Disposal Restrictions most of this waste will need to be treated to permit disposal. In general this

treatment will need to include stabilization/solidification either as a sole method or as part of a treatment train. A planned DOE facility, the Waste Receiving and Processing (WRAP) Module 2A, is scoped to provide this required treatment for containerized contact-handled (CH), mixed low-level waste (MLLW) at Hanford. An engineering development program has been conducted by Westinghouse Hanford Company (WHC) to select the best system for utilizing a cement based process in WRAP Module 2A. Three mixing processes were developed for analysis and testing; in-drum mixing, continuous mixing, and batch mixing. Some full scale tests were conducted and 55 gallon drums of solidified product were produced. These drums were core sampled and examined to evaluate mixing effectiveness. Total solids loading and the order of addition of waste and binder constituents were also varied. The highest confidence approach to meet the WRAP Module 2A waste immobilization system needs appears to be the out-of-drum batch mixing concept. This system is believed to offer the most flexibility and efficiency, given the highly variable and troublesome waste streams feeding the facility.

1222 (WHC-SA-2361) Operational guidance for using DOT-6M/2R packaging. Kelly, D.L.; Hummer, J.H. Westinghouse Hanford Co., Richland, WA (United States). Mar 1994. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-9405109-3: Department of Energy defense programs packaging workshop, Knoxville, TN (United States), 16-19 May 1994). Order Number DE94009760. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this paper is to describe a new US Department of Energy (DOE), Transportation Management Division task to create a US Department of Transportation (DOT) Specification 6M/2R packaging configuration user's guide. The need for a user's guide was identified because the DOT-6M/2R packaging configuration is widely used by DOE site contractors, and DOE receives many questions about the approved packaging configurations. Currently, two DOE organizations have the authority to approve new DOT-6M/2R configurations. For Defense Programs, the Transportation and Packaging Safety Division (EH-332) administers the program. For Environmental Restoration and Waste Management, the Transportation Management Division (EM-261) administers the program.

1223 (WHC-SD-EN-RA-014) Riverland ERA maintenance pad site diesel contamination risk assessment. Valcich, P.J. Westinghouse Hanford Co., Richland, WA (United States). 2 Dec 1993. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94005461. Source: OSTI; NTIS; GPO Dep.

The maintenance pad site consists of a concrete pad and underlying soils, approximately 15 by 46 m in area, and a drainage ditch with dimensions of 2.4 by 91 m. The ditch is located approximately 60 m from the concrete pad and is oriented parallel to the pads long axis. The facility was built in 1943, at which time the concrete pad was the floor of a maintenance shed for railroad activities. In 1955, use of the facility as a maintenance shed was discontinued. Between 1955 and 1957, the facility was used as a radioactivity decontamination area for railroad cars; acetone-soaked rags were used to remove surface contamination from the cars. The concrete pad was washed down with a mixture of water and diesel fuel, which was then flushed via clay pipe to the drainage ditch. In 1963, the maintenance shed was torn

down and the concrete pad covered with approximately one-half meter of fill. The concrete pad was re-exposed in 1993. The site was sampled for Toxicity Characteristic Leachate Procedure (TCLP) metals, volatile, and semi-volatile compounds, as well as for extractable fuel hydrocarbons. A total of 17 samples were collected from surface concrete, soil beneath surface concrete, and ditch soil. One concrete sample and one ditch soil sample were split. The ditch soil sample was also duplicated. The relative percent difference (RPD) in extractable hydrocarbons of the two split samples, one from concrete and one from ditch soil are, respectively, 52% and 186%. The RPD for the duplicate sample, taken from the same ditch soil sample from which one of the splits was taken, is 39%.

1224 (WHC-SD-W026-TRP-006) Entry/Exit Port testing, test report. Winkelman, R.H. Westinghouse Hanford Co., Richland, WA (United States). May 1993. 34p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94001007. Source: OSTI; NTIS; INIS; GPO Dep.

The Waste Receiving and Processing Module I (WRAP-1) facility must have the ability to allow 55-gallon drums to enter and exit glovebox enclosures. An Entry/Exit Port (Appendix 1, Figure 1), designed by United Engineers and Constructors (UE&C), is one method chosen for drum transfer. The Entry/Exit Port is to be used for entry of 55-gallon drums into both process entry gloveboxes, exit of 55-gallon drum waste pucks from the low-level waste (LLW) glovebox, and loadout of waste from the restricted waste management glovebox. The Entry/Exit Port relies on capture velocity air flow and a neoprene seal to provide alpha confinement when the Port is in the open and closed positions, respectively. Since the glovebox is in a slight vacuum, air flow is directed into the glovebox through the space between the overpack drum and glovebox floor. The air flow is to direct any airborne contamination into the glovebox. A neoprene seal is used to seal the Port door to the glovebox floor, thus maintaining confinement in the closed position. Entry/Exit Port testing took place February 17, 1993, through April 14, 1993, in the 305 building of Westinghouse Hanford Company. Testing was performed in accordance with the Entry/Exit Port Testing Test Plan, document number WHC-SD-W026-TP-005. A prototype Entry/Exit Port built at the Hanford Site was tested using fluorescent paint pigment and smoke candles as simulant contaminants. This test report is an interim test report. Further developmental testing is required to test modifications made to the Port as the original design of the Port did not provide complete confinement during all stages of operation.

1225 (WHC-SD-W100-TP-002) WRAP 2A Waste Form Qualification Plan. Burbank, D.A. Jr. Westinghouse Hanford Co., Richland, WA (United States). [1993]. 33p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94009385. Source: OSTI; NTIS; INIS; GPO Dep.

WRAP Module 2A is a facility that will serve to treat retrieved, stored, and newly generated contact-handled mixed low level waste (MLLW) at the Department of Energy's Hanford site near Richland, Washington. The treatment processes to be used are limited to non-thermal processes, defined as processes operating at a temperature less than 500°F. In addition to waste pretreatment and conditioning processes including sorting, size reduction, and homogenization, the final treatment technologies will consist of immobilization, stabilization, and encapsulation to produce

final waste forms that are suitable for disposal in compliance with all applicable regulatory requirements. The wide variety of chemical and physical characteristics exhibited by the WRAP 2A feed streams will necessitate the performance of a comprehensive waste form qualification (WFQ) testing program. The WFQ program will provide the technical basis supporting the process selection and will demonstrate that the selected treatment processes produce final waste forms that will meet all applicable regulatory requirements and performance specifications. This document describes the overall WRAP 2A WFQ program.

1226 (WHC-SD-WM-RD-044) Evaluation of melter system technologies for vitrification of high-sodium content low-level radioactive liquid wastes. Wilson, C.N. Westinghouse Hanford Co., Richland, WA (United States). 21 Mar 1994. 36p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94011330. Source: OSTI; NTIS; INIS; GPO Dep.

Westinghouse Hanford Company (WHC) is conducting a two-phased demonstration testing and evaluation of candidate melter system technologies for vitrification of Hanford Site low-level tank wastes. The testing is to be performed by melter equipment and vitrification technology commercial suppliers. This Statement of Work is for Phases 1 and 2 of the demonstration testing program. The primary objective of the demonstration testing is to identify the best available melter system technology for the Hanford Site LLW vitrification facility. Data obtained also will support various WHC engineering studies and conceptual design of the LLW vitrification facility. Multiple technologies will be selected for demonstration and evaluation. Testing will be conducted using non-radioactive LLW simulants in Seller-specified pilot/testing facilities.

1227 (WHC-SP-0126-2) Westinghouse Hanford Company Plan for certifying newly generated contact-handled transuranic waste for emplacement in the Waste Isolation Pilot Plant. Kibbe, D.R.; Lipinski, R.M. Westinghouse Hanford Co., Richland, WA (United States). Apr 1991. 21p. Sponsored by USDOE, Washington, DC (USA). DOE Contract AC06-87RL10930. Order Number DE91013241. Source: OSTI; NTIS; INIS; GPO Dep.

Westinghouse Hanford Company (Westinghouse Hanford) currently manages an interim storage site for Westinghouse Hanford and non-Westinghouse Hanford-generated transuranic (TRU) waste and operates TRU waste generating facilities within the Hanford Site in Washington State. Approval has been received from the Waste Acceptance Criteria Certification Committee (WACCC) and Westinghouse Hanford TRU waste generating facilities to certify newly generated contact-handled TRU (CH-TRU) solid waste to meet the Waste Acceptance Criteria (WAC). This document describes the overall plan for certifying newly generated CH-TRU solid waste to meet the WAC requirements for storage at the Waste Isolation Pilot Plant (WIPP) site. Attached to this document are facility-specific certification plans for the Westinghouse Hanford TRU waste generators that have received WACCC approval. The certification plans describe operations that generate CH-TRU solid waste and the specific procedures by which these wastes will be certified and segregated from uncertified wastes at the generating facilities. 1 fig.

1228 (WHC-SP-0434-14) Quarterly Briefing Book on Environmental and Waste Management Activities. Quayle, T.A. Westinghouse Hanford Co., Richland, WA

(United States). Apr 1992. 172p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93001465. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this report is to provide managers and senior staff at the US Department of Energy Richland Field Office and its contractors with timely and concise information on Hanford Site environmental and waste management activities. Each edition updates the information on the topics in the previous edition, deletes those determined not to be of current interest, and adds new topics to keep up to date with changing environmental and waste management requirements and issues. Section A covers current waste management and environmental restoration issues. Section B has writeups on national or sitewide environmental and waste management topics. Section C includes program- and waste-specific environmental and waste management topics. Section D provides information on waste sites and inventories on the site. This edition includes an alphabetized listing of the writeups. It is hoped this listing will make it easier for readers to find the information they seek.

1229 (WHC-SP-0822) 242-A Evaporator water hammer event investigation. Wegener, D.L. Westinghouse Hanford Co., Richland, WA (United States). Apr 1992. 63p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93007031. Source: OSTI; NTIS; GPO Dep.

On February 28, 1992, at approximately 1053 hours, a water hammer occurred at the 242-A Evaporator Facility located in the 200 East Area of the Hanford Site. The facility's Raw Water/Used Raw Water (RW/URW) system was undergoing operational testing at the time of the event. While trying to establish system water pressure, a downstream pressure control valve was overcome by water pressure and abruptly shut. Approximately 2300 gal/min of raw water flow was established before the valve closed. Supply water pressure was determined to be approximately 105 psig. During preliminary damage assessments a pressure gauge was found overranged and water was observed leaking from various components. Detailed evaluations are being conducted to assess potential damage to the EC-1 Condenser and other equipment associated with the RW/URW systems.

1230 (WHC-SP-0835) Maintenance Implementation Plan for the 100K Fuel Storage Basins and 100N Reactor. Turner, F.R. Westinghouse Hanford Co., Richland, WA (United States). Jun 1992. 70p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92040796. Source: OSTI; NTIS; INIS; GPO Dep.

The 100N Reactor and 100K Fuel Storage Basins facilities are located in the northwest quadrant of the US Department of Energy, Richland Field Office (RL) Hanford Site adjacent to the Columbia River approximately 35 mi from the city of Richland Washington. The 100N Reactor is a graphite-moderated pressure tube, light watercooled reactor constructed in 1959-1963. Conversion of the 100N Reactor to produce byproduct steam for electrical production was authorized in September 1962. The 100K Area is a dual reactor site constructed in 1954-1955. Each reactor facility, K East and K West Reactor complexes, are almost identical in design, construction, and geographic orientation, and are separated by approximately 2,000 ft. This MIP includes all activities associated with (1) all structures and facilities located within the site area designated as the 100N Area, except for those facilities in which Kaiser Engineers Hanford

and Operations Support Services organizations are in residence, and (2) those portions of structures and facilities located within the site area designated as 100K that are directly associated with the operation and maintenance of the fuel storage basins in 105 K East and 105 K West Buildings. Specifically excluded from this plan are all structures and facilities (or portions thereof) that have been assigned to, or operated by, organizations other than the 100N Reactor Plant Organization.

1231 (WHC-SP-0851) Maintenance Implementation Plan for solid waste. Adrian, J.D. Westinghouse Hanford Co., Richland, WA (United States). Jun 1992. 75p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93001669. Source: OSTI; NTIS; INIS; GPO Dep.

This Maintenance Implementation Plan (MIP) has been developed for implementation of the US Department of Energy (DOE) Order 4330.4A, Maintenance Implementation Program (DOE 1990) at the Hanford Site Solid Waste complex. It addresses maintenance functions associated with Solid Waste Management, which includes the field operational group and the facilities operational group. An assessment of the existing maintenance programs for Solid Waste was performed, and the results of this assessment were evaluated to determine corrective actions required to bring Solid Waste Maintenance into compliance with the order. The MIP assessment disclosed that most elements defined in the order are currently implemented for Solid Waste. It also identified issues which must be addressed to bring the maintenance function into full compliance with DOE Order 4330.4A. These include documentation of the maintenance training program, expanded scope of inspections to address the As Low As Reasonably Achievable (ALARA) concept, development of a Master Equipment List (MEL), and more adequate facilities to provide enhanced storage and control of tools and equipment.

1232 (WHC-SP-0852) Maintenance Implementation Plan for the 300 Area Nuclear Facilities: 308 fuels fabrication, N fuels fabrication, and 340 facility and tanker operations. Westinghouse Hanford Co., Richland, WA (United States). Jun 1992. 57p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93001673. Source: OSTI; NTIS; GPO Dep.

This Maintenance Implementation Plan (MIP) has been developed for the 300 Area Nuclear Facilities, consisting of 308, 340, and N Fuels. It is based on assessments of the existing maintenance program(s) to the requirements specified by US Department of Energy (DOE) Order 4330.4A, Chapter 2, Change #3 (DOE 1990). The results of these assessments were then evaluated to determine corrective actions required. The objective of this plan is to provide baseline information utilized in establishing programs to meet the requirements of the DOE Order. The prime consideration in applying a graded approach to the proposed programs has been for maintaining (or re-establishing) safe personnel and environmental conditions. The existing maintenance program(s) which maintain and preserve facility structure(s) and essential systems will continue and will be included as part of the new programs.

1233 (WHC-SP-0918) Maintenance Implementation Plan for the Grout Facility. Yoakum, A.K. Westinghouse Hanford Co., Richland, WA (United States). Aug 1993. 56p. Sponsored by USDOE, Washington, DC (United

States). DOE Contract AC06-87RL10930. Order Number DE93040337. Source: OSTI; NTIS; GPO Dep.

The objective of the Maintenance Implementation Plan (MIP) is to describe how the Grout Treatment Facility will implement the requirements established by US Department of Energy (DOE) Order 4330.4A, Maintenance Management Program, Chapter 2.0 Nuclear Facilities (DOE 1990). The plan provides a blueprint for a disciplined approach to implementation and compliance. Each element of the order is prioritized, categorized, and then placed into one of three phases for implementation.

1234 (WHC-SP-0920) Hanford Waste Vitrification Plant Project technical exchange plan for fiscal year 1993. Woodcock, G. Westinghouse Hanford Co., Richland, WA (United States). Jan 1993. 55p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93011254. Source: OSTI; NTIS; INIS; GPO Dep.

This document defines the Hanford Waste Vitrification Plant (HWVP) Project's needs and interest in technical information exchange with other vitrification projects, the sources of needed information, the roles and responsibilities of HWVP Project organizations, the procedures for information exchange, and plans for information exchange during fiscal year (FY) 1993.

1235 (WHC-SP-1072) Disposition of PUREX facility tanks D5 and E6 uranium and plutonium solutions: Final report. Harty, D.P. Westinghouse Hanford Co., Richland, WA (United States). Dec 1993. 123p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94011414. Source: OSTI; NTIS; INIS; GPO Dep.

Approximately 9 kilograms of plutonium and 5 metric tons of uranium in a 1 molar nitric acid solution are being stored in two PUREX facility vessels, tanks D5 and E6. The plutonium was accumulated during cleanup activities of the plutonium product area of the PUREX facility. Personnel at PUREX recently completed a formal presentation to the Surplus Materials Peer Panel (SMPP) regarding disposition of the material currently in these tanks. The peer panel is a group of complex-wide experts who have been chartered by EM-64 (Office of Site and Facility Transfer) to provide a third party independent review of disposition decisions. The information presented to the peer panel is provided in the first section of this report. The panel was generally receptive to the information provided at that time and the recommendations which were identified.

1236 (WINCO-1127) Development of a continuous process for adjusting nitrate, zirconium, and free hydrofluoric acid concentrations in zirconium fuel dissolver product. Cresap, D.A.; Halverson, D.S. Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (United States). Apr 1993. 88p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-84ID12435. Order Number DE94000722. Source: OSTI; NTIS; INIS; GPO Dep.

In the Fluorinel Dissolution Process (FDP) upgrade, excess hydrofluoric acid in the dissolver product must be complexed with aluminum nitrate (ANN) to eliminate corrosion concerns, adjusted with nitrate to facilitate extraction, and diluted with water to ensure solution stability. This is currently accomplished via batch processing in large vessels. However, to accommodate increases in projected throughput and reduce water production in a cost-effective manner, a semi-continuous system (In-line Complexing

(ILC)) has been developed. The major conclusions drawn from tests demonstrating the feasibility of this concept are given in this report.

1237 (WINCO-1129) Talc-silicon glass-ceramic waste forms for immobilization of high-level calcined waste. Vinjamuri, K. Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (United States). Jun 1993. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-84ID12435. Order Number DE94000721. Source: OSTI; NTIS; INIS; GPO Dep.

Talc-silicon glass-ceramic waste forms are being evaluated as candidates for immobilization of the high level calcined waste stored onsite at the Idaho Chemical Processing Plant. These glass-ceramic waste forms were prepared by hot isostatically pressing a mixture of simulated nonradioactive high level calcined waste, talc, silicon and aluminum metal additives. The waste forms were characterized for density, chemical durability, and glass and crystalline phase compositions. The results indicate improved density and chemical durability as the silicon content is increased.

1238 (WINCO-1130) Calcination of Fluorinel-sodium waste blends using sugar as a feed additive (formerly WINCO-11879). Newby, B.J.; Thomson, T.D.; O'Brien, B.H. Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (United States). Jun 1992. 49p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-84ID12435. Order Number DE94000720. Source: OSTI; NTIS; INIS; GPO Dep.

Methods were studied for using sugar as a feed additive for converting the sodium-bearing wastes stored at the Idaho Chemical Processing Plant into granular, free flowing solids by fluidized-bed calcination at 500°C. All methods studied blended sodium-bearing wastes with Fluorinel wastes but differed in the types of sugar (sucrose or dextrose) that were added to the blend. The most promising sugar additive was determined to be sucrose, since it is converted more completely to inorganic carbon than is dextrose. The effect of the feed aluminum-to-alkali metal ratio on calcination of these blends with sugar was also investigated. Increasing the aluminum-to-alkali metal ratio from 0.6 to 1.0 decreased the calcine product-to-fines ratio from 3.0 to 1.0 and the attrition index from 80 to 15%. Further increasing the ratio to 1.25 had no effect.

1239 (WINCO-1131) ICPP Fluorinel Dissolution Process (FDP) Plant Protection System (PPS) baseline criteria evaluation. Allen, G.W.; Clayton, R.J.; Fielding, K.D.; Mozes, M.L. Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (United States). Jun 1993. 49p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-84ID12435. Order Number DE94000719. Source: OSTI; NTIS; GPO Dep.

This report documents a baseline criteria evaluation of the FAST Plant Protection System (PPS) at the Idaho Chemical Processing Plant (ICPP). Westinghouse Idaho Nuclear Company (WINCO), Computer Process Application (CPA) personnel originally prepared this report as requested by the FAST Fluorinel Dissolution Process (FDP) Operational Readiness Review (ORR) committee. It was required by the ORR committee for the 1992 restart of FDP operations. However on April 29, 1992, the Department of Energy (DOE) directed WINCO to discontinue reprocessing of spent nuclear fuel at the ICPP. This eliminated the mission of the FDP. The report includes an evaluation of the PPS against criteria requested by the ORR committee and against criteria

contained in the WINCO PPS Requirements Manual. This second criteria evaluation is summarized in Appendix A.

1240 (WINCO-1133) Effect of aluminum and silicon reactants and process parameters on glass-ceramic waste form characteristics for immobilization of high-level fluorinel-sodium calcined waste. Vinjamuri, K. Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (United States). Jun 1993. 45p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-84ID12435. Order Number DE94000717. Source: OSTI; NTIS; INIS; GPO Dep.

In this report, the effects of aluminum and silicon reactants, process soak time and the initial calcine particle size on glass-ceramic waste form characteristics for immobilization of the high-level fluorinel-sodium calcined waste stored at the Idaho Chemical Processing Plant (ICPP) are investigated. The waste form characteristics include density, total and normalized elemental leach rates, and microstructure. Glass-ceramic waste forms were prepared by hot isostatically pressing (HIPing) a pre-compacted mixture of pilot plant fluorinel-sodium calcine, Al, and Si metal powders at 1050°C, 20,000 psi for 4 hours. One of the formulations with 2 wt % Al was HIPed for 4, 8, 16 and 24 hours at the same temperature and pressure. The calcine particle size range include as calcined particle size smaller than 600 µm (finer than -30 mesh, or 215 µm Mass Median Diameter, MMD) and 180 µm (finer than 80 mesh, or 49 µm MMD).

1241 (WINCO-1136) ¹³⁷Cs and ¹³¹I tracer studies on Zr/Na and Al/Na pilot plant calcine to evaluate thermal processes as calcine pretreatment options. Tranter, T.J.; Brewer, K.N. Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (United States). Jul 1993. 43p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-84ID12435. Order Number DE94000713. Source: OSTI; NTIS; INIS; GPO Dep.

The reason for performing volatility studies on pilot plant calcine is to determine the cesium, and iodine decontamination factors as a function of time, temperature, and calcine type. This report discusses separations processes which are being evaluated for ICPP calcine to reduce the high-level waste volume requiring disposal in a geological repository. Reducing the high-level waste volume may reduce disposal cost and conserve repository space. Several aqueous separation processes may be applicable in partitioning the high-level constituents (actinides and fission products). These processes require calcine dissolution in acid prior to actinide and fission product separation. Cesium may be a difficult element to separate from the dissolved calcine because of the solutions: Acidity and complicated chemical matrix. Sodium, calcium, aluminum, and zirconium may interfere with cesium removal from the acidic or neutralized solution. Because of this, a thermal pretreatment option was evaluated in hopes of selectively removing cesium prior to calcine dissolution.

1242 (WINCO-1139) Physical and chemical characteristics of fluorinel/sodium calcine generated during 30 cm Pilot-Plant Run 17. Brewer, K.N.; Kessinger, G.F.; Littleton, L.L.; Olson, A.L. Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (United States). Jul 1993. 148p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-84ID12435. Order Number DE94000714. Source: OSTI; NTIS; INIS; GPO Dep.

The 30 centimeter (cm) pilot plant calciner Run 17, of March 9, 1987, was performed to study the calcination of

fluorinel-sodium blended waste blended at the ratio 3.5:1 fluorinel to sodium, respectively. The product of the run was analyzed by a variety of analytical techniques that included X-ray powder diffraction (XRD), inductively coupled plasma spectroscopy (ICP), scanning electron microscopy (SEM), and X-ray photoelectron spectroscopy (XPS) to deduce physical and chemical characteristics. The analytical data, as well as data analyses and conclusions drawn from the data, are presented.

1243 (WINCO-1146) Idaho Chemical Processing Plant Liquid Effluent Treatment and Disposal Facility hot test report. Hastings, R.L. Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (United States). Sep 1993. 128p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-84ID12435. Order Number DE94008911. Source: OSTI; NTIS; INIS; GPO Dep.

Prior to initial operation with radioactive feed or "hot" operation, the Liquid Effluent Treatment and Disposal (LET&D) Facility underwent extensive testing. This report provides a detailed description and analysis of this testing. Testing has determined that LET&D is capable of processing radioactive solutions between the design flowrates of 275 gph to 550 gph. Modifications made to prevent condensation on the off-gas HEPA filters, to the process vacuum control, bottoms cooler rupture disks, and feed control system operation were successful. Unfortunately, two mixers failed prior to "hot" testing due to manufacturer's error which limited operation of the PEW Evaporator System and sampling was not able to prove that design removal efficiencies for Mercury, Cadmium, Plutonium, and Non-Volatile Radionuclides.

1244 (WINCO-1150) Development and engineering plan for graphite spent fuels conditioning program. Bendixsen, C.L. (ed.); Fillmore, D.L.; Kirkham, R.J.; Lord, D.L.; Phillips, M.B.; Pinto, A.P.; Staiger, M.D. Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (United States). Sep 1993. 82p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-84ID12435. Order Number DE94008807. Source: OSTI; NTIS; INIS; GPO Dep.

Irradiated (or spent) graphite fuel stored at the Idaho Chemical Processing Plant (ICPP) includes Fort St. Vrain (FSV) reactor and Peach Bottom reactor spent fuels. Conditioning and disposal of spent graphite fuels presently includes three broad alternatives: (1) direct disposal with minimum fuel packaging or conditioning, (2) mechanical disassembly of spent fuel into high-level waste and low-level waste portions to minimize geologic repository requirements, and (3) waste-volume reduction via burning of bulk graphite and other spent fuel chemical processing of the spent fuel. A multi-year program for the engineering development and demonstration of conditioning processes is described. Program costs, schedules, and facility requirements are estimated.

1245 (WINCO-1153) Corrosion in ICPP fuel storage basins. Dirk, W.J. Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (United States). Sep 1993. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-84ID12435. Order Number DE94008811. Source: OSTI; NTIS; INIS; GPO Dep.

The Idaho Chemical Processing Plant currently stores irradiated nuclear fuel in fuel storage basins. Historically, fuel has been stored for over 30 years. During the 1970's, an algae problem occurred which required higher levels of chemical treatment of the basin water to maintain visibility

for fuel storage operations. This treatment led to higher levels of chlorides than seen previously which cause increased corrosion of aluminum and carbon steel, but has had little effect on the stainless steel in the basin. Corrosion measurements of select aluminum fuel storage cans, aluminum fuel storage buckets, and operational support equipment have been completed. Aluminum has exhibited good general corrosion rates, but has shown accelerated preferential attack in the form of pitting. Hot dipped zinc coated carbon steel, which has been in the basin for approximately 40 years, has shown a general corrosion rate of 4 mpy, and there is evidence of large shallow pits on the surface. A welded Type 304 stainless steel corrosion coupon has shown no attack after 13 years exposure. Galvanic couples between carbon steel welded to Type 304 stainless steel occur in fuel storage yokes exposed to the basin water. These welded couples have shown galvanic attack as well as hot weld cracking and intergranular cracking. The intergranular stress corrosion cracking is attributed to crevices formed during fabrication which allowed chlorides to concentrate.

1246 (WINCO-1164) Decontamination of FAST (CPP-666) fuel storage area stainless steel fuel storage racks. Kessinger, G.F. Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (United States). Oct 1993. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-84ID12435. Order Number DE94008809. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this report was to identify and evaluate alternatives for the decontamination of the RSM stainless steel that will be removed from the Idaho Chemical Processing plant (ICPP) fuel storage area (FSA) located in the FAST (CPP-666) building, and to recommend decontamination alternatives for treating this material. Upon the completion of a literature search, the review of the pertinent literature, and based on the review of a variety of chemical, mechanical, and compound (both chemical and mechanical) decontamination techniques, the preliminary results of analyses of FSA critically barrier contaminants, and the data collected during the FSA Reracking project, it was concluded that decontamination and beneficial recycle of the FSA stainless steel produced is technically feasible and likely to be cost effective as compared to burying the material at the RWMC. It is recommended that an organic acid, or commercial product containing an organic acid, be used to decontaminate the FSA stainless steel; however, it is also recommended that other surface decontamination methods be tested in the event that this method proves unsuitable. Among the techniques that should be investigated are mechanical techniques (CO₂ pellet blasting and ultra-high pressure water blasting) and chemical techniques that are compatible with present ICPP waste streams.

1247 (WINCO-1165) Evaluation of the electrorefining technique for the processing of radioactive scrap metals. Kessinger, G.F. Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (United States). Oct 1993. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-84ID12435. Order Number DE94008808. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents the results of a literature study performed to identify applications of the electrorefining technique to the decontamination of radioactively-contaminated scrap metal (RSM). Upon the completion of the literature search and the review of numerous references, it was concluded that there were applications of this technique that were appropriate for the decontamination of some types of

RSM, especially when the desired product is a pure elemental metal of high purity. It was also concluded that this technique was not well-suited for the decontamination of RSM stainless steels and other alloys, when it was desired that the metallurgical characteristics of the alloy be present in the decontaminated product.

1248 (WINCO-1171) Evaluation and selection of aqueous-based technology for partitioning radionuclides from ICPP calcine. Olson, A.L.; Schulz, W.W.; Burchfield, L.A.; Carlson, C.D.; Swanson, J.L.; Thompson, M.C. Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (United States). Feb 1993. 69p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-84ID12435. Order Number DE94008803. Source: OSTI; NTIS; INIS; GPO Dep.

Early in 1993 Westinghouse Idaho Nuclear Company (WINCO) chartered a Panel of Nuclear Separations Experts. The purpose of this Panel was to assist WINCO scientists and engineers in selecting, evaluating, and ranking candidate aqueous-based processes and technologies for potential use in partitioning selected radionuclides from nitric acid solutions of retrieved Idaho Chemical Processing Plant (ICPP) calcine. Radionuclides of interest are all transuranium elements, ^{90}Sr , ^{99}Tc , ^{129}I , and ^{137}Cs . The six man Panel met for 4 days (February 16-19, 1993) on the campus of the Idaho State University in Pocatello, Idaho. Principal topics addressed included: Available radionuclide removal technology; applicability of separations technology and processes to ICPP calcine; and potential integrated radionuclide partitioning schemes. This report, prepared from contributions from all Panel members, presents a comprehensive account of the proceedings and significant findings of the February, 1993 meeting in Pocatello.

1249 (WINCO-1172) WINCO Metal Recycle annual report, FY 1993. Bechtold, T.E. (ed.). Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (United States). Dec 1993. 77p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-84ID12435. Order Number DE94008916. Source: OSTI; NTIS; INIS; GPO Dep.

This report is a summary of the first year progress of the WINCO Metal Recycle Program. Efforts were directed towards assessment of radioactive scrap metal inventories, economics and concepts for recycling, technology development, and transfer of technology to the private sector. Seven DOE laboratories worked together to develop a means for characterizing scrap metal. Radioactive scrap metal generation rates were established for several of these laboratories. Initial cost estimates indicate that recycle may be preferable over burial if sufficient decontamination factors can be achieved during melt refining. Radiation levels of resulting ingots must be minimized in order to keep fabrication costs low. Industry has much of the expertise and capability to execute the recycling of radioactive scrap metal. While no single company can sort, melt, refine, roll and fabricate, a combination of two to three can complete this operation. The one process which requires development is in melt refining for removal of radionuclides other than uranium. WINCO is developing this capability in conjunction with academia and industry. This work will continue into FY-94.

1250 (WINCO-1173) Hot Isostatically-pressed aluminosilicate glass-ceramic with natural crystalline analogues for immobilizing the calcined high-level nuclear waste at the Idaho Chemical Processing Plant. Raman, S. Westinghouse Idaho Nuclear Co., Inc., Idaho

Falls, ID (United States). Dec 1993. 134p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-84ID12435. Order Number DE94008802. Source: OSTI; NTIS; INIS; GPO Dep.

The additives Si, Al, MgO, P_2O_5 were mechanically blended with fluorine/sodium calcine in varying proportions. The batches were vacuum sealed in stainless steel canisters and hot isostatically pressed at 20,000 PSI and 1000 C for 4 hours. The resulting suite of glass-ceramic waste forms parallels the natural rocks in microstructural and compositional heterogeneity. Several crystalline phases are analogous in composition and structure to naturally occurring minerals. Additional crystalline phases are zirconia and Ca-Mg borate. The glasses are enriched in silica and alumina. Approximately 7% calcine elements occur dissolved in this glass and the total glass content in the waste forms averages 20 wt%. The remainder of the calcine elements are partitioned into crystalline phases at 75 wt% calcine waste loading. The waste forms were tested for chemical durability in accordance with the MCC1-test procedure. The leach rates are a function of the relative proportions of additives and calcine, which in turn influence the composition and abundances of the glass and crystalline phases. The DOE leach rate criterion of less than 1 g/m²-day is met by all the elements B, Cs and Na are increased by lowering the melt viscosity. This is related to increased crystallization or devitrification with increases in MgO addition. This exploratory work has shown that the increases in waste loading occur by preferred partitioning of the calcine components among crystalline and glass phases. The determination of optimum processing parameters in the form of additive concentration levels, homogeneous blending among the components, and pressure-temperature stabilities of phases must be continued to eliminate undesirable effects of chemical composition, microstructure and glass devitrification.

1251 (WINCO-1176) Idaho Chemical Processing Plant Spent Fuel and Waste Management Technology Development Program Plan. Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (United States). Applied Technology Dept. Sep 1993. 50p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-84ID12435. Order Number DE94008801. Source: OSTI; NTIS; INIS; GPO Dep.

The Department of Energy (DOE) has received spent nuclear fuel (SNF) at the Idaho Chemical Processing Plant (ICPP) for interim storage and reprocessing since 1953. Reprocessing of SNF has resulted in an existing inventory of 1.5 million gallons of radioactive sodium-bearing liquid waste and 3800 cubic meters (m³) of calcine, in addition to the 768 metric tons (MT) of SNF and various other fuel materials in inventory. To date, the major activity of the ICPP has been the reprocessing of SNF to recover fissile uranium; however, recent changes in world events have diminished the demand to recover and recycle this material. As a result, DOE has discontinued reprocessing SNF for uranium recovery, making the need to properly manage and dispose of these and future materials a high priority. In accordance with the Nuclear Waste Policy Act (NWPA) of 1982, as amended, disposal of SNF and high-level waste (HLW) is planned for a geological repository. Preparation of SNF, HLW, and other radioactive wastes for disposal may include mechanical, physical, and/or chemical processes. This plan outlines the program strategy of the ICPP Spent Fuel and Waste Management Technology Development Program (SF&WMTDP) to develop and demonstrate the technology required to ensure that SNF and radioactive waste will properly stored and

prepared for final disposal. Program elements in support of acceptable interim storage and waste minimization include: developing and implementing improved radioactive waste treatment technologies; identifying and implementing enhanced decontamination and decommissioning techniques; developing radioactive scrap metal (RSM) recycle capabilities; and developing and implementing improved technologies for the interim storage of SNF.

1252 (WINCO-1177) CMPO purity tests in the TRUEX solvent using americium-241. Brewer, K.N.; Herbst, R.S.; Tranter, T.J.; Todd, T.A. Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (United States). Dec 1993. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-84ID12435. Order Number DE94008800. Source: OSTI; NTIS; INIS; GPO Dep.

The Transuranic Extraction (TRUEX) Process was developed by E.P. Horwitz and coworkers at Argonne National Laboratory (ANL) to separate the +4, +6, and +3 actinides from acidic aqueous solutions of nuclear wastes. Octyl (phenyl)-N-N-diisobutyl-carbamoylmethylphosphine oxide (CMPO) is the active actinide complexant used in the TRUEX solvent. CMPO is combined with tributyl phosphate (TBP) in an organic diluent, typically n-dodecane, to form the TRUEX solvent. Small quantities of impurities in the CMPO resulting from: (1) synthesis, (2) acid hydrolysis, or (3) radiolysis can result in actinide stripping problems from the solvent. The impurity, octylphenylphosphinic acid (POPPA), is a powerful extractant at low acid concentrations which may be formed during CMPO synthesis. Consequently, commercial CMPO may contain sufficient quantities of POPPA to significantly impact the stripping of actinides from the TRUEX solvent. The purpose of these tests was to (1) determine if commercially available CMPO is sufficiently pure to alleviate actinide stripping problems from the TRUEX process and (2) to determine if solvent cleanup methods are sufficient to purify the commercially purchased CMPO. Extraction and solvent cleanup methodologies used by Horwitz and coworkers at ANL were used to determine CMPO purity with ^{241}Am . The improvement of the americium distribution coefficient in dilute nitric acid resulting from further purifying this CMPO is not significant enough to warrant additional CMPO purifying steps. The commercially purchased CMPO is found to be acceptable to use, as received, in a full-scale TRUEX process.

1253 (WINCO-1178) Conceptual design report for handling Fort St. Vrain fuel element components. Gavalya, R.A. Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (United States). Sep 1993. 49p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-84ID12435. Order Number DE94008799. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents conceptual designs for containment of high-level wastes (HLW) and low-level wastes (LLW) that will result from disassembly of fuel elements from the High Temperature Gas-Cooled Reactor at the Fort St. Vrain nuclear power plant in Platteville, Colorado. Hexagonal fuel elements will enter the disassembly area as a HLW and exit as either as HLW or LLW. The HLW will consist of spent fuel compacts that have been removed from the hexagonal graphite block. Graphite dust and graphite particles produced during the disassembly process will also be routed to the container that will hold the HLW spent fuel compacts. The LLW will consist of the emptied graphite block. Three alternatives have been introduced for interim storage of the HLW containers after the spent fuel has been loaded. The

three alternatives are: (a) store containers where fuel elements are currently being stored, (b) construct a new dry storage facility, and (c) employ Multi-Purpose Canisters (currently in conceptual design stage). Containment of the LLW graphite block will depend on several factors: (a) LLW classification, (b) radiation levels, and (c) volume-reducing technique (if used). Packaging may range from cardboard boxes for incinerable wastes to 55-ton cask inserts for remote-handled wastes. Before final designs for the containment of the HLW and LLW can be developed, several issues need to be addressed: (a) packing factor for fuel compacts in HLW container, (b) storage/disposal of loaded HLW containers, (c) characterization of the emptied graphite blocks, and (d) which technique for volume-reduction purposes (if any) will be used.

1254 (WINCO-1180) CO₂ pellet blasting literature search and decontamination scoping tests report. Archibald, K.E. Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (United States). Dec 1993. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-84ID12435. Order Number DE94008918. Source: OSTI; NTIS; INIS; GPO Dep.

Past decontamination and solvent recovery activities at the Idaho Chemical Processing Plant (ICPP) have resulted in the accumulation of 1.5 million gallons of radioactively contaminated sodium-bearing liquid waste. Future decontamination activities at the ICPP could result in the production of 5 million gallons or more of sodium-bearing waste using current decontamination techniques. Chemical decontamination flushes have provided a satisfactory level of decontamination. However, this method generates large amounts of sodium-bearing secondary waste. Steam jet cleaning has also been used with a great deal of success but cannot be used on concrete or soft materials. With the curtailment of reprocessing at the ICPP, the focus of decontamination is shifting from maintenance for continued operation of the facilities to decommissioning. Treatment of sodium-bearing waste is a particularly difficult problem due to the high content of alkali metals in the sodium-bearing liquid waste. It requires a very large volume of cold chemical additive for calcination. In addition, the sodium content of the sodium-bearing waste exceeds the limit that can be incorporated into vitrified waste without the addition of glass-forming compounds (primarily silicon) to produce an acceptable immobilized waste form. The primary initiatives of the Decontamination Development Program is the development of methods to eliminate/minimize the use of sodium-bearing decontamination chemicals and to minimize all liquid decontamination wastes. One method chosen for cold scoping studies during FY-93 was CO₂ pellet blasting. CO₂ pellet blasting has been used extensively by commercial industries for general cleaning. However, using this method for decontamination of nuclear materials is a fairly new concept. The following report discusses the research and scoping tests completed on CO₂ pellet blasting.

1255 (WINCO-1187) Criteria and evaluation of three decontamination techniques. Tripp, J.L. Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (United States). Jan 1994. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-84ID12435. Order Number DE94008798. Source: OSTI; NTIS; INIS; GPO Dep.

Past decontamination and solvent recovery activities at the Idaho Chemical Processing Plant (ICPP), which is part of the Idaho National Engineering Laboratory (INEL), have resulted in the accumulation of 1.5 million gallons of

radioactively contaminated sodium-bearing liquid waste. Future decontamination activities at the ICPP could result in the production of 5 million gallons or more of sodium-bearing waste using the current decontamination techniques of chemical/water flushes and steam jet cleaning. This waste requires a large amount of cold chemical additive to process because the low melting temperatures of sodium and potassium salts cause agglomeration in the bed of the calciner vessel. Criteria have been established for evaluating methods and technologies available for decontaminating equipment and facilities. The criteria were weighted according to their relative importance using a Kepner-Tregoe Problem Solving process. These criteria were used to rank three decontamination techniques new to the ICPP: laser ablation, liquid abrasive blasting and CO₂ pellet blasting, against the standard decontamination techniques of sodium-based chemical cleaning and water/steam jets used.

1256 (WINCO-1191) Radionuclides in United States commercial nuclear power reactors. Bechtold, T.E. (ed.) (Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (United States)); Dyer, N.C. Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (United States). Jan 1994. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-84ID12435. Order Number DE94008925. Source: OSTI; NTIS; INIS; GPO Dep.

In the next ten to twenty years, many of the commercial nuclear power reactors in the United States will be reaching their projected lifetime of forty years. As these power plants are decommissioned, it seems prudent to consider the recycling of structural materials such as stainless steel. Some of these materials and components have become radioactive through either nuclear activation of the elements within the components or surface contamination with radioactivity from the operational activities. In order to understand the problems associated with recycling stainless steel from decommissioned nuclear power reactors, it is necessary to have information on the radionuclides expected on or in the contaminated materials. A study has been conducted of radionuclide contamination information that is available for commercial nuclear power reactors in the United States. There are two types of nuclear power reactors in commercial use in the United States, pressurized water reactors (PWRs) and boiling water reactors (BWRs). Before presenting radionuclide activities information, a brief discussion is given on the major components and operational differences for the PWRs and BWRs. Radionuclide contamination information is presented from 11 PWRs and over 8 BWRs. These data include both the radionuclides within the circulating reactor coolant water as well as radionuclide contamination on and within component parts.

1257 (WINCO-11933) Effect of aluminum and silicon reactants and HIP soak time on characteristics of glass-ceramic waste forms. Vinjamuri, K. Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (United States). Apr 1993. 40p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-84ID12435. (CONF-930438-30: 95. annual meeting of the American Ceramic Society, Cincinnati, OH (United States), 18-22 Apr 1993). Order Number DE94000936. Source: OSTI; NTIS; INIS; GPO Dep.

The high level liquid waste (HLLW) from nuclear fuel reprocessing is being calcined into solid granules and being stored onsite at the Idaho Chemical Processing Plant (ICPP) since 1963. Final disposal of the calcined waste in a geologic repository requires further consolidation of the calcine into a solid waste form. One of the solid waste forms

being considered for immobilization of the ICPP calcines is the glass-ceramic. The glass-ceramic waste form is a promising option because it can potentially reduce the calcined high level waste (HLW) volume significantly compared to glass waste forms while maintaining similar leach rates. Based on technical evaluations, and laboratory and pilot plant mockup tests, the Environmental Protection Agency (EPA) believes that the glass-ceramic process is more efficient than the glass process for ICPP calcine waste forms. The EPA has determined that the glass-ceramic waste form technology is an acceptable technology to meet the Best Demonstrated Acceptable Technology (BDAT) for ICPP HLW calcine. In this progress report, the impact of aluminum and silicon reactants and HIP soak time on leach rates, microstructure and phase composition of glass-ceramic waste forms are discussed.

1258 (WINCO-11939) Mixed debris treatment at the Idaho National Engineering Laboratory (INEL). Garcia, E.C. (EG and G Idaho, Inc., Idaho Falls, ID (United States)); Porter, C.L.; Wallace, M.T. Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (United States). [1993]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-84ID12435. (CONF-930873-30: 2. international mixed waste symposium, Baltimore, MD (United States), 17-20 Aug 1993). Order Number DE94000927. Source: OSTI; NTIS; INIS; GPO Dep.

August 18, 1992 the Environmental Protection Agency (EPA) published the final revised treatment standards for hazardous debris, including mixed debris. (1) Whereas previous standards had been concentration based, the revised standards are performance based. Debris must be treated prior to land disposal, using specific technologies from one or more of the following families of debris treatment technologies: Extraction, destruction, or immobilization. Seventeen specific technologies with generic application are discussed in the final rule. The existing capabilities and types of debris at the INEL were scrubbed against the debris rule to determine an overall treatment strategy. Seven types of debris were identified: combustible, porous, non-porous, inherently hazardous, HEPA filters, asbestos contaminated, and reactive metals contaminated debris. With the exception of debris contaminated with reactive metals treatment can be achieved utilizing existing facilities coupled with minor modifications.

1259 (WM-PD-91-003-Vol.1) Dry Cask Storage Project, conceptual design report and line item proposal for FY-1993: Volume 1. Norris, R.J. EG and G Idaho, Inc., Idaho Falls, ID (United States). Apr 1991. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93007638. Source: OSTI; NTIS; INIS; GPO Dep.

The Test Area North Hot Shop Storage Pool contains 343 canisters of core debris from Three Mile Island, plus 13 fuel modules from the Loss-of-Fluid Test Reactor and a small number of commercial fuel rods and assemblies owned by the Department of Energy. The Dry Cask Storage Project will remove this fuel from the pool and place it in storage casks for retention until the proposed "Federal Spent Fuel Repository" is opened. This Conceptual Design Report and project proposal is a compilation of information for use in evaluating the Dry Cask Storage Project for Line Item funding and construction beginning in 1993. The Document is presented in two volumes: Volume 1 contains sections 1 through 15 and is intended to be a stand-alone summary of information on the Line Item Construction Project. Volume 2

contains Appendices A through G, presenting more detailed project information on design, cost, schedule, and environmental impact.

1260 (WSRC-RP-93-610) **Mid-year status report for TTP #SR-1320-02 UST: Cs extraction testing.** Bibler, J.P. Westinghouse Savannah River Co., Aiken, SC (United States). 29 Apr 1993. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE93041132. Source: OSTI; NTIS; INIS; GPO Dep.

This project was designed to perform several tasks to provide transfer of technology to PNL concerning optimization of a cesium-specific ion exchange resin, developed at WSRC. The tasks support the development of a Compact Processing Unit (CPU) for Cs-removal from a variety of waste streams at Westinghouse Hanford (WH). In a series of experiments, WSRC has studied the behavior of a small column of the resin at various, increasingly greater flow rates with the HW simulant solution to determine an optimum column loading rate. Elution studies of the resin after saturation with Cs+ will generate an elution profile from which an optimum elution medium, flow rate, and volume can be determined. Small column tests at temperatures ranging from 40°C to 80°C are planned but have not yet begun. Further, WSRC has begun a study in which the resin is subjected to ionizing radiation in a Co-60 source. This study will determine if any flammable or hazardous compounds, that might require special process controls, are formed as a result of irradiation. It will also define the ability of the resin to maintain its selectivity and capacity in a radiation field. During this period, a literature survey of the effects of radiation on this type of resin and similar compounds was initiated. For this survey, the extensive database established by the Radiation Chemistry Data Center at the University of Notre Dame is being used.

HIGH-LEVEL WASTE TANK REMEDIATION

Refer also to citation(s) 439, 472, 496, 667, 668, 669, 670, 671, 729, 741, 742, 743, 744, 746, 890, 976, 1050, 1051, 1052, 1053, 1054, 1055, 1056, 1057, 1058, 1071, 1084, 1089, 1094, 1095, 1096, 1108, 1109, 1131, 1138, 1767, 2036, 2096, 2117, 2389, 2447, 2453, 2483, 2620

1261 (ANL-91/17) **Temperature effects on waste glass performance.** Mazer, J.J. Argonne National Lab., IL (United States). Feb 1991. 32p. Sponsored by USDOE, Washington, DC (USA). DOE Contract W-31109-ENG-38. Order Number DE91014083. Source: OSTI; NTIS; INIS; GPO Dep.

The temperature dependence of glass durability, particularly that of nuclear waste glasses, is assessed by reviewing past studies. The reaction mechanism for glass dissolution in water is complex and involves multiple simultaneous reaction processes, including molecular water diffusion, ion exchange, surface reaction, and precipitation. These processes can change in relative importance or dominance with time or changes in temperature. The temperature dependence of each reaction process has been shown to follow an Arrhenius relationship in studies where the reaction process has been isolated, but the overall temperature dependence for nuclear waste glass reaction mechanisms is less well understood. Nuclear waste glass studies have often neglected to identify and characterize the reaction

mechanism because of difficulties in performing microanalyses; thus, it is unclear if such results can be extrapolated to other temperatures or reaction times. Recent developments in analytical capabilities suggest that investigations of nuclear waste glass reactions with water can lead to better understandings of their reaction mechanisms and their temperature dependences. Until a better understanding of glass reaction mechanisms is available, caution should be exercised in using temperature as an accelerating parameter. 76 refs., 1 tab.

1262 (ANL/CMT/CP-76238) **The reaction of SRL 202 glass in J-13 and DIW.** Ebert, W.L.; Bates, J.K.; Buck, E.C. Argonne National Lab., IL (United States). [1992]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-921101-71: 16. Materials Research Society (MRS) fall meeting, Boston, MA (United States), 30 Nov - 5 Dec 1992). Order Number DE93006405. Source: OSTI; NTIS; INIS; GPO Dep.

Static leach tests were performed in both 304L stainless steel and Teflon vessels using a synthetic high-level waste glass with either deionized water (DIW) or a tuff groundwater solution as the leachant to assess the effects of the vessel and the initial leachant composition on the extent and nature of the glass reaction. The tests were performed using monolith samples at 340 m⁻¹ and crushed samples at 2000 m⁻¹ for times up to 1 year. The results show less silicon is released from the glass into the groundwater solution than into DIW at both high and low glass surface area/leachant volume ratios (SAN), but the alkali metal and boron releases are not affected by the leachant used. Tests performed in a stainless steel vessel resulted in slightly lower leachate pH values, but similar reaction rates to those performed in a Teflon vessel, as measured by the boron release. Blank tests with DIW or EJ-13 in the vessels showed the Teflon vessels to release small amounts of fluoride (1 to 2 ppm) and to acidify the DIW slightly (4.0 < pH < 5.6). The pH values of blank tests with EJ-13 increased from 8.2 to about 8.6 in steel and to about 9.2 in Teflon vessels. The slightly higher pH values attained in Teflon vessels are attributed to outgassing of CO₂ during the test.

1263 (ANL/CMT/CP-76239) **Analytical electron microscopy study of colloids from nuclear waste glass reaction.** Buck, E.C.; Bates, J.K.; Cunnane, J.C.; Ebert, W.L.; Feng, X.; Wronkiewicz, D.J. Argonne National Lab., IL (United States). [1992]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-921101-74: 16. Materials Research Society (MRS) fall meeting, Boston, MA (United States), 30 Nov - 5 Dec 1992). Order Number DE93006403. Source: OSTI; NTIS; INIS; GPO Dep.

An Analytical Electron Microscopy study of colloidal particles formed during reaction of waste glass has been performed. The effect of waste glass test parameters on colloid formation is examined. Characterization of phases present in the leachate of these tests has shown that layers spalled from the glass and precipitated phases are both sources of colloids in the leachate. Elements, such as uranium, have been found to concentrate within colloidal particles in the leachate.

1264 (ANL/CMT/CP-76240) **Effects of radiation exposure on glass alteration in a steam environment.** Wronkiewicz, D.J. (Argonne National Lab., IL (United States)); Bates, J.K.; Tani, B.S.; Wang, L.M. Argonne National Lab., IL (United States). [1992]. 9p. Sponsored by

USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-921101-76: 16. Materials Research Society (MRS) fall meeting, Boston, MA (United States), 30 Nov - 5 dec 1992). Order Number DE93006419. Source: OSTI; NTIS; INIS; GPO Dep.

Several Savannah River Plant (SRL) glass compositions were reacted in steam at temperatures of 150 to 200°C. Half of the tests utilized actinide-doped monoliths and were exposed to an external ionizing gamma source, while the remainder were doped only with U and reacted without gamma exposure. All glass samples readily reacted to form secondary mineral phases within the first week of testing. An in situ layer of smectite initially developed on nonirradiated SRL 202 glass test samples. After 21 days, a thin layer of illite was precipitated from solution onto the smectite layer. A number of alteration products including zeolite, Casilicate, and alkali or alkaline earth uranyl silicate phases were also distributed over most sample surfaces. In the irradiated SRL 202 glass tests, up to three layers enveloped rounded, and sometimes fractured, glass cores. After 35 to 56 days these remnant cores were replaced by a mottled or banded Fe- and Si-rich material. The formation of some secondary mineral phases also has been accelerated in the irradiated tests, and in some instances, the irradiated environment may have led to the precipitation of a different suite of minerals. The alteration layer(s) developed at rates of 2.3 and 32 $\mu\text{m}/\text{day}$ for the nonirradiated and irradiated SRL 202 glasses, respectively, indicating that layer development is accelerated by a factor of ~ 10 to 15X due to radiation exposure under the test conditions.

1265 (ANL/CMT/CP-76241) Does fully radioactive glass behave differently than simulated waste glass? Feng, X.; Bates, J.K.; Bradley, C.R.; Buck, E.C. Argonne National Lab., IL (United States). [1992]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-921101-31: 16. Materials Research Society (MRS) fall meeting, Boston, MA (United States), 30 Nov - 5 dec 1992). Order Number DE93005574. Source: OSTI; NTIS; INIS; GPO Dep.

There has been interest in the comparison of the leach behavior between fully radioactive and simulated nuclear waste glasses, to assess the differences in reaction mechanism, type, and sequence of secondary phases, and the relative durability among the two types of glasses. The results from these comparisons will provide confidence in the use of the large amount of the data generated in the studies of simulated nuclear waste glass for the modeling of performance of radioactive glasses. Most of the previous comparison studies have been performed at a low to intermediate ratio of glass surface area to solution volume and for time periods of less than one year. These studies have generally concluded there is a little difference in leach behavior between the two glass types. This study reinvestigates that conclusion by utilizing an extensive test matrix, with SA/V ranging between 340 to 20,000 m^2/m^3 on three waste glass compositions, for time periods planned up to eight years. The early results are consistent with other studies, in that the leach behavior of simulated waste glasses is similar to that of fully radioactive glasses. However, the longer-term tests at higher SA/V suggest that the leach behavior of the two types of glass diverges, under certain conditions. The longer-term comparison of the leach behavior is discussed.

1266 (ANL/CMT/CP-76242) Accelerated glass reaction under PCT conditions. Ebert, W.L.; Bates, J.K.; Buck, E.C.; Bradley, C.R. Argonne National Lab., IL (United

States). [1992]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-921101-75: 16. Materials Research Society (MRS) fall meeting, Boston, MA (United States), 30 Nov - 5 dec 1992). Order Number DE93006402. Source: OSTI; NTIS; INIS; GPO Dep.

Static leach tests similar to PCT (Product Consistency Test) were performed for up to 2 years to assess long-term reaction behavior of high-level nuclear waste glasses similar to those at Defense Waste Processing Facility. These tests show the reaction rate to decrease with the reaction time from an initially high rate to a low rate, but then to accelerate to a higher rate after reaction times of about 1 year, depending on glass surface area/leachant volume ratio used. Solution concentrations of soluble glass components increase as the reaction is accelerated, while release of other glass components into solution is controlled by secondary phases. Net result is that transformation of glass to stable phases is accelerated while the solution becomes enriched in soluble components not effectively contained in secondary phases. Rate becomes linear in time after the acceleration and may be similar to the initial forward rate. A current model of glass reaction predicts that the glass reaction will be accelerated upon the formation of secondary phases which lower the silicic acid solution concentration. These tests show total Si concentration to increase upon reaction acceleration, however, which may be due to the slightly higher pH attained with the acceleration. The sudden change in the reaction rate is likely due to secondary phase formation. 17 refs, 2 tabs, 3 figs.

1267 (ANL/CMT/CP-76415) High-level nuclear waste borosilicate glass: A compendium of characteristics. Cunnane, J.C. (Argonne National Lab., IL (United States)); Bates, J.K.; Ebert, W.L.; Feng, X.; Mazer, J.J.; Wronkiewicz, D.J.; Sproull, J.; Bourcier, W.L.; McGrail, B.P. Argonne National Lab., IL (United States). [1992]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-921101-13: 16. Materials Research Society (MRS) fall meeting, Boston, MA (United States), 30 Nov - 5 dec 1992). Order Number DE93004190. Source: OSTI; NTIS; INIS; GPO Dep.

With the imminent startup, in the United States, of facilities for vitrification of high-level nuclear waste, a document has been prepared that compiles the scientific basis for understanding the alteration of the waste glass products under the range of service conditions to which they may be exposed during storage, transportation, and eventual geologic disposal. A summary of selected parts of the content of this document is provided. Waste glass alterations in a geologic repository may include corrosion of the glass network due to groundwater and/or water vapor contact. Experimental testing results are described and interpreted in terms of the underlying chemical reactions and physical processes involved. The status of mechanistic modeling, which can be used for long-term predictions, is described and the remaining uncertainties associated with long-term simulations are summarized.

1268 (ANL/CMT/CP-77506) Development and demonstration of the TRUEX solvent extraction process. Vandegriff, G.F.; Chamberlain, D.B.; Conner, C.; Copple, J.M.; Dow, J.A.; Everson, L.; Hutter, J.C.; Leonard, R.A.; Nunez, L.; Regalbuto, M.C.; Sedlet, J.; Srinivasan, B.; Weber, S.; Wygmans, D.G. Argonne National Lab., IL (United States). [1993]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38.

(CONF-930205-27: Waste management '93, Tucson, AZ (United States), 28 Feb - 4 mar 1993). Order Number DE93009207. Source: OSTI; NTIS; INIS; GPO Dep.

The Generic TRUEX Model (GTM) was developed for use in designing site and feed-specific TRUEX flowsheets and in estimating the space and cost requirements for installing a TRUEX process. This paper discusses data collected in support of the GTM and its use in (1) designing process flowsheets and (2) performing sensitivity analyses. Demonstration of the TRUEX process is underway at Argonne National Laboratory (ANL), where plutonium-containing analytical waste solutions generated at the DOE New Brunswick Laboratory (NBL) are being converted from TRU waste (~1 g Pu/L), with no current means of disposal, to solutions that contain less than 10 nCi of transuranic elements per milliliter of waste solution. Results and implications of this demonstration are discussed in this paper.

1269 (ANL/CMT/CP-77655) Study on the colloids generated from testing of high-level nuclear waste glasses. Feng, X.; Buck, E.C.; Mertz, C.; Bates, J.K.; Cunnane, J.C.; Chaiko, D.J. Argonne National Lab., IL (United States). [1993]. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930205-18: Waste management '93, Tucson, AZ (United States), 28 Feb - 4 mar 1993). Order Number DE93008655. Source: OSTI; NTIS; INIS; GPO Dep.

The generation of colloids in the interaction of high-level nuclear waste glasses with groundwater at 90°C has been investigated. The stability of the colloidal suspensions has been characterized with respect to salt concentration, pH time, particle size, and zeta potential. The compositions and the morphology of the colloids have also been determined with transmission electron microscopy (TEM). From our test results combined with earlier ones, we conclude that the waste glass may contribute to the colloid formation by increasing ion concentration in groundwater, which causes nucleation of colloids; by releasing radionuclides that adsorb onto existing groundwater colloids; and by spalling colloidal-size fragments from the surface layer of the reacted glass. The colloids are silicon-rich particles, such as smectites and uranium silicates. When the salt concentration in the solution is high the colloidal suspensions agglomerate. However, the agglomerated particles can be resuspended if the salt concentration is lowered by dilution with groundwater. The colloids agglomerate quickly after the leachate is cooled to room temperature. Most of the colloids settle out of the solution within a few days at ambient temperature. The isoelectric point is at a pH of approximately 1.0. Between pH 1 and 10.5, the colloids are negatively charged, which suggests that they will deposit readily on, positively charged surfaces. The average particle size is largest at the isoelectric point and is smallest around pH 6.

1270 (ANL/CMT/CP-78025) A literature review of surface alteration layer effects on waste glass behavior. Feng, X.; Cunnane, J.C.; Bates, J.K. Argonne National Lab., IL (United States). [1993]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930438-10: 95. annual meeting of the American Ceramic Society, Cincinnati, OH (United States), 18-22 Apr 1993). Order Number DE93012898. Source: OSTI; NTIS; INIS; GPO Dep.

When in contact with an aqueous solution, nuclear waste glass is subject to a chemical attack that results in progressive alteration. During this alteration, constituent elements of the glass pass into the solution; elements initially in solution

diffuse into, or are adsorbed onto, the solid; and new phases appear. This results in the formation of surface layers on the reacted glass. The glass corrosion and radionuclide release can be better understood by investigating these surface layer effects. In the past decade, there have been numerous studies regarding the effects of surface layers on glass reactions. This paper presents a systematic analysis and summary of the past knowledge regarding the effects of surface layers on glass-water interaction. This paper describes the major formation mechanisms of surface layers; reviews the role of surface layers in controlling mass transport and glass reaction affinity (through crystalline phases, an amorphous silica, a gel layer, or all the components in the glass); and discusses how the surface layers contribute to the retention of radionuclides during glass dissolution.

1271 (ANL/CMT/CP-79163) Factors influencing chemical durability of nuclear waste glasses. Feng, Xiandong; Bates, J.K. Argonne National Lab., IL (United States). [1993]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9303134-1: 9. international conference on advanced science and technology, Schaumburg, IL (United States), 27 Mar 1993). Order Number DE93009983. Source: OSTI; NTIS; INIS; GPO Dep.

A short summary is given of our studies on the major factors that affect the chemical durability of nuclear waste glasses. These factors include glass composition, solution composition, SA/V (ratio of glass surface area to the volume of solution), radiation, and colloidal formation. These investigations have enabled us to gain a better understanding of the chemical durability of nuclear waste glasses and to accumulate a data base for modeling the long-term durability of waste glass, which will be used in the risk assessment of nuclear waste disposal. This knowledge gained also enhances our ability to formulate optimal waste glass compositions.

1272 (ANL/CMT/CP-79597) The long-term alteration of borosilicate waste glasses. Ebert, W.L.; Bates, J.K.; Bradley, C.R.; Buck, E.C.; Dietz, N.L.; Brown, N.R. Argonne National Lab., IL (United States). [1993]. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930438-22: 95. annual meeting of the American Ceramic Society, Cincinnati, OH (United States), 18-22 Apr 1993). Order Number DE93015161. Source: OSTI; NTIS; GPO Dep.

Prediction of the long-term durability of glass waste forms under potential disposal conditions is based on a mechanistic model of glass corrosion which has been derived from short-term laboratory tests. The model of glass reaction that has evolved identifies the hydrolysis of an Si-O bond to release silicic acid as the step which controls the long-term glass reactivity. This reaction step is initially fast under dilute solution conditions, but slows as the silicic acid concentration in solution increases. An increase in the solution concentrations of glass components will occur with progressive glass corrosion, and so the solutions which contact waste glasses over long reaction times will have high concentrations of glass components. Therefore, the glass reactivity is usually expected to decrease with the reaction progress as the contacting solution becomes more concentrated. The corrosion behavior of glasses contacted by highly concentrated solutions must be characterized to assess the long-term glass stability.

1273 (ANL/CMT/CP-79802) Analytical electron microscopy examination of solid reaction products in

long-term test of SRL 200 waste glasses. Buck, E.C.; Fortner, J.A.; Bates, J.K.; Feng, X.; Dietz, N.L.; Bradley, C.R.; Tani, B.S. Argonne National Lab., IL (United States). [1993]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-931108-38: Fall meeting of the Materials Research Society (MRS), Boston, MA (United States), 29 Nov - 3 dec 1993). Order Number DE94005482. Source: OSTI; NTIS; INIS; GPO Dep.

Alteration phases, found on the leached surfaces and present as colloids in the leachates of 200-based frit (fully active and simulated) nuclear waste glass, reacted under static test conditions, at a surface area to leachate volume ratio of $20,000 \text{ m}^{-1}$ for 15 days to 728 days, have been examined by analytical electron microscopy. The compositions of the secondary phases were determined using x-ray energy dispersive spectroscopy and electron energy loss spectroscopy, and structural analysis was accomplished by electron diffraction. Long-term samples of simulated glass, which had undergone an acceleration of reaction after 182 days, possessed a number of silicate secondary phases, including; smectite (iron silicate and potassium iron aluminosilicate), wecksite (uranium silicate), zeolite (calcium potassium aluminosilicate), tobermorite (calcium silicate), and a pure silica phase. However, uranium silicates and smectite have also been observed in tests, which have not undergone the acceleration of reaction, in both the leachate and leached layer, suggesting that these phases are not responsible for the acceleration of reaction.

1274 (ANL/CMT/CP-79803) Effects of radiation exposure on SRL 131 composition glass in a steam environment. Wronkiewicz, D.J. (Argonne National Lab., IL (United States)); Bradley, C.R.; Bates, J.K.; Wang, L.M. Argonne National Lab., IL (United States). [1993]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-931108-6: Fall meeting of the Materials Research Society (MRS), Boston, MA (United States), 29 Nov - 3 dec 1993). Order Number DE94003207. Source: OSTI; NTIS; INIS; GPO Dep.

Monoliths of SRL 131 borosilicate glass were irradiated in a saturated air-steam environment, at temperatures of 150°C , to examine the effects of radiation on nuclear waste glass behavior. Half of the tests used actinide and Tc-99 doped glass and were exposed to an external ionizing gamma source, while the remaining glass samples were doped only with uranium and were reacted without any external radiation exposure. The effects of radiation exposure on glass alteration and secondary phase formation were determined by comparing the reaction rates and mineral paragenesis of the two sets of samples. All glass samples readily reacted with the water that condensed on their surfaces, producing a smectite clay layer within the first three days of testing. Additional crystalline phases precipitated on the altered glass surface with increasing reaction times, including zeolites, smectite, calcium and sodium silicates, phosphates, evaporitic salts, and uranyl silicates. Similar phases were produced on both the nonirradiated and irradiated samples; however, the quantity of precipitates was increased and the rate of paragenetic sequence development was accelerated in the latter. After 56 days of testing, the smectite layer developed at an average rate of ~ 0.16 and $0.63 \mu\text{m/day}$ for the nonirradiated and irradiated samples, respectively. These comparisons indicate that layer development is accelerated approximately four-fold due to the radiation exposure at high glass surface area/liquid volume (SA/V) conditions. This increase apparently occurs in response to the rapid concentration of radiolytic products,

including nitric acid, in the thin films of water contacting the sample monoliths.

1275 (ANL/CMT/CP-80024) High-level waste glass compendium; what it tells us concerning the durability of borosilicate waste glass. Cunnane, J.C. (Argonne National Lab., IL (United States)); Allison, J. Argonne National Lab., IL (United States). [1993]. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-931108-22: Fall meeting of the Materials Research Society (MRS), Boston, MA (United States), 29 Nov - 3 dec 1993). Order Number DE94004601. Source: OSTI; NTIS; INIS; GPO Dep.

Facilities for vitrification of high-level nuclear waste in the United States are scheduled for startup in the next few years. It is, therefore, appropriate to examine the current scientific basis for understanding the corrosion of high-level waste borosilicate glass for the range of service conditions to which the glass products from these facilities may be exposed. To this end, a document has been prepared which compiles worldwide information on borosilicate waste glass corrosion. Based on the content of this document, the acceptability of canistered waste glass for geological disposal is addressed. Waste glass corrosion in a geologic repository may be due to groundwater and/or water vapor contact. The important processes that determine the glass corrosion kinetics under these conditions are discussed based on experimental evidence from laboratory testing. Testing data together with understanding of the long-term corrosion kinetics are used to estimate radionuclide release rates. These rates are discussed in terms of regulatory performance standards.

1276 (ANL/CMT/CP-80025) Laboratory testing of waste glass aqueous corrosion; effects of experimental parameters. Ebert, W.L.; Mazer, J.J. Argonne National Lab., IL (United States). [1993]. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-931108-23: Fall meeting of the Materials Research Society (MRS), Boston, MA (United States), 29 Nov - 3 dec 1993). Order Number DE94004575. Source: OSTI; NTIS; INIS; GPO Dep.

A literature survey has been performed to assess the effects of the temperature, glass surface area/leachate volume ratio, leachant composition, leachant flow rate, and glass composition (actual radioactive vs. simulated glass) used in laboratory tests on the measured glass reaction rate. The effects of these parameters must be accounted for in mechanistic models used to project glass durability over long times. Test parameters can also be utilized to highlight particular processes in laboratory tests. Waste glass corrosion results as water diffusion, ion-exchange, and hydrolysis reactions occur simultaneously to devitrify the glass and release soluble glass components into solution. The rates of these processes are interrelated by the affects of the solution chemistry and glass alteration phases on each process, and the dominant (fastest) process may change as the reaction progresses. Transport of components from the release sites into solution may also affect the observed corrosion rate. The reaction temperature will affect the rate of each process, while other parameters will affect the solution chemistry and which processes are observed during the test. The early stages of corrosion will be observed under test conditions which maintain dilute leachates and the later stages will be observed under conditions that generate more concentrated leachate solutions. Typically, water diffusion and ion-exchange reactions dominate the observed glass

corrosion in dilute solutions while hydrolysis reactions dominant in more concentrated solutions. Which process(es) controls the long-term glass corrosion is not fully understood, and the long-term corrosion rate may be either transport- or reaction-limited.

1277 (ANL/CMT/CP-80026) Surface layer effects on waste glass corrosion. Feng, X. Argonne National Lab., IL (United States). [1993]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-931108-19: Fall meeting of the Materials Research Society (MRS), Boston, MA (United States), 29 Nov - 3 dec 1993). Order Number DE94004572. Source: OSTI; NTIS; INIS; GPO Dep.

Water contact subjects waste glass to chemical attack that results in the formation of surface alteration layers. Two principal hypotheses have been advanced concerning the effect of surface alteration layers on continued glass corrosion: (1) they act as a mass transport barrier and (2) they influence the chemical affinity of the glass reaction. In general, transport barrier effects have been found to be less important than affinity effects in the corrosion of most high-level nuclear waste glasses. However, they can be important under some circumstances, for example, in a very alkaline solution, in leachants containing Mg ions, or under conditions where the matrix dissolution rate is very low. The latter suggests that physical barrier effect may affect the long-term glass dissolution rate. Surface layers influence glass reaction affinity through the effects of the altered glass and secondary phases on the solution chemistry. The reaction affinity may be controlled by various precipitates and crystalline phases, amorphous silica phases, gel layer, or all the components of the glass. The surface alteration layers influence radionuclide release mainly through colloid formation, crystalline phase incorporation, and gel layer retention. This paper reviews current understanding and uncertainties.

1278 (ANL/CMT/CP-80027) Waste glass weathering. Bates, J.K.; Buck, E.C. Argonne National Lab., IL (United States). [1993]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-931108-45: Fall meeting of the Materials Research Society (MRS), Boston, MA (United States), 29 Nov - 3 dec 1993). Order Number DE94005478. Source: OSTI; NTIS; INIS; GPO Dep.

The weathering of glass is reviewed by examining processes that affect the reaction of commercial, historical, natural, and nuclear waste glass under conditions of contact with humid air and slowly dripping water, which may lead to immersion in nearly static solution. Radionuclide release data from weathered glass under conditions that may exist in an unsaturated environment are presented and compared to release under standard leaching conditions. While the comparison between the release under weathering and leaching conditions is not exact, due to variability of reaction in humid air, evidence is presented of radionuclide release under a variety of conditions. These results suggest that both the amount and form of radionuclide release can be affected by the weathering of glass.

1279 (ANL/CMT/CP-80028) Radionuclide decay effects on waste glass corrosion and weathering. Wronkiewicz, D.J. Argonne National Lab., IL (United States). [1993]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-931108-88: Fall meeting of the Materials Research Society (MRS),

Boston, MA (United States), 29 Nov - 3 dec 1993). Order Number DE94007699. Source: OSTI; NTIS; INIS; GPO Dep.

The release of glass components into solution, including radionuclides, may be influenced by the presence of radiolytically produced nitric acid, carboxylic acid, and transient water dissociation products such as $\cdot\text{OH}$ and O_2^- . Under batch test conditions, glass corrosion has been shown to increase up to a maximum of three-to five-fold in irradiated tests relative to nonirradiated tests, while in other studies the presence of radiolytic products has actually decreased glass corrosion rates. Bicarbonate groundwaters will buffer against pH decreases and changes in corrosion rates. Under high surface area-to-solution volume (S/V) conditions, the bicarbonate buffering reservoir may be quickly overwhelmed by radiolytic acids that are concentrated in the thin films of water contacting the samples. Glass reaction rates have been shown to increase up to 10-to-15-fold due to radiation exposure under high S/V conditions. Radiation damage to solid glass materials results in bond damage and atomic displacements. This type of damage has been shown to increase the release rates of glass components up to four-fold during subsequent corrosion tests, although under actual disposal conditions, glass annealing processes may negate the solid radiation damage effects.

1280 (ANL/CMT/CP-80123) The role of natural glasses as analogues in projecting the long-term alteration of high-level nuclear waste glasses: Part 1. Mazer, J.J. Argonne National Lab., IL (United States). [1993]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-931108-58-Pt.1: Fall meeting of the Materials Research Society (MRS), Boston, MA (United States), 29 Nov - 3 dec 1993). Order Number DE94005920. Source: OSTI; NTIS; INIS; GPO Dep.

The common observation of glasses persisting in natural environments for long periods of time (up to tens of millions of years) provides compelling evidence that these materials can be kinetically stable in a variety of subsurface environments. This paper reviews how natural and historical synthesized glasses can be employed as natural analogues for understanding and projecting the long-term alteration of high-level nuclear waste glasses. The corrosion of basaltic glass results in many of the same alteration features found in laboratory testing of the corrosion of high-level radioactive waste glasses. Evidence has also been found indicating similarities in the rate controlling processes, such as the effects of silica concentration on corrosion in groundwater and in laboratory leachates. Naturally altered rhyolitic glasses and tektites provide additional evidence that can be used to constrain estimates of long-term waste glass alteration. When reacted under conditions where water is plentiful, the corrosion for these glasses is dominated by network hydrolysis, while the corrosion is dominated by molecular water diffusion and secondary mineral formation under conditions where water contact is intermittent or where water is relatively scarce. Synthesized glasses that have been naturally altered result in alkali-depleted alteration features that are similar to those found for natural glasses and for nuclear waste glasses. The characteristics of these alteration features appear to be dependent on the alteration conditions which affect the dominant reaction processes during weathering. In all cases, care must be taken to ensure that the information being provided by natural analogues is related to nuclear waste glass corrosion in a clear and meaningful way.

1281 (ANL/CMT/CP-80775) Extraction of technetium from simulated Hanford tank wastes. Chaiko, D.J. (Argonne National Lab., IL (United States)); Vojta, Y.; Takeuchi, M. Argonne National Lab., IL (United States). [1993]. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-931043-5: 8. symposium on separation science and technology for energy applications, Knoxville, TN (United States), 24-28 Oct 1993). Order Number DE94002362. Source: OSTI; NTIS; INIS; GPO Dep.

Aqueous biphasic separation systems are being developed for the treatment of liquid radioactive wastes. These extraction systems are based on the use of polyethylene glycols (PEGs) for the selective extraction and recovery of long-lived radionuclides, such as ^{129}I , ^{75}Se , and ^{99}Tc , from caustic solutions containing high concentrations of nitrate, nitrite, and carbonate. Because of the high ionic strengths of supernatant liquids in Hanford underground storage tanks, aqueous biphasic systems can be generated by simply adding aqueous PEG solutions directly to the waste solution. In the process, anionic species like I^- and TcO_4^- are selectively transferred to the less dense PEG phase. The partition coefficient for a wide range of inorganic cations and anions, such as sodium, potassium, aluminum, nitrate, nitrate, and carbonate, are all less than one. The authors present experimental data on extraction of technetium from several simulated Hanford tank wastes at 25° and 50°C.

1282 (ANL/CMT/CP-81047) Disposition of actinides released from high-level waste glass. Ebert, W.L.; Bates, J.K.; Buck, E.C.; Gong, M.; Wolf, S.F. Argonne National Lab., IL (United States). [1994]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940416-7: 96. annual meeting of the American Ceramic Society, Indianapolis, IN (United States), 24-28 Apr 1994). Order Number DE94011474. Source: OSTI; NTIS; INIS; GPO Dep.

A series of static leach tests was conducted using glasses developed for vitrifying tank wastes at the Savannah River Site to monitor the disposition of actinide elements upon corrosion of the glasses. In these tests, glasses produced from SRL 131 and SRL 202 frits were corroded at 90°C in a tuff groundwater. Tests were conducted using crushed glass at different glass surface area-to-solution volume (S/V) ratios to assess the effect of the S/V on the solution chemistry, the corrosion of the glass, and the disposition of actinide elements. Observations regarding the effects of the S/V on the solution chemistry and the corrosion of the glass matrix have been reported previously. This paper highlights the solution analyses performed to assess how the S/V used in a static leach test affects the disposition of actinide elements between fractions that are suspended or dissolved in the solution, and retained by the altered glass or other materials.

1283 (ANL/CMT/CP-81229) Colloid formation during the corrosion of SRL 200 glass. Buck, E.C.; Bates, J.K.; Feng, X. Argonne National Lab., IL (United States). [1994]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940416-6: 96. annual meeting of the American Ceramic Society, Indianapolis, IN (United States), 24-28 Apr 1994). Order Number DE94011475. Source: OSTI; NTIS; INIS; GPO Dep.

Nonradioactive SRL 200S glass and fully radioactive SRL 200R glass were reacted at glass surface areas to leachant volume (SA/V) ratios of 20,000, 2,000, and 340 m^{-1} for times varying from several days to a few years. The particles present in the leachates of these tests have been

examined by analytical electron microscopy (AEM). The major colloidal clay phase was identified as a smectite clay from its characteristic electron diffraction pattern. The clay colloids eventually disappear from the solution and return to the glass; the time at which this occurs depends on the SA/V. Uranium silicate particles and calcium-bearing phases were also sometimes found in the leachates.

1284 (ANL/CP-71530) Disposal of vitrified waste in an unsaturated environment. Bates, J.K. Argonne National Lab., IL (United States). [1991]. 8p. Sponsored by USDOE, Washington, DC (USA). DOE Contract W-31109-ENG-38. (CONF-910435-61: 2. annual American Nuclear Society (ANS) international high level radioactive waste management conference, Las Vegas, NV (United States), 28 Apr - 3 May 1991). Order Number DE91010278. Source: OSTI; NTIS; INIS; GPO Dep.

An experimental program is described wherein the effect of important independent variables on glass reaction under conditions that may exist for unsaturated storage is examined. The effect of radioactive vs. simulated glasses is being examined in a set of simple and integrated tests. Results through 140 days show that no major differences exist between the two glass types although some trends are being established that need further examination. The effect of SA/V was examined in preliminary tests done at 10, 50, and 100 m^{-1} . Analysis of the reacted glass structure indicated that as the SA/V changed, the assemblage of crystalline phases that formed on the reacted glass varied and the process by which the glass structure reacted changed. Finally, the effect of radiation on glass reactivity is being studied. For each variable studied, tests are in progress that will provide information to support startup of the glass processing facilities and licensing of a repository. 16 refs., 2 figs., 3 tabs.

1285 (ANL/CP-73319) AEM analyses of SRL 131 glass altered as a function of SA/V. Mazer, J.J.; Bates, J.K.; Biber, B.M.; Bradley, C.R. Argonne National Lab., IL (United States). [1991]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-911109-1: Fall meeting of the European Materials Research Society (EMRS), Strasbourg (France), 5-8 Nov 1991). Order Number DE92001924. Source: OSTI; NTIS; INIS; GPO Dep.

The goal of the present study was to consider the effects of SVT (svt=surface area-to-volume ratio multiplied by reaction time) scaling on glass/water reactions, particularly with respect to characterizing the alteration layer formed at different values of SVT. Preliminary testing indicated that a Na-rich borosilicate glass, SRL 131, would achieve significant reaction in a relatively short period of time. While 131 glass is not expected to be produced at the defense waste processing facility (DWPF) its composition falls in the range for consideration. The results presented here include a comparison of the solution concentrations and detailed descriptions of the alteration layers that formed, analyzed using Analytical Electron Microscopy (AEM). The examination of solution concentrations and solids changes simultaneously allows a more complete assessment of the effects of surface area to volume ratio (SA/V) on glass reaction. 20 refs., 2 figs., 1 tab.

1286 (ANL/CP-73431) Obsidians and tektites: Natural analogues for water diffusion in nuclear waste glasses. Mazer, J.J. (Argonne National Lab., IL (United States)); Bates, J.K.; Bradley, C.R.; Stevenson, C.M.

Argonne National Lab., IL (United States). [1991]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-911109-2: Fall meeting of the European Materials Research Society (EMRS), Strasbourg (France), 5-8 Nov 1991). Order Number DE92001923. Source: OSTI; NTIS; INIS; GPO Dep.

Projected scenarios for the proposed Yucca Mountain repository include significant periods of time when high relative humidity atmospheres will be present, thus the reaction processes of interest will include those known to occur under these conditions. The ideal natural analog for the proposed Yucca Mountain repository would consist of natural borosilicate glasses exposed to expected repository conditions for thousands of years; however, the prospects for identifying such an analog are remote, but an important caveat for using natural analog studies is to relate the reaction processes in the analog to those in the system of interest, rather than a strict comparison of the glass compositions. In lieu of this, identifying natural glasses that have reacted via reaction processes expected in the repository is the most attractive option. The goal of this study is to quantify molecular water diffusion in the natural analogs obsidian and tektites. Results from this study can be used in assessing the importance of factors affecting molecular water diffusion in nuclear waste glasses, relative to other identified reaction processes. In this way, a better understanding of the long-term reaction mechanism can be developed and incorporated into performance assessment models. 17 refs., 4 figs.

1287 (ANL/CP-73611) Shaping particles for ultramicrotomy. Bradley, C.R.; Dietz, N.L.; Bates, J.K. Argonne National Lab., IL (United States). [1991]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-911202-16: Annual fall meeting of the Materials Research Society (MRS), Boston, MA (United States), 2-6 Dec 1991). Order Number DE92005242. Source: OSTI; NTIS; GPO Dep.

A technique for preshaping large particles of reacted glass for ultramicrotomy is described. This technique preserves delicate surface layers and results in more sections per block extending deeper into the sample than other techniques.

1288 (ANL/CP-74200) Initial comparison of leach behavior between fully radioactive and simulated nuclear waste glasses through long-term testing: Part 1, Solution analysis. Feng, Xiangdong; Bates, J.K. Argonne National Lab., IL (United States). [1992]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-920430-70: 3. international high level radioactive waste management (IHLRWM) conference, Las Vegas, NV (United States), 12-16 Apr 1992). Order Number DE92010516. Source: OSTI; NTIS; INIS; GPO Dep.

A comparison of glass reactivity between radioactive sludge based and simulated nuclear waste glasses has been made through long-term testing of both glass types for SRL 165, SRL 131, and SRL 200 frit compositions. The data demonstrate that for time periods through 280 days, differences in elemental release to solution up to 400% are observed. However, in general, differences in glass reactivity as measured by the release of boron, lithium, and sodium are less than a factor of two. The differences in reactivity are not large enough to alter the order of glass durability for the different compositions or to change the controlling glass dissolution mechanism. A radiation effect exists, mainly in the influence on the leachate pH, which in turn affects the

glass reaction mechanism and rate. The differences in reactivity between fully radioactive and the simulated glasses can be reasonably explained if the controlling reaction mechanism is accounted for. Those differences are glass composition and leaching mechanism dependent. Lithium is found to have the highest elemental release in an ion-exchange dominated glass reaction process, while lithium has a lower release than boron and sodium in a matrix dissolution dominated process, where boron and sodium are usually among the most concentrated solution species.

1289 (ANL/CP-74206) A comparison of glass reaction at high and low SA/V: PCT vs MCC-1. Ebert, W.L.; Bates, J.K. Argonne National Lab., IL (United States). [1992]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-920430-73: 3. international high level radioactive waste management (IHLRWM) conference, Las Vegas, NV (United States), 12-16 Apr 1992). Order Number DE92010887. Source: OSTI; NTIS; INIS; GPO Dep.

Leach tests have been performed at surface area/volume (SA/V) of 10, 2000, and 20,000 m⁻¹ using actinide-doped borosilicate waste glass (SRL 131 and SRL 202) to assess the effects of the SA/V on the mechanism and rate of the glass reaction. Solution results are presented which show the major effect of the SA/V to be dilution. Higher SA/V result in higher leachate pH values being attained due to initial ion exchange reactions. The higher pH values then accelerate hydrolysis of the glass. Colloids rich in aluminum and iron form at high SA/V after very little glass has reacted. Actinides released during glass reaction sorb onto these colloids which eventually become large enough to settle out of solution. The measured response is sensitive to the SA/V of the test, and is dominated by ion exchange at 10 m⁻¹, by matrix dissolution at 2000 m⁻¹, and by colloid formation at 20,000 m⁻¹ within laboratory test timeframes.

1290 (ANL/CP-74216) Initial comparison of leach behavior between fully radioactive and simulated nuclear waste glass through long-term testing: Part 2, Reacted layer analysis. Bates, J.K.; Feng, X.; Bradley, C.R.; Buck, E.C. Argonne National Lab., IL (United States). [1992]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-920307-43: Waste management '92, Tucson, AZ (United States), 1-5 Mar 1992). Order Number DE92009715. Source: OSTI; NTIS; INIS; GPO Dep.

An initial comparison of glass behavior of simulated nuclear waste glasses has been made through long-term testing of general glass types SRL165, SRL131 and SRL200. The data demonstrate that up to 560 days at S/V of 2000/m, the reacted layers consist of one outer clay layer, which is undetermined by discontinuous etch pits. The regions between the etch pits are alkali depleted. The surface layer becomes thicker as test duration progresses and the reacted layer after the same test time is thinner at higher S/V than at lower S/V. The relative glass durability measured by the thickness of the reacted layer is 165/42S > 131/11S > 200S, which is consistent with solution analyses. In general, the reacted layers on all glass compositions are poorly crystallized which makes the clay identification difficult. The diffraction spacings and EDS compositions for 131/11S and 200S, although not unique to, are consistent with Na (or Ca-) montmorillonite or nontronite. Both of these are dioctahedral smectite.

1291 (ANL/EA/CP-80958) Approach for systematic evaluation of transuranic waste management alternatives. Hong, K.; Koebrick, B.; Kotek, T. Argonne National Lab., IL (United States). [1994]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940225-23: Waste management '94, Tucson, AZ (United States), 27 Feb - 3 mar 1994). Order Number DE94006828. Source: OSTI; NTIS; INIS; GPO Dep.

This paper describes an approach for systematic evaluation of management alternatives that are being considered for the treatment, storage, and disposal of transuranic waste (TRUW) at U.S. Department of Energy sites. The approach, which is currently under development, would apply WASTE-MGMT, a database application model developed at Argonne National Laboratory, to estimate projected environmental releases and would evaluate impact measures such as health risk and costs associated with each of the waste management alternatives. The customized application would combine site-specific TRUW inventory and characterization data with treatment and transportation parameters to estimate the quantities and characteristics of the wastes to be treated, emissions of hazardous substances from the treatment facilities, and the quantities and characteristics of the wastes to be shipped between sites. These data would then be used to estimate for several TRUW management scenarios the costs and health risks of constructing and operating the required treatment facilities and of transporting TRUW for treatment and final disposal. Treatment, storage, and disposal of TRUW at DOE sites is composed of many variables and options at each stage. The approach described in this paper would provide for efficient consideration of all of these facets when evaluating potentially feasible TRUW management alternatives. By expanding existing databases, this model could eventually be adapted to accommodate the introduction of new treatment technologies, updated TRUW characterization data, and/or revised waste acceptance criteria.

1292 (ANL/RE-92/2) Effect of viscosity on seismic response of waste storage tanks. Tang, Yu; Uras, R.A.; Chang, Yao-Wen. Argonne National Lab., IL (United States). Reactor Engineering Div. Jun 1992. 141p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE92017237. Source: OSTI; NTIS; INIS; GPO Dep.

The dynamic response of liquid-storage tanks subjected to harmonic excitations and earthquake ground motions has been studied. A rigid tank of negligible mass, rigidly supported at the base having a diameter of 50 ft. and fluid height of 20.4 ft. was used in the computer analysis. The liquid is assumed to have a density of 1.5 g/ml. Viscosity values, $\mu = 60, 200, 100$, and 10,000 cP, were used in the numerical analyses to study the effects of viscosity on sloshing wave height, impulsive and convective pressure on the tank wall, base shear and base moments. Harmonic excitations as well as earthquake ground motions were used as input motions. The harmonic excitations used in the analyses covers a wide range of frequencies, including both the resonant and non-resonant frequencies. Two earthquake motions were used. One matches the Newmark-Hall median response spectrum and is anchored at 0.24 g for a rock site with a damping of 2% and a time duration of 10 s. The other is the 1978 Tabas earthquake which had a peak ZPA of 0.81 g and a time duration of 29 s. A small tank, about 1/15 the size of the typical waste storage tank, was used in the harmonic excitation study to investigate the effect of viscosity

on the response of liquid-storage tanks and how the viscosity effect is affected by the size of the storage tank. The results of this study show that for the typical waste storage tank subjected to earthquake motions, the effect of viscosity on sloshing wave height and impulsive and convective pressures is very small and can be neglected. For viscosity effect to become noticeable in the response of the typical waste storage tank, the waste viscosity must be greater than 10,000 cP. This value is far greater than the estimated viscosity value of the high level wastes, which may range from 60 to 200 cP for some tanks.

1293 (ANL/RE/CP-79030) Effect of viscosity on dynamic response of a liquid storage tank. Tang, Yu; Uras, R.A.; Chang, Yao W. Argonne National Lab., IL (United States). [1993]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930702-33: 1993 ASME pressure vessel and piping conference, Denver, CO (United States), 25-29 Jul 1993). Order Number DE93015547. Source: OSTI; NTIS; INIS; GPO Dep.

An exploratory study on the effect of viscosity on the dynamic response of a liquid storage tank is presented. The tank is assumed to be rigid. Both harmonic and earthquake excitations are used in the study. The finite element method is employed to attack the problem. The response functions examined include the sloshing wave height and the impulsive and convective components of the hydrodynamic pressure. The study shows that the viscosity affects the sloshing wave height and the associated convective component of the pressure response, and it has a negligible effect on the impulsive component. A simple practical approach is proposed to take this effect into account.

1294 (BNL-46540) Overview of seismic panel activities. Bandyopadhyay, K.K. Brookhaven National Lab., Upton, NY (United States). [1991]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-9110122-6: Natural phenomena hazards mitigation conference, St. Louis, MO (United States), 15-18 Oct 1991). Order Number DE91018726. Source: OSTI; NTIS; INIS; GPO Dep.

In January 1991, the DOE-EM appointed a Seismic Panel to develop seismic criteria that can be used for evaluation of underground storage tanks containing high level radioactive wastes. The Panel expects to issue the first draft of the criteria report in January 1992. This paper provides an overview of the Panel's activities and briefly discusses the criteria. 3 refs.

1295 (BNL-48363) Structural analysis of an underground reinforced concrete waste storage tank due to over-pressurization. Xu, J. (Brookhaven National Lab., Upton, NY (United States)); Bandyopadhyay, K.; Shteyngart, S.; Eckert, H. Brookhaven National Lab., Upton, NY (United States). [1993]. 32p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-930352-14: 2. Japan Society of Mechanical Engineers (JSME)/American Society of Mechanical Engineers (ASME) joint international conference on nuclear engineering, San Francisco, CA (United States), 21-24 Mar 1993). Order Number DE93007272. Source: OSTI; NTIS; INIS; GPO Dep.

This paper presents the results of a structural analysis performed by use of the finite element method in determining the pressure-carrying capacity of an underground tank which contains nuclear wastes. The tank and surrounding

soil were modeled and analyzed using the ABAQUS program. Special emphases were given on determining the effects of soil-containment interaction by employing Coulomb friction model. The effect of material properties was investigated by considering two sets of stress-strain data for the steel plates. In addition, a refined mesh was used to evaluate the strain concentration effects at steel liner thickness discontinuities.

1296 (BNL-48750) Polymers for subterranean containment barriers for underground storage tanks (USTs): Letter report on FY 1992 activities. Heiser, J.H.; Colombo, P.; Clinton, J. Brookhaven National Lab., Upton, NY (United States). Dec 1992. 45p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE93019470. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy (DOE) set up the Underground Storage Tank Integrated Demonstration Program (USTID) to demonstrate technologies for the retrieval and treatment of tank waste, and closure of underground storage tanks (USTs). There are more than 250 underground storage tanks throughout the DOE complex. These tanks contain a wide variety of wastes including high level, low level, transuranic, mixed and hazardous wastes. Many of the tanks have performed beyond the designed lifetime resulting in leakage and contamination of the local geologic media and groundwater. To mitigate this problem it has been proposed that an interim subterranean containment barrier be placed around the tanks. This would minimize or prevent future contamination of soil and groundwater in the event that further tank leakages occur before or during remediation. Use of interim subterranean barriers can also provide sufficient time to evaluate and select appropriate remediation alternatives. The DOE Hanford site was chosen as the demonstration site for containment barrier technologies. A panel of experts for the USTID was convened in February, 1992, to identify technologies for placement of subterranean barriers. The selection was based on the ability of candidate grouts to withstand high radiation doses, high temperatures and aggressive tank waste leachates. The group identified and ranked nine grouting technologies that have potential to place vertical barriers and five for horizontal barriers around the tank. The panel also endorsed placement technologies that require minimal excavation of soil surrounding the tanks.

1297 (BNL-49761) Spacing effects on seismic responses of underground waste storage tanks. Xu, J. (Brookhaven National Lab., Upton, NY (United States)); Bandyopadhyay, K.; Miller, C.A.; Costantino, C.J. Brookhaven National Lab., Upton, NY (United States). [1994]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-940613-9: 1994 pressure vessels and piping conference, Minneapolis, MN (United States), 19-23 Jun 1994). Order Number DE94011738. Source: OSTI; NTIS; INIS; GPO Dep.

In this paper, an investigation is performed for determination of the effects of spacing on seismic response of grouped underground tank structures. The study is carried out using a 2-D Finite Element Method, and the key mechanisms for transmitting structure-soil-structure interaction (SSSI) effects are identified. A parametric analysis is performed to quantify the SSSI effects. Results of the study are presented.

1298 (BNL-52357) Dynamic soil pressures on rigid vertical walls. Veletsos, A.S. (Rice Univ., Houston, TX (United States)); Younan, A.H. Brookhaven National Lab.,

Upton, NY (United States); Rice Univ., Houston, TX (United States). Dec 1992. 59p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE93008899. Source: OSTI; NTIS; GPO Dep.

A critical evaluation is made of the dynamic pressures and the associated forces induced by ground shaking on a rigid, straight, vertical wall retaining a semi-infinite, uniform viscoelastic layer of constant thickness. The effects of both harmonic and earthquake-induced excitations are examined. Simple approximate expressions for the responses of the system are developed, and comprehensive numerical data are presented which elucidate the effects and relative importance of the various parameters involved. These solutions are then compared with those obtained by use of a simple model proposed previously by Scott, and the accuracy of this model is assessed. Finally, two versions of an alternative model are proposed which better approximate the action of the system. In the first, the properties of the model are defined by frequency-dependent parameters, whereas in the second, which is particularly helpful in analyses of transient response, they are represented by frequency-independent, constant parameters.

1299 (BNL-52361) Seismic design and evaluation guidelines for the Department of Energy high-level waste storage tanks and appurtenances. Bandyopadhyay, K.; Cornell, A.; Costantino, C.; Kennedy, R.; Miller, C.; Veletsos, A. Brookhaven National Lab., Upton, NY (United States). Jan 1993. 321p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE93011793. Source: OSTI; NTIS; INIS; GPO Dep.

This document provides guidelines for the design and evaluation of underground high-level waste storage tanks due to seismic loads. Attempts were made to reflect the knowledge acquired in the last two decades in the areas of defining the ground motion and calculating hydrodynamic loads and dynamic soil pressures for underground tank structures. The application of the analysis approach is illustrated with an example. The guidelines are developed for specific design of underground storage tanks, namely double-shell structures. However, the methodology discussed is applicable for other types of tank structures as well. The application of these and of suitably adjusted versions of these concepts to other structural types will be addressed in a future version of this document.

1300 (BNL-52372) Dynamic soil pressures on rigid cylindrical vaults. Veletsos, A.S. (Rice Univ., Houston, TX (United States)); Younan, A.H. Brookhaven National Lab., Upton, NY (United States). Feb 1993. 57p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE93013930. Source: OSTI; NTIS; GPO Dep.

A critical evaluation is made of the dynamic pressures and the associated forces induced by ground shaking on an upright, circular, rigid vault that is embedded in a uniform viscoelastic stratum of constant thickness and infinite extent in the horizontal plane. Both the vault and the stratum are presumed to be supported on a non-deformable base undergoing a space-invariant, uniform horizontal motion. The effects of both harmonic and earthquake-induced excitations are examined. Simple approximate expressions for the responses of the system are formulated, and comprehensive numerical data are presented which elucidate the underlying response mechanisms and the effects and relative importance of the various parameters involved. The parameters

investigated include the height to radius ratio for the vault, the conditions at the vault-medium interface, and the material properties of the stratum. In addition to valuable insights into the response of the particular system being examined, the results presented provide a conceptual framework for the analysis and interpretation of solutions for more involved systems as well.

1301 (BNL-52378) Sloshing response of layered liquids in rigid tanks. Veletsos, A.S. (Rice Univ., Houston, TX (US)); Shivakumar, P. Brookhaven National Lab., Upton, NY (United States). Apr 1993. 48p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE93017730. Source: OSTI; NTIS; INIS; GPO Dep.

Whereas the response to earthquakes of tanks containing a uniform, homogeneous liquid has been the subject of numerous studies in recent years, there is a paucity of information concerning the corresponding response of tanks containing layers of liquid of different densities. Current interest in the response of tanks with layered liquids is motivated by two factors: (1) many waste storage tanks in nuclear facilities contain two or more layers of liquid or liquid-like material of different densities; and (2) recent processing for the recovery and decontamination of discharge fuel materials is typically carried out in tanks containing two-layered liquids. The sloshing action of layered liquids in rigid cylindrical and long rectangular tanks is investigated considering both their free vibrational characteristics and their response to a horizontal component of base shaking. Special attention is given to the maximum surface displacement induced by the base motion. The analysis is formulated for systems with N superimposed layers of different thicknesses and densities, and it is illustrated by a numerical example. In addition, comprehensive numerical data are presented for two-layered and some three-layered systems which elucidate the underlying response mechanisms and the effects and relative importance of the numerous parameters involved. It is shown that for each horizontal natural mode of vibration, there are N distinct vertical modes, the frequencies of which are lower than the natural frequency of a homogeneous liquid of the same total depth. It is further shown that the maximum surface sloshing displacement of the base-excited layered system is typically larger than of the corresponding homogeneous system, and that the results for the long rectangular and the cylindrical tanks are quite similar.

1302 (BNL-52384) Thermal degradation of concrete in the temperature range from ambient to 315°C (600°F). Kassir, M.K.; Bandyopadhyay, K.K.; Reich, M. Brookhaven National Lab., Upton, NY (United States). Jun 1993. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE93019775. Source: OSTI; NTIS; GPO Dep.

This report is concerned with determining the effect of elevated temperatures on the behavior of concrete. Emphasis is placed on quantifying the degree of potential degradation of the physical properties of concrete in high-level waste storage tanks. The range in the temperature elevation of interest covers from ambient to 315°C (600°F). The literature has been reviewed to examine the applicable experimental data and quantify the degradation in the concrete and reinforcing steel. Since many variables and test conditions control the results in the data base, upper and lower bounds of the degraded properties at temperatures applicable to the environments of the storage tanks are summarized and presented in explicit forms. Such results are useful in assessing

the effect of elevated temperatures on the structural behavior of the tanks. Also, they provide the technical basis for a parametric study that may be necessary to investigate the thermal aspects of the structural integrity of the tanks.

1303 (BNL-52402) Dynamic modeling and response of soil-wall systems. Veletsos, A.S. (Rice Univ., Houston, TX (United States)); Younan, A.H. Brookhaven National Lab., Upton, NY (United States); Rice Univ., Houston, TX (United States). Oct 1993. 50p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-79CH10016. Order Number DE94005933. Source: OSTI; NTIS; INIS; GPO Dep.

The study reported herein is the third in a series of investigations motivated by need to gain improved understanding of the responses to earthquakes of deeply embedded and underground tanks storing radioactive wastes, and to develop rational but simple methods of analysis and design for such systems. Following a brief review of the errors that may result from the use of a popular model for evaluating the dynamic soil forces induced in a base-excited rigid wall retaining an elastic stratum, the sources of the errors are identified and a modification is proposed which defines correctly the action of the system. In the proposed modification, the stratum is modeled by a series of elastically supported, semi-infinite horizontal bars with distributed mass instead of massless springs. The concepts involved are introduced by reference to a system composed of a fixed-based wall and a homogeneous elastic stratum, and are then applied to the analysis of more complex soil-wall systems. Both harmonic and transient excitations are considered, and comprehensive numerical solutions are presented which elucidate the actions involved and the effects and relative importance of the relevant parameters.

1304 (BNL-52417) Hydrodynamic effects in tanks containing layered liquids. Veletsos, A.; Shivakumar, P.; Bandyopadhyay, K. Brookhaven National Lab., Upton, NY (United States). Mar 1994. 55p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE94009948. Source: OSTI; NTIS; GPO Dep.

As a supplement to a recently reported study, the hydrodynamic wall pressures and the associated tank forces induced by horizontal ground shaking in a rigid, vertical, circular cylindrical tank containing liquid layers of different thickness and mass densities are examined, and comprehensive numerical solutions are presented for two-layered and some three-layered systems which elucidate the underlying response mechanisms and the effects of the various parameters involved. Both the impulsive and convective actions are studied. Additionally, solutions are presented for multi-layered systems approximating liquid with an exponential, continuous variation in density, and the interrelationship of the solutions for the continuous system and its discretized, layered approximation is discussed.

1305 (BNL-52420) Dynamic response of rigid tanks with inhomogeneous liquids. Shivakumar, P.; Veletsos, A.; Bandyopadhyay, K. Brookhaven National Lab., Upton, NY (United States). Apr 1994. 51p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE94012619. Source: OSTI; NTIS; GPO Dep.

A study of the free vibrational characteristics and of the response to horizontal ground shaking of a rigid cylindrical tank containing an inviscid liquid with a continuous vertical

variation in density is presented. The response quantities examined include the vertical sloshing motions of the liquid at its free-surface, and the impulsive and convective components of the hydrodynamic wall pressures and associated tank forces. The equations of motion for the system are formulated for an arbitrary variation in liquid density but the solutions presented are for a density that increases exponentially from top to bottom. Comprehensive numerical data are included which elucidate the underlying response mechanisms and the effects and relative importance of the various parameters involved. The solution for the continuous density variation considered herein is also compared with a previously reported solution in which the liquid was modeled as a multi-layered, discrete system.

1306 (CONF-900210-Vol.2) Waste management '90: Working towards a cleaner environment: Waste processing, transportation, storage and disposal, technical programs and public education: Volume 2, HLW and LLW technology: Proceedings. Post, R.G. (ed.) (Arizona Univ., Tucson, AZ (USA)). American Nuclear Society (United States). Fuel Cycle and Waste Management Div.; American Society of Mechanical Engineers, New York, NY (United States); USDOE, Washington, DC (United States); Arizona Univ., Tucson, AZ (United States). Coll. of Engineering and Mines. ©1990. 988p. Sponsored by American Nuclear Society; University of Arizona; USDOE, Washington, DC (United States). From Waste management '90: working towards a cleaner environment: waste processing, transportation, storage and disposal, technical programs and public education; Tucson, AZ (United States); 25 Feb - 1 mar 1990. Source: Arizona Board of Regents, University of Arizona, Tucson, AZ 85721.

This volume contains 131 papers on waste management. Topics include waste processing, transportation, storage and disposal as well as technical programs and public education. Individual papers will be indexed and entered on the database separately. (KJD)

1307 (CONF-911268-1) Approach to improved safety of high-level radioactive waste storage by the US Department of Energy. Tseng, J.C. (USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States)); Wiffen, D.M.; Daniels, R.S. USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). [1991]. 18p. Sponsored by USDOE, Washington, DC (United States). From CERS '91: Chinese experts radwaste symposium; Taipei (China); 17-18 Dec 1991. Order Number DE92003026. Source: OSTI; NTIS; INIS; GPO Dep.

In mid-1990 two unreviewed safety questions were identified associated with high-level radioactive wastes (HLW) storage at the US Department of Energy (DOE) Hanford Site located near Richland, Washington. Admiral Watkins, the Secretary of Energy, and Leo Duffy, the Acting Assistant Secretary for Environmental Restoration and Waste Management (EM), immediately initiated an aggressive program to resolve these two unreviewed safety questions and to improve the overall safety posture of HLW storage. This paper will first describe the DOE's approach to improve the safety of HLW storage, and then discuss DOE's program to resolve the high-priority safety issues at the Hanford Site. 3 refs.

1308 (CONF-930572-7) The nitrate to ammonia and ceramic (NAC) process. Mattus, A.J.; Lee, D.D. Oak Ridge National Lab., TN (United States). [1993]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract

AC05-84OR21400. From 12. annual international symposium on thermal treatment technologies - incineration conference; Knoxville, TN (United States); 3-7 May 1993. Order Number DE93015963. Source: OSTI; NTIS; INIS; GPO Dep.

A new low-temperature (50–60°C) process for the reduction of nitrate or nitrite to ammonia gas in a stirred, ethylene glycol led reactor has been developed. The process has nearly completed 2 years of bench-top testing in preparation for a pilot-scale demonstration in the fall of 1994. The nitrate to ammonia and ceramic (NAC) process utilizes the active metal Al (in powder or shot form) in alkaline solution to convert nitrate to ammonia gas with the liberation of heat. Between 0.8 and 1.6 kg of Al per kilogram of sodium nitrate is required to convert solutions of between 3.1 and 6.2 M nitrate to near zero concentration. Prior to feeding Al to the reactor, 40 μ m quartz is added based upon the total sodium content of the waste. Upon adding the Al, a by-product of gibbsite precipitates in the reactor as the ammonia leaves the solution. At the end of the reaction, the alumina-silica-based solids are dewatered, calcined, pressed, and sintered into a hard ceramic. Comparing the volume of the final ceramic product with the volume of the starting waste solution, we obtain an ~70% volume reduction. This compares with an expected 50% volume increase if the waste were immobilized in cement-based grout. The process is being developed for use at Hanford, where as much as 125,000 tonnes of nitrate salts is stored in 4 million liter tanks. DOE may be able to shred radioactively contaminated scrap aluminum, and use this metal to feed the NAC reactor.

1309 (CONF-930873-18) The nitrate to ammonia and ceramic (NAC) process - a newly developed low-temperature technology. Mattus, A.J.; Lee, D.D. Oak Ridge National Lab., TN (United States). [1993]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 2. international mixed waste symposium; Baltimore, MD (United States); 17-20 Aug 1993. Order Number DE93015212. Source: OSTI; NTIS; GPO Dep.

Bench-top feasibility studies with Hanford single-shell tank (SST) simulants, using a new low-temperature (50-60°C) process for converting nitrate to ammonia and ceramic (NAC), showed that between 90 and 99% of the nitrate at Hanford can be readily converted to ammonia. Aluminum powders or shot can be used to convert alkaline, nitrate-based supernate to ammonia and an alumina-silica-based ceramic solid. The process may utilize already contaminated aluminum scrap metal from various DOE sites to effect the conversion. The final nitrate-free ceramic product can be calcined, pressed, and sintered like any other ceramic. Based on starting volumes of 6.2 and 3.1 M sodium nitrate solution (probable supernate concentrations resulting from salt-cake/sludge removal from Hanford SSTs), volume reductions as high as 70% are currently obtained, compared with an expected 40 to 50% volume increase if the Hanford supernate were grouted. Engineering data indicate that the process will be very economical. Data were used to cost a batch facility with a production rate of 1200 kilograms of nitrate per hour for processing all the Hanford SST waste over 20 years. Process cost analysis indicates that between \$2.01 and 2.66 will be required to convert each kilogram of nitrate. These costs are one-third to one-half of the processing costs for electrolytic and thermal processes. The ceramic waste form offers other cost savings associated with a smaller volume of waste as well as eliminates other process steps such as grouting. Silica added to the reactor, based upon the total

sodium in the waste, permits us to actually bind the sodium in a nepheline phase of the final ceramic structure as well as bind most metals and nonmetals in the ceramic.

1310 (CONF-9308180-1) **Underground storage tanks/efficient separations accomplishments.** McGinnis, C.P.; Hunt, R.D. Oak Ridge National Lab., TN (United States). [1993]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 9. annual model conference on waste management and environmental restoration; Oak Ridge, TN (United States); 23-26 Aug 1993. Order Number DE94000334. Source: OSTI; NTIS; INIS; GPO Dep.

Efficient Separation-Integrated Program (ESP-IP) and the Underground Storage Tank-Integrated Demonstration (UST-ID). This paper reviews the accomplishments and future directions of the programs at Oak Ridge National Laboratory (ORNL). The five major ESP-IP projects are (1) the sludge washing and dissolution of ORNL Melton Valley Storage Tanks (MVST) Waste, (2) the aluminum removal from washed sludge, (3) the formation of colloids in sludge washing, (4) the alkaline-side extraction of actinides and technetium from tank waste using crown ethers and other extractants, and (5) integrated program coordinator support. The five principal UST-ID projects are (1) the Nitrate to Ammonia and Ceramic (NAC) process, (2) the comprehensive demonstration of sludge and supernate processing, (3) the technical interchange with the Commissariat à l'Energie Atomique (CEA), (4) the TRUEX data collection and model validation, and (5) the Waste Processing and Disposal Program (WPDP). Finally, a planned Request for Expression of Interest (REI) on organic destruction is discussed.

1311 (CONF-931043-3) **Separation projects within the US Department of Energy's Underground Storage Tank: Integrated Demonstration.** McGinnis, C.P. (Oak Ridge National Lab., TN (United States)); Hunt, R.D.; Gibson, S.M.; Gilchrist, R.L. Oak Ridge National Lab., TN (United States). [1993]. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 8. symposium on separation science and technology for energy applications; Knoxville, TN (United States); 24-28 Oct 1993. Order Number DE94003495. Source: OSTI; NTIS; INIS; GPO Dep.

The greatest challenge facing the US Department of Energy is the remediation of the 1×10^8 gal of high-level and low-level radioactive waste in the underground storage tanks (USTs) at its Hanford, Savannah River, Oak Ridge, Idaho, and Fernald sites. With current technologies, this remediation will cost at least 100 billion dollars. In an effort to reduce costs, improve safety, and minimize delays, the Underground Storage Tank-Integrated Demonstration was created for demonstration, testing, and evaluation (DT&E) of promising new technologies that can be used for UST remediation. These demonstrations, which are typically at the pilot-plant scale, will determine which processes will be used in the full-scale remediation of the USTs. These DT&E studies are performed by the Characterization and Waste Retrieval Program or by the Waste Processing and Disposal Program (WPDP). This paper presents the technical progress and future plans of the WPDP projects. The 11 WPDP programs in FY 1993 focused on three problem areas, which involve the treatment of supernate, the treatment of sludge, and nitrate destruction and subsequent waste forms. In addition, a planned Request for Expression of

Interest on organic destruction techniques from private industries and universities and the WPDP's future direction and programmatic issues are discussed.

1312 (CONF-931136-1) **PCB dechlorination in anaerobic soil slurry reactors.** Klasson, K.T.; Evans, B.S. Oak Ridge National Lab., TN (United States). 29 Nov 1993. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 6. conference on gas, oil and environmental biotechnology; Colorado Springs, CO (United States); 29 Nov - 1 dec 1993. Order Number DE94002798. Source: OSTI; NTIS; INIS; GPO Dep.

Many industrial locations, including the US Department of Energy's, have identified needs for treatment of polychlorinated biphenyl (PCB) wastes and remediation of PCB-contaminated sites. Biodegradation of PCBs is a potentially effective technology for the treatment of PCB-contaminated soils and sludges, including mixed wastes; however, a practical remediation technology has not yet been demonstrated. In laboratory experiments, soil slurry bioreactors inoculated with microorganisms extracted from PCB-contaminated sediments from the Hudson River have been used to obtain anaerobic dechlorination of PCBs. The onset of dechlorination activity can be accelerated by addition of nutritional amendments and inducers. After 15 weeks of incubation with PCB-contaminated soil and nutrient solution, dechlorination has been observed under several working conditions. The best results show that the average chlorine content steadily dropped from 4.3 to 3.5 chlorines per biphenyl over a 15-week period.

1313 (CONF-940225-110) **Recent progress of the waste processing and disposal projects within the Underground Storage Tank-Integrated Demonstration.** Hunt, R.D. (Oak Ridge National Lab., TN (United States)); McGinnis, C.P.; Cruse, J.M. Oak Ridge National Lab., TN (United States). [1994]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Waste management '94; Tucson, AZ (United States); 27 Feb - 3 mar 1994. Order Number DE94012321. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy (DOE) Office of Environmental Restoration and Waste Remediation has created the Office of Technology Development (OTD) to provide new and improved remediation technologies for the 1×10^8 gal of radioactive waste in the underground storage tanks (USTs) at five DOE sites. The OTD established and the Underground Storage Tank-Integrated Demonstration (UST-ID) to perform demonstrations, tests, and evaluations on these new technologies before these processes are transferred to the tank sites for use in full-scale remediation of the USTs. The UST-ID projects are performed by the Characterization and Waste Retrieval Program or the Waste Processing and Disposal Program (WPDP). During FY 1994, the WPDP is funding 12 projects in the areas of supernate processing, sludge processing, nitrate destruction, and final waste forms. The supernate projects are primarily concerned with cesium removal. A mobile evaporator and concentrator for cesium-free supernate is also being demonstrated. The sludge projects are emphasizing sludge dissolution and the evaluation of the TRUEX and diamide solvent extraction processes for transuranic waste streams. One WPDP project is examining both supernate and sludge processes in an effort to develop a system-level plan for handling all UST waste. The other WPDP studies are concerned with nitrate and organic destruction as well as subsequent waste forms. The current status of these WPDP projects is presented.

1314 (CONF-940553-25) The reactivity effects of nuclide buildup and decay during long-term fuel storage. Suto, T.; Bowman, S.M.; Parks, C.V. Oak Ridge National Lab., TN (United States). [1994]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From International high-level radioactive waste management conference; Las Vegas, NV (United States); 22-26 May 1994. Order Number DE94009162. Source: OSTI; NTIS; INIS; GPO Dep.

This paper presents the results of an analysis of spent fuel reactivity over a 100,000-year cooling time. The goal of this work was to study the changes in reactivity and to recognize which nuclides contribute to such changes. The analysis employs the use of the effective one-group cross-section data of each nuclide studied. The primary contributors to k_{∞} changes during long-term spent fuel storage were identified as ^{239}Pu , ^{240}Pu , ^{241}Pu , ^{241}Am , and ^{235}U . The approach presented here can be processed simply by spreadsheet-type calculations on a personal computer after performing only one SAS2H calculation to obtain one-group cross-section data and nuclide densities.

1315 (DOE/EA-0809) Thermocouple tree system installation and operation in non-leaking ferrocyanide tanks, Hanford Site, Richland, Washington: Environmental assessment. USDOE Assistant Secretary for Environmental Restoration and Waste Management, Washington, DC (United States). Sep 1992. 26p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93001944. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy (DOE) has prepared an environmental assessment (EA), DOE/EA-0809, to assess environmental impacts associated with installing and operating thermocouple tree (TCT) systems in 11 non-leaking Hanford Site single-shell ferrocyanide-containing high-level waste tanks. The objective is to improve DOE's knowledge of ferrocyanide waste temperatures, including the possible presence of discrete localized areas of elevated temperatures within the tanks ("hot spots"), by providing additional temperature monitoring instrumentation. DOE needs to take action to gain a better understanding of the potential for hot spots to exist within the tanks that could result in an explosion or release of radioactive material, and to better understand potential reactive behavior of the ferrocyanide waste in order to resolve current Unreviewed Safety Questions declared for these tanks. Based on the evaluation in the EA, DOE has determined that the proposed action is not a major Federal action significantly affecting the quality of the human environment within the meaning of the National Environmental Policy Act (NE PA) of 1969. Therefore, the preparation of an environmental impact statement is not required, and DOE is issuing this Finding of No Significant Impact.

1316 (DOE/EM-0056P) Independent engineering review of the Hanford Waste Vitrification System. USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). Oct 1991. 214p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92002219. Source: OSTI; NTIS; INIS; GPO Dep.

The Hanford Waste Vitrification Plant (HWVP) was initiated in June 1987. The HWVP is an essential element of the plan to end present interim storage practices for defense wastes and to provide for permanent disposal. The project start was justified, in part, on efficient technology and design

information transfer from the prototype Defense Waste Processing Facility (DWPF). Development of other serial Hanford Waste Vitrification System (HWVS) elements, such as the waste retrieval system for the double-shell tanks (DSTs), and the pretreatment system to reduce the waste volume converted into glass, also was required to accomplish permanent waste disposal. In July 1991, at the time of this review, the HWVP was in the Title 2 design phase. The objective of this technical assessment is to determine whether the status of the technology development and engineering practice is sufficient to provide reasonable assurance that the HWVP and the balance of the HWVS system will operate in an efficient and cost-effective manner. The criteria used to facilitate a judgment of potential successful operation are: vitrification of high-level radioactive waste from specified DSTs on a reasonably continuous basis; and glass produced with physical and chemical properties formally acknowledged as being acceptable for disposal in a repository for high-level radioactive waste. The criteria were proposed specifically for the Independent Engineering Review to focus that assessment effort. They are not represented as the criteria by which the Department will judge the prudence of the Project. 78 refs., 10 figs., 12 tabs.

1317 (DOE/EM-0080T) Independent technical review of Savannah River Site Defense Waste Processing Facility technical issues. USDOE Assistant Secretary for Environmental Restoration and Waste Management, Washington, DC (United States). Jul 1992. 90p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92019798. Source: OSTI; NTIS; INIS; GPO Dep.

The Savannah River Site (SRS) Defense Waste Processing Facility (DWPF) will vitrify high-level radioactive waste that is presently stored as liquid, salt-cake, and sludge in 51 waste-storage tanks. Construction of the DWPF began in 1984, and the Westinghouse Savannah Company (WSRC) considers the plant to be 100% turned over from construction and 91% complete. Cold-chemical runs are scheduled to begin in November 1992, and hot start up is projected for June 1994. It is estimated that the plant lifetime must exceed 15 years to complete the vitrification of the current, high-level tank waste. In a memo to the Assistant Secretary for Defense Programs (DP-1), the Assistant Secretary for Environmental Restoration and Waste management (EM-1) established the need for an Independent Technical Review (ITR), or the Red Team, to "review process technology issues preventing start up of the DWPF." This report documents the findings of an Independent Technical Review (ITR) conducted by the Department of Energy (DOE), Office of Environmental Restoration and Waste Management (EM), at the request of the Assistant Secretary for Environmental Restoration and Waste Management, of specified aspects of Defense Waste Processing Facility (DWPF) process technology. Information for the assessment was drawn from documents provided to the ITR Team by the Westinghouse Savannah River Company (WSRC), and presentations, discussions, interviews, and tours held at the Savannah River Site (SRS) during the weeks of February and March 9, 1992.

1318 (DOE/EM-0095P) Independent technical review of the Hanford Tank Farm Operations. USDOE Assistant Secretary for Environmental Restoration and Waste Management, Washington, DC (United States). Jul 1992. 188p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93001758. Source: OSTI; NTIS; INIS; GPO Dep.

The Independent Technical Assessment of the Hanford Tank Farm Operations was commissioned by the Assistant Secretary for Environmental Restoration and Waste Management on November 1, 1991. The Independent Technical Assessment team conducted on-site interviews and inspections during the following periods: November 18 to 22, 1991; April 13 to 17; and April 27 to May 1, 1992. Westinghouse Hanford Company is the management and operating contractor for the Department of Energy at the Hanford site. The Hanford Tank Farm Operations consists of 177 underground storage tanks containing 61 million gallons of high-level radioactive mixed wastes from the chemical reprocessing of nuclear fuel. The Tank Farm Operations also includes associated transfer lines, ancillary equipment, and instrumentation. The Independent Technical Assessment of the Hanford Tank Farm Operations builds upon the prior assessments of the Hanford Waste Vitrification System and the Hanford Site Tank Waste Disposal Strategy. The objective of this technical assessment was to determine whether an integrated and sound program exists to manage the tank-waste storage and tankfarm operations consistent with the Assistant Secretary for Environmental Restoration and Waste Management's guidance of overall risk minimization. The scope of this review includes the organization, management, operation, planning, facilities, and mitigation of the safety-concerns of the Hanford Tank Waste Remediation System. The assessments presented in the body of this report are based on the detailed observations discussed in the appendices. When the assessments use the term "Hanford" as an organizational body it means DOE-RL and Westinghouse Hanford Company as a minimum, and in many instances all of the stake holders for the Hanford site.

1319 (DOE/EM-0104) Independent Technical Review of In-Tank Precipitation (ITP) at the Savannah River Site. USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). Jun 1993. 107p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94000552. Source: OSTI; NTIS; INIS; GPO Dep.

An Independent Technical Review of In-Tank Precipitation (ITP) and Extended Sludge Processing (ESP) at the Savannah River Site (SRS) was carried out in March, 1993. The review focused on ITP/ESP equipment and chemical processes, integration of ITP/ESP within the High Level Waste (HLW) and Defense Waste Processing Facility (DWPF) systems, and management and regulatory concerns. Following the ITR executive summary, this report includes: Chapter I—summary assessment; Chapter II—recommendations; and Chapter III—technical evaluations.

1320 (DOE/EM-0122P) Underground Storage Tank Integrated Demonstration (UST-ID): Technology summary. USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). Office of Technology Development. Feb 1994. 74p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94008854. Source: OSTI; NTIS; INIS; GPO Dep.

The DOE complex currently has 332 underground storage tanks (USTs) that have been used to process and store radioactive and chemical mixed waste generated from weapon materials production. Very little of the over 100 million gallons of high-level and low-level radioactive liquid waste has been treated and disposed of in final form. Two waste storage tank design types are prevalent across the DOE complex: single-shell wall and double-shell wall designs. They are made of stainless steel, concrete, and concrete

with carbon steel liners, and their capacities vary from 5000 gallons (19 m³) to 10⁶ gallons (3785 m³). The tanks have an overburden layer of soil ranging from a few feet to tens of feet. Responding to the need for remediation of tank waste, driven by Federal Facility Compliance Agreements (FFCAs) at all participating sites, the Underground Storage Tank Integrated Demonstration (UST-ID) Program was created by the US DOE Office of Technology Development in February 1991. Its mission is to focus the development, testing, and evaluation of remediation technologies within a system architecture to characterize, retrieve, treat to concentrate, and dispose of radioactive waste stored in USTs at DOE facilities. The ultimate goal is to provide safe and cost-effective solutions that are acceptable to the public and the regulators. The UST-ID has focused on five DOE locations: the Hanford Site, which is the host site, in Richland, Washington; the Fernald Site in Fernald, Ohio; the Idaho National Engineering Laboratory near Idaho Falls, Idaho; the Oak Ridge Reservation in Oak Ridge, Tennessee, and the Savannah River Site in Savannah River, South Carolina.

1321 (DOE/EM-0124P) Minimum Additive Waste Stabilization (MAWS): Technology summary. USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). Office of Technology Development. Feb 1994. 69p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94008856. Source: OSTI; NTIS; INIS; GPO Dep.

In the Minimum Additive Waste Stabilization (MAWS) concept, actual waste streams are utilized as additive resources for vitrification, which may contain the basic components (glass formers and fluxes) for making a suitable glass or glassy slag. If too much glass former is present, then the melt viscosity or temperature will be too high for processing; while if there is too much flux, then the durability may suffer. Therefore, there are optimum combinations of these two important classes of constituents depending on the criteria required. The challenge is to combine these resources in such a way that minimizes the use of non-waste additives yet yields a processable and durable final waste form for disposal. The benefit to this approach is that the volume of the final waste form is minimized (waste loading maximized) since little or no additives are used and vitrification itself results in volume reduction through evaporation of water, combustion of organics, and compaction of the solids into a non-porous glass. This implies a significant reduction in disposal costs due to volume reduction alone, and minimizes future risks/costs due to the long term durability and leach resistance of glass. This is accomplished by using integrated systems that are both cost-effective and produce an environmentally sound waste form for disposal. Individual component technologies may include: vitrification; thermal destruction; soil washing; gas scrubbing/filtration; and, ion-exchange wastewater treatment. The particular combination of technologies will depend on the waste streams to be treated. At the heart of MAWS is vitrification technology, which incorporates all primary and secondary waste streams into a final, long-term, stabilized glass wasteform. The integrated technology approach, and view of waste streams as resources, is innovative yet practical to cost effectively treat a broad range of DOE mixed and low-level wastes.

1322 (DOE/HWP-99) Proceedings of the US Department of Energy Office of Environmental Restoration and Waste Management waste reduction workshop 4. Oak Ridge National Lab., TN (United States). HAZWRAP Support Contractor Office. Mar 1990. 294p. Sponsored by

USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (CONF-9002121-: 4. U.S. Department of Energy Office of Environmental Restoration and Waste Management waste reduction workshop, Tampa, FL (United States), 6-7 Feb 1990). Order Number DE90010826. Source: NTIS, PC A13/MF A01; OSTI; INIS; GPO Dep.

The fourth of a series of waste minimization/reduction workshops was held at the Sheridan Grand Hotel in Tampa, Florida, on February 6-7, 1990. The workshops are held under the auspices of the Department of Energy's (DOE's) Office of Environmental Restoration and Waste Management. This workshop provided a forum for waste minimization/reduction planning, including waste minimization assessments. The workshops assist DOE waste-generating sites in implementing waste minimization/reduction programs, plans, and activities, thus providing for optimal waste reduction within the DOE complex. All wastes are considered within this discipline: liquid, solid, and airborne, within the categories of high-level, transuranic (TRU), low-level (LLW), hazardous, and mixed. Topics of discussion within workshops encompassed a wide range of subjects. Subjects included any method or technical activity from waste generation to disposal, such as process design or improvement, substitution of materials, waste segregation and recycling/reuse, waste treatment and processing, and administrative controls (procurement and waste awareness training). Consideration was also given to activities for remedial action and for decontamination and disposal. 1 tab.

1323 (DOE/HWP-104) Proceedings of the US Department of Energy Office of Environmental Restoration and Waste Management: Waste reduction workshop 5. USDOE Oak Ridge Operations Office, TN (United States). Sep 1990. 291p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (CONF-9007182-: 5. waste reduction workshop, Idaho Falls, ID (United States), 24-26 Jul 1990). Order Number DE91001636. Source: NTIS, PC A13/MF A01; OSTI; INIS; GPO Dep.

The fifth of a series of waste minimization (WMIN)/reduction workshops (Waste Reduction Workshop V) was held at the Little Tree Inn in Idaho Falls, Idaho, on July 24-26, 1990. The workshops are held under the auspices of the US Department of Energy's (DOE's) Office of Environmental Restoration and Waste Management (EM). The purpose of this workshop was to provide a forum for sharing site activities in WMIN/reduction planning. Topics covered were management commitment, organizational structure, goal setting, reporting requirements, data bases and tracking systems, pollution prevention, awareness and incentives, information exchange, process waste assessment (PWA) implementation, and recycling internal and external. The workshops assist DOE waste-generating sites in implementing WMIN/reduction programs, plans, and activities, thus providing for optimal waste reduction within the DOE complex. All wastes are considered within this discipline: liquid, solid, and airborne, within the categories of high-level waste (HLW), transuranic waste (TRU), low-level waste (LLW), hazardous waste, and mixed waste.

1324 (DOE/ID-10408) Heat Transfer Reactor Experiment (HTRE)-3 Container Storage Unit Resource Conservation Recovery Act closure plan. Spry, M.J. (MSE, Inc., Idaho Falls, ID (United States)). EG and G Idaho, Inc., Idaho Falls, ID (United States); MSE, Inc., Idaho Falls, ID (United States). Nov 1992. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract

AC07-76ID01570. Order Number DE93007121. Source: OSTI; NTIS; INIS; GPO Dep.

This document describes the closure of the HTRE-3 Container Storage Unit under the requirements of the Resource Conservation and Recovery Act. The unit's location, size, history, and current status are described. The document also summarizes the decontamination and decommissioning efforts performed in 1983 and provides an estimate of waste residues remaining in the HTRE-3 assembly. A risk evaluation was performed that demonstrates that the residue does not pose a hazard to public health or the environment. Based on the risk evaluation, it is proposed that the HTRE-3 Container Storage Unit be closed in its present condition, without further decontamination or removal activities.

1325 (DOE/ID-10409) Transuranic Storage Area (TSA)-2 container storage unit RCRA closure plan. Lodman, D.W.; Spry, M.J.; Nolte, E.P.; Barry, G.A. MSE, Inc., Idaho Falls, ID (United States). Nov 1992. 53p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93007123. Source: OSTI; NTIS; INIS; GPO Dep.

This document describes the proposed plans for closure of the Transuranic Storage Area (TSA)-2 container storage unit at the Idaho National Engineering Laboratory in accordance with the Resource Conservation and Recovery Act closure requirements. The location, size, capacity, history, and current status of the unit are described. Future plans for the unit include incorporating the earthen-covered portion of the TSA-2 pad into a TSA retrieval enclosure along with the TSA-1 and TSAR pads, and closure of the portion of the TSA-2 pad under the Air Support Weather Shield (ASWS-2). This plan addresses closure of the ASWS-2 by decontaminating structures and equipment that may have contacted the waste. Sufficient sampling and documentation of all closure activities will be performed to demonstrate clean closure. A tentative schedule is provided in the form of a milestone chart.

1326 (DOE/ID-10410) Transuranic Storage Area (TSA)-3 container storage unit RCRA closure plan. Barry, G.A. (MSE, Inc., Idaho Falls, ID (United States)); Lodman, D.L.; Spry, M.J.; Poor, K.J. EG and G Idaho, Inc., Idaho Falls, ID (United States); MSE, Inc., Idaho Falls, ID (United States). Nov 1992. 53p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93007124. Source: OSTI; NTIS; INIS; GPO Dep.

This document describes the proposed plan for closure of the Transuranic Storage Area (TSA)-3 container storage unit at the Idaho National Engineering Laboratory in accordance with the Resource Conservation and Recovery Act closure requirements. The location, size, capacity, history, and current status of the unit are described. The unit will be closed by decontaminating structures and equipment that may have contacted waste. Sufficient sampling and documentation of all activities will be performed to demonstrate clean closure. A tentative schedule is provided in the form of a milestone chart.

1327 (DOE/ID-10411) Sampling and decontamination plan for the Transuranic Storage Area-1/R container storage unit. Barry, G.A. (MSE, Inc., Idaho Falls, ID (United States)). EG and G Idaho, Inc., Idaho Falls, ID (United States); MSE, Inc., Idaho Falls, ID (United States). Nov 1992. 31p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93007122. Source: OSTI; NTIS; INIS; GPO Dep.

This document describes the sampling and decontamination of the Transuranic Storage Area (TSA)-I-R container storage area and the earthen-covered portion of the TSA-2 container storage unit at the Radioactive Waste Management Complex. Stored containers from the earthen-covered asphalt pads will be retrieved from the TSA-I-R and TSA-2 container storage units. Container retrieval will be conducted under the TSA retrieval enclosure, a fabricated steel building to be constructed over the earthen-covered pad to provide containment and weather protection. Following container retrieval, the TSA retrieval enclosure will be decontaminated to remove radioactive and hazardous contamination. The underlying soils will be sampled and analyzed to determine whether any contaminated soils require removal.

1328 (DOE/RL-93-39) National emission standards for hazardous air pollutants application for approval to construct rotary mode core-sampling truck and exhauster. USDOE Richland Field Office, WA (United States). May 1993. 16p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93019977. Source: OSTI; NTIS; INIS; GPO Dep.

Characterization of wastes in the underground single-shell tanks and double-shell tanks on the Hanford Site is crucial in developing the final disposal options for the waste and closure strategy for the Hanford Site. Additionally, characterization of tank waste is important for the waste tank safety programs. The Hanford Federal Facility Agreement and Consent Order (also referred to as the Tri-Party Agreement) Milestone M-10-00 requires the obtaining and analyzing of at least two samples from each single-shell tank, and Milestone M-10-13 specifically requires the ability to sample hard saltcake. Existing equipment does not allow sampling of all single-shell tanks within established tank safety limits. Consequently, the US Department of Energy, Richland Operations Office has developed a rotary mode core-sampling system that uses nitrogen gas to cool and clear the drill bit. A rotary mode core-sampling truck will be used on approximately 80 single-shell tanks which contain saltcake wastes, and will provide crucial information on the contents of the tanks. This application is a request for approval to construct and operate the rotary mode core-sampling truck and exhauster in the 200 East and 200 West Area Tank Farms of the Hanford Site. This request is being made pursuant to 40 CFR 61, Subpart H.

1329 (DOE/RL/12253-T1) Deflagration studies on waste Tank 101-SY: Test plan: Phase 1, Laboratory flammability studies of mixtures of hydrogen, nitrous oxide, and air. Cashdollar, K.L.; Zlochower, I.A.; Hertzberg, M. Bureau of Mines, Pittsburgh, PA (United States). Pittsburgh Research Center. Jun 1991. 53p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AI06-91RL12253. Order Number DE92003490. Source: OSTI; NTIS; GPO Dep.

This report discusses test procedures and calibration of equipment to study the flammability and deflagration of hydrogen, nitrous oxide, and air in waste tanks. (JL)

1330 (DOE/RL/12253-T3) Deflagration studies on waste Tank 101-SY: Test plan: Phase 1, Laboratory flammability studies of mixtures of hydrogen, nitrous oxide, and air: Revised. Cashdollar, K.L.; Zlochower, I.A.; Hertzberg, M. Bureau of Mines, Pittsburgh, PA (United States). Pittsburgh Research Center. Jul 1991. 56p. Sponsored by USDOE, Washington, DC (United States). DOE

Contract AI06-91RL12253. Order Number DE92003489. Source: OSTI; NTIS; GPO Dep.

Waste slurries produced during the recovery of plutonium and uranium from irradiated fuel are stored in underground storage tanks. While a variety of waste types have been generated, of particular concern are the wastes stored in Tank 101-SY. A slurry growth-gas evolution cycle has been observed since 1981. The waste consists of a thick slurry, consisting of a solution high in NaOH, NaNO₃, NaAlO₂, dissolved organic complexants (EDTA, HEDTA, NTA, and degradation products), other salts (sulfates and phosphates), and radionuclides (primarily cesium and strontium). During a gas release the major gaseous species identified include: hydrogen and nitrous oxide (N₂O). Significant amounts of nitrogen may also be present. Traces of ammonia, carbon oxides, and other nitrogen oxides are also detected. Air and water vapor are also present in the tank vapor space. The purpose of the deflagration study is to determine risks of the hydrogen, nitrous oxide, nitrogen, and oxygen system. To be determined are pressure and temperature as a function of composition of reacting gases and the concentration of gases before and after the combustion event. Analyses of gases after the combustion event will be restricted to those tests that had an initial concentration of ≤8% hydrogen. This information will be used to evaluate safety issues related to periodic slurry growth and flammable gas releases from Tank 101-SY. The conditions to be evaluated will simulate gases in the vapor space above the salt cake as well as gases that potentially are trapped in pockets within/under the waste. The deflagration study will relate experimental laboratory results to conditions in the existing tanks.

1331 (EGG-WM-10477) Issues related to EM management of DOE spent nuclear fuel. Abbott, D.G. (EG&G Idaho, Inc., Idaho Falls, ID (United States)); Abashian, M.S.; Chakraborti, S.; Roberson, K.; Meloin, J.M. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jul 1993. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94002878. Source: OSTI; NTIS; INIS; GPO Dep.

This document is a summary of the important issues involved in managing spent nuclear fuel (SNF) owned by the Department of Energy (DOE). Issues related to civilian SNF activities are not discussed. DOE-owned SNF is stored primarily at the Hanford Site, Idaho National Engineering Laboratory (INEL), Savannah River Site (SRS), Oak Ridge National Laboratory (ORNL), and West Valley Demonstration Project. Smaller quantities of SNF are stored at Brookhaven National Laboratory, Sandia National Laboratories, and Los Alamos National Laboratory (LANL). There is a wide variety of fuel types, including both low and high enrichment fuels from weapons production, DOE reactors, research and development programs, naval programs, and universities. Most fuel is stored in pools associated with reactor or reprocessing facilities. Smaller quantities are in dry storage. Physical conditions of the fuel range from excellent to poor or severely damaged. An issue is defined as an important question that must be answered or decision that must be made on a topic or subject relevant to achieving the complimentary objectives of (a) storing SNF in compliance with applicable regulations and orders until it can be disposed, and (b) safely disposing of DOE's SNF. The purpose of this document is to define the issues; no recommendations are made on resolutions. As DOE's national SNF management program is implemented, a system of issues identification, documentation, tracking, and resolution will be implemented. This document is an initial effort at issues

identification. The first section of this document is an overview of issues that are common to several or all DOE facilities that manage SNF. The common issues are organized according to specific aspects of spent fuel management. This is followed by discussions of management issues that apply specifically to individual DOE facilities. The last section provides literature references.

1332 (HWVP-89-001-Rev.1) Hanford Waste Vitrification Plant Project Plan: Revision 1. Brown, R.W. USDOE Richland Field Office, WA (United States). Jun 1993. 37p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93018729. Source: OSTI; NTIS; INIS; GPO Dep.

A major mission of the US DOE is the permanent disposal of Hanford defense wastes by safe, environmentally acceptable, and cost effective methods which meet applicable regulations. The Hanford Waste Vitrification Plant (HWVP) Project was initiated to immobilize the Hanford high-level waste (HLW) and provide interim storage. The HWVP will vitrify the pre-treated HLW into borosilicate glass, cast the glass into stainless steel canisters, and store the canisters on site until they are shipped to a federal geologic repository. The HWVP project objective is to design, construct, and operate a facility for immobilizing defense high-level waste for storage. Technical objectives include using the Defense Waste Processing Facility designed plants systems or elements, where practical, and the exchange and review of information on plants in foreign countries. More definitive objectives for quality, reliability, environmental, and safety are provided in the HWVP Project Management Plan.

1333 (HWVP-89-007-Rev.3) Quality assurance program description: Hanford Waste Vitrification Plant, Part 1: Revision 3. USDOE Richland Field Office, WA (United States). [1992]. 132p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-92RL12434. Order Number DE93018409. Source: OSTI; NTIS; INIS; GPO Dep.

This document describes the Department of Energy's Richland Field Office (DOE-RL) quality assurance (QA) program for the processing of high-level waste as well as the Vitrification Project Quality Assurance Program for the design and construction of the Hanford Waste Vitrification Plant (HWVP). It also identifies and describes the planned activities that constitute the required quality assurance program for the HWVP. This program applies to the broad scope of quality-affecting activities associated with the overall HWVP Facility. Quality-affecting activities include designing, purchasing, fabricating, handling, shipping, storing, cleaning, erecting, installing, inspecting, testing, maintaining, repairing, and modifying. Also included are the development, qualification, and production of waste forms which may be safely used to dispose of high-level radioactive waste resulting from national defense activities. The HWVP QA program is made up of many constituent programs that are being implemented by the participating organizations. This Quality Assurance program description is intended to outline and define the scope and application of the major programs that make up the HWVP QA program. It provides a means by which the overall program can be managed and directed to achieve its objectives. Subsequent parts of this description will identify the program's objectives, its scope, application, and structure.

1334 (LA-12528) Partitioning high-level waste from alkaline solution: A literature survey. Marsh, S.F. Los Alamos National Lab., NM (United States). May 1993.

11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93013595. Source: OSTI; NTIS; INIS; GPO Dep.

Most chemical partitioning procedures are designed for acidic feed solutions. However, the high-level waste solutions in the underground storage tanks at US Department of Energy defense production sites are alkaline. Effective partitioning procedures for alkaline solutions could decrease the need to acidify these solutions and to dissolve the solids in acid, which would simplify subsequent processing and decrease the generation of secondary waste. The author compiles candidate technologies from his review of the chemical literature, experience, and personal contacts. Several of these are recommended for evaluation.

1335 (LA-12654) Distributions of 14 elements on 60 selected absorbers from two simulant solutions (acid-dissolved sludge and alkaline supernate) for Hanford HLW Tank 102-SY. Marsh, S.F.; Svitra, Z.V.; Bowen, S.M. Los Alamos National Lab., NM (United States). Oct 1993. 109p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE94001570. Source: OSTI; NTIS; INIS; GPO Dep.

Sixty commercially available or experimental absorber materials were evaluated for partitioning high-level radioactive waste. These absorbers included cation and anion exchange resins, inorganic exchangers, composite absorbers, and a series of liquid extractants sorbed on porous support-beads. The distributions of 14 elements onto each absorber were measured from simulated solutions that represent acid-dissolved sludge and alkaline supernate solutions from Hanford high-level waste (HLW) Tank 102-SY. The selected elements, which represent fission products (Ce, Cs, Sr, Tc, and Y); actinides (U, Pu, and Am); and matrix elements (Cr, Co, Fe, Mn, Zn, and Zr), were traced by radionuclides and assayed by gamma spectrometry. Distribution coefficients for each of the 1680 element/absorber/solution combinations were measured for dynamic contact periods of 30 min, 2 h, and 6 h to provide sorption kinetics information for the specified elements from these complex media. More than 5000 measured distribution coefficients are tabulated.

1336 (LA-12676-MS) Chemical composition of Hanford Tank SY-102. Birnbaum, E.; Agnew, S.; Jarvinen, G.; Yarbrow, S. Los Alamos National Lab., NM (United States). Dec 1993. 99p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE94003872. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy established the Tank Waste Remediation System (TWRS) to safely manage and dispose of the radioactive waste, both current and future, stored in double-shell and single-shell tanks at the Hanford sites. One major program element in TWRS is pretreatment which was established to process the waste prior to disposal using the Hanford Waste Vitrification Plant. In support of this program, Los Alamos National Laboratory has developed a conceptual process flow sheet which will remediate the entire contents of a selected double-shelled underground waste tank, including supernatant and sludge, into forms that allow storage and final disposal in a safe, cost-effective and environmentally sound manner. The specific tank selected for remediation is 241-SY-102 located in the 200 West Area. As part of the flow sheet development effort, the composition of the tank was defined and documented. This database was built by examining the history of liquid waste transfers to the tank and by performing careful analysis of all of the analytical data that have been gathered during the tank's lifetime.

In order to more completely understand the variances in analytical results, material and charge balances were done to help define the chemistry of the various components in the tank. This methodology of defining the tank composition and the final results are documented in this report.

1337 (LA-12701-MS) Tank SY-102 remediation project: Flowsheet and conceptual design report. Yarbro, S.L.; Punjak, W.A.; Schreiber, S.B.; Dunn, S.L.; Jarvinen, G.D.; Marsh, S.F.; Pope, N.G.; Agnew, S.; Birnbaum, E.R.; Thomas, K.W.; Oitic, E.A. Los Alamos National Lab., NM (United States). Jan 1994. 114p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE94005243. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy established the Tank Waste Remediation System (TWRS) to safely manage and dispose of radioactive waste stored in underground tanks on the Hanford Site. A major program in TWRS is pretreatment which was established to process the waste prior to disposal. Pretreatment is needed to resolve tank safety issues and to separate wastes into high-level and low-level fractions for subsequent immobilization and disposal. There is a fixed inventory of actinides and fission products in the tank which must be prepared for disposal. By segregating the actinides and fission products from the bulk of the waste, the tank's contents can be effectively managed. Due to the high public visibility and environmental sensitivity of this problem, real progress and demonstrated efforts toward addressing it must begin as soon as possible. As a part of this program, personnel at the Los Alamos National Laboratory (LANL) have developed and demonstrated a flowsheet to remediate tank SY-102 which is located in the 200 West Area and contains high-level radioactive waste. This report documents the results of the flowsheet demonstrations performed with simulated, but radioactive, wastes using an existing glove-box line at the Los Alamos Plutonium Facility. The tank waste was characterized using both a tank history approach and an exhaustive evaluation of the available core sample analyses. This report also presents a conceptual design complete with a working material flow model, a major equipment list, and cost estimates.

1338 (LA-UR-91-2077) An HMS/TRAC analysis of a high-level radioactive waste tank. Travis, J.R. (Science Applications International Corp., San Diego, CA (USA)); Nichols, B.D.; Spore, J.W.; Wilson, T.L. Los Alamos National Lab., NM (United States). [1991]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-910817-14: 11. international conference on structural mechanics in reactor technology (SMIRT-11), Tokyo (Japan), 18-23 Aug 1991). Order Number DE91014597. Source: OSTI; NTIS; INIS; GPO Dep.

It has been observed that a high-level radioactive waste tank generates quantities of hydrogen and nitrous oxide mixtures that are potentially well within flammability limits. These gases are produced from chemical and nuclear decay reactions in a slurry of radioactive waste material. The slurry is covered by a thick crust composed of sodium nitrate and nitrite salts. Significant amounts of the combustible and reactant gases are produced over a 3- to 4-month period before the crust ruptures and the gases are vented into the air cover gas space above the crust. Postulating an ignition of the hydrogen/nitrous oxide/air mixture after this venting into the cover gas, we have calculated the pressure and temperature loading on the double-walled waste tank with

the three-dimensional, time-dependent fluid dynamics coupled with chemical kinetics HMS (Hydrogen Mixing Studies) computer code. The waste tank has a ventilation system designed to maintain a slight negative gage pressure during steady-state operation. We have modeled the ventilation system with TRAC (the Transient Reactor Analysis Code), and we have coupled these two best-estimate accident analysis tools to provide the ventilation response to pressure and temperatures generated by the hydrogen burn. Significant pressures are produced by this event, and the threat to the tank's integrity currently is being evaluated. 3 refs., 4 figs.

1339 (LA-UR-92-654) Safety support for hydrogen reanalysis of Waste Tank 101-SY. Sullivan, L.H. (Los Alamos National Lab., NM (United States)); Eisenhower, S.W.; Henninger, R.J.; Hill, S.W.; MacFarlane, D.R.; Nichols, B.D.; Spore, J.W.; Wilson, T.L.; Travis, J.R.; Coleman, J.R.; Bandyopadhyay, K. Los Alamos National Lab., NM (United States). [1991]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-920307-33: Waste management '92, Tucson, AZ (United States), 1-5 Mar 1992). Order Number DE92008491. Source: OSTI; NTIS; INIS; GPO Dep.

Tank 101-Sy, a double-shell tank on the Hanford SY high-level waste tank farm, has periodic releases of large volumes of gas. The released gas contains hydrogen (a fuel), nitrous oxide (a strong oxidizer), and other gases. These gases are intimately mixed, and therefore, it is very difficult to reduce the potential for a hydrogen combustion event. The safety is hydrogen gas exceeding one-quarter of the Lower Flammability Limit during these periodic releases. The Department of Energy Office of Environmental Restoration and Waste Management requested Los Alamos and Brookhaven National Laboratories to perform a reanalysis of a postulated hydrogen combustion event in Tank 101-SY. This paper provides the results of this work. The results of this analysis are similar to the Westinghouse Hanford Company results with slightly higher pressures and larger releases. The results given here are believed to be conservative in that the pressures are higher and the radiological releases are larger than that would be produced by a best-estimate analysis.

1340 (LA-UR-92-2508) Hydrothermal treatment of Hanford waste constituents. Dell'Orco, P.C. (Texas Univ., Austin, TX (United States). Environmental and Water Resources Engineering); Foy, B.R.; Robinson, J.M.; Buelow, S.J. Los Alamos National Lab., NM (United States). [1992]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-920808-3: American Institute of Chemical Engineers (AIChE) summer national meeting, Minneapolis, MN (United States), 9-12 Aug 1992). Order Number DE92018995. Source: OSTI; NTIS; INIS; GPO Dep.

The destruction of nitrates, organics, and ferrocyanides contained in underground storage tanks at the Department of Energy Hanford site in Washington state would significantly reduce the volume, hazard, and toxicity of the waste, while meeting pretreatment requirements for vitrification and grouting. The purpose of this study was to investigate the applicability of supercritical water oxidation for the destruction of nitrates, organics, and ferrocyanides. Laboratory studies were performed studying oxidation/reduction reactions of nitrate with a simple organic compound, methanol, and with ammonia. Additional studies examined the reaction of nitrate with ferrocyanide. When reacted with methanol above 500°C, greater than 99% of the nitrate was destroyed at the shortest residence times (< 6 seconds). At the same

conditions, greater than 80% of the methanol was converted to bicarbonate and carbon dioxide. Studies involving the reaction of nitrate and nitrite with ammonia indicated that the reaction proceeds to completion in short residence times at temperatures above the critical point of water (374.2°C). Ferrocyanide also reacted rapidly with nitrate above the critical point, to produce carbon dioxide and ammonia.

1341 (LA-UR-92-3977) Remediation of Hanford tank waste using magnetic separation. Worl, L.A.; Avens, L.R.; de Agüero, K.J.; Coyne Prenger, F.; Stewart, W.F.; Hill, D.D. Los Alamos National Lab., NM (United States). [1992]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-930204-1: '93 meeting on waste management, Tucson, AZ (United States), 28 Feb - 4 Mar 1993). Order Number DE93005456. Source: OSTI; NTIS; INIS; GPO Dep.

Large volumes of high-level radioactive waste are stored at the Department of Energy's Hanford site. Magnetic separation, a physical separation process, can be used to segregate actinides and certain fission products from the waste. High gradient magnetic separation (HGMS) tests have been performed successfully using a simulated, nonradioactive underground storage tank (UST) waste. Variations in HGMS test parameters included separator matrix material, magnetic field strength, slurry surfactant, and slurry solids loading. Cerium was added to the simulated tank waste to act as a uranium surrogate. Results show that over 77% of the uranium surrogate can be captured and concentrated from the original bulk with a simple procedure. The results of these tests and the feasibility of magnetic separation for pretreatment of UST waste are discussed.

1342 (LA-UR-93-456) Destruction of nitrates, organics, and ferrocyanides by hydrothermal processing. Robinson, J.M.; Foy, B.R.; Dell'Orco, P.C.; Anderson, G.; Archuleta, F.; Atencio, J.; Breshears, D.; Brewer, R.; Eaton, H.; McFarland, R.; McInroy, R.; Reynolds, T.; Sedillo, M.; Wilmanns, E.; Buelow, S.J. Los Alamos National Lab., NM (United States). [1993]. 17p. Sponsored by USDOE, Washington, DC (United States); Associated Western Universities, Inc., Salt Lake City, UT (United States). DOE Contract W-7405-ENG-36. (CONF-930205-23: Waste management '93, Tucson, AZ (United States), 28 Feb - 4 Mar 1993). Order Number DE93008714. Source: OSTI; NTIS; INIS; GPO Dep.

This work targets the remediation of the aqueous mixed wastes stored in the underground tanks at the Department of Energy site in Hanford, Washington via hydrothermal processing. The feasibility of destroying the nitrate, organic, and ferrocyanide components of the wastes under supercritical and near critical conditions (623 °K to 873 °K, 22.1 MPa to 103.4 MPa) is addressed. A novel method was developed for determining the solubility of nitrate salts in supercritical water solutions at pressures ranging from 24.8 MPa to 30.3 MPa (3600 psi to 4400 psi) and temperatures from 723 °K to 798 °K. Sodium nitrate solubilities ranged from 293 mg/kg at 24.8 MPa and 798 °K to 1963 mg/kg at 30.3 MPa and 723 °K. Solubility was found to vary directly with pressure, and inversely with temperature. An empirical relationship was developed for the estimation of sodium nitrate solubility at water densities between 0.08 and 0.16 kg/L and temperatures between 723 °K and 798 °K. A small volume batch reactor equipped with optical diagnostics was used to monitor the phase behavior of a diluted variant of a tank 101-SY simulant. Preliminary results suggest that a single phase is formed at 83 MPa at 773 °K.

1343 (LA-UR-93-2584) Data acquisition and control system for the High-Level Waste Tank Farm at Hanford, Washington. Hoida, H.W. (Los Alamos National Lab., NM (United States)); Hatcher, C.R.; Trujillo, L.T.; Holt, D.H.; Vargo, G.F.; Martin, J.; Stastny, G.; Echave, R.; Eldridge, K. Los Alamos National Lab., NM (United States). [1993]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-930749-37: 34, annual meeting of the Institute of Nuclear Materials Management, Scottsdale, AZ (United States), 18-21 Jul 1993). Order Number DE93018548. Source: OSTI; NTIS; INIS; GPO Dep.

The High-Level Nuclear Waste Storage Tank 241-SY-101 periodically releases flammable gasses. Mitigation experiments to release the gasses continuously to avoid a catastrophic build-up are planned for FY93 and beyond. Los Alamos has provided a data acquisition and control system (DACS) to monitor and control mitigation experiments on SY-101. The DACS consists of a data acquisition trailer to house the electronic components and computers in a friendly environment, a computer system running process control software for monitoring and controlling the tests, signal conditioners to convert the instrument signals to a usable form for the DACS, programmable logic controllers to process sensor signals and take action quickly, a fast data acquisition system for recording transient data, and a remote monitoring system to monitor the progress of the experiment. Equipment to monitor the release of the gasses was also provided. The first experiment involves a mixer pump to mix the waste and allow the gasses to be released at the surface of the liquid as the gas is being formed. The initial tests are scheduled for July 1993.

1344 (LA-UR-93-3489) PSA results for Hanford high level waste Tank 101-SY. MacFarlane, D.R. (Los Alamos National Lab., NM (United States)); Bott, T.F.; Brown, L.F.; Stack, D.W.; Kindinger, J.; Deremer, R.K.; Medhekar, S.R.; Mikschl, T.J. Los Alamos National Lab., NM (United States). [1993]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-940312-8: 2. Probabilistic safety assessment and management conference (PSAM), San Diego, CA (United States), 20-24 Mar 1994). Order Number DE94000676. Source: OSTI; NTIS; INIS; GPO Dep.

Los Alamos National Laboratory has performed a comprehensive probabilistic safety assessment (PSA) that includes consideration of external events for the weapons-production wastes stored in tank number 241-SY-101, commonly known as Tank 101-SY, as configured in December 1992. This tank, which periodically releases ("burps") a gaseous mixture of hydrogen, nitrous oxide, ammonia, and nitrogen, was analyzed because of public safety concerns associated with the potential for release of radioactive tank contents should this gas mixture be ignited during one of the burps. In an effort to mitigate the burping phenomenon, an experiment is underway in which a large pump has been inserted into the tank to determine if pump-induced circulation of the tank contents will promote a slow, controlled release of the gases. This PSA for Tank 101-SY, which did not consider the pump experiment or future tank-remediation activities, involved three distinct tasks. First, the accident sequence analysis identified and quantified those potential accidents whose consequences result in tank material release. Second, characteristics and release paths for the airborne and liquid radioactive source terms were determined. Finally, the consequences, primarily onsite and offsite potential health effects resulting from radionuclide release, were estimated, and overall risk curves were constructed. An overview of

each of these tasks and a summary of the overall results of the analysis are presented in the following sections.

1345 (LA-UR-93-3800) Simulation and rheological analysis of Hanford Tank 241-SY-101: Final report. Sams, E.C.; Tennant, R.A.; Piccola, J.P. Jr. Los Alamos National Lab., NM (United States). Oct 1993. 172p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE94002724. Source: OSTI; NTIS; INIS; GPO Dep.

Rheological characterization and small scale simulation of Hanford Tank 241-SY-101 has been initiated to aid in the remediation efforts for the Department of Energy Hanford Site. The study has been initiated in response to growing concerns about the potential flammability hazard pertaining to the periodic release of up to 10,000 cubic feet of hydrogen, nitrous oxide, nitrogen, and ammonia gases. Various stimulants emulating the radioactive waste stored in this tank have been used to ascertain the rheological parameters of the waste, simulate the ongoing processes of gas generation and release phenomenon inside the tank, and determine the feasibility of jet mixing to achieve a controlled release of the gas mixture.

1346 (LA-UR-94-52) Distributions of 14 elements into 10 liquid extractants from simulated acid-dissolved sludge and acidified supernate solutions of Hanford high-level waste. Marsh, S.F. (Sandia National Labs., Albuquerque, NM (United States)); Svitra, Z.V.; Bowen, S.M. Los Alamos National Lab., NM (United States). [1994]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-940225-5: Waste management '94, Tucson, AZ (United States), 27 Feb - 3 mar 1994). Order Number DE94006226. Source: OSTI; NTIS; INIS; GPO Dep.

The distributions of 14 elements into ten extractants were measured from simulant solutions that represent acidic dissolved sludge and acidified supernate from Hanford HLW Tank 102-SY. The extractants: LIXTM-26, LIXTM-54, LIXTM-84, LIXTM-1010, CyanexTM 272, CyanexTM 923, AliquatTM 336, DHDECMP, DHDECMP-DIPB, and CMPO-DIPB, were sorbed on porous carbon beads to provide dry-appearing beads that would be suitable for column operations. The selected elements, which represent fission products: Ce, Cs, Sr, Tc, and Y; actinides: U, Pu, and Am; and matrix elements: Cr, Co, Fe, Mn, Zn, and Zr; were traced by radionuclides and measured by gamma spectrometry. Distribution coefficients for each of 280 element/absorber/solution combinations were measured for dynamic contact periods of 30 minutes, 2 hours, and 6 hours to provide sorption kinetics information for the selected elements from these complex media. The resulting 840 measured distribution coefficients are presented.

1347 (ORNL/ER-84) Risk-based prioritization for the interim remediation of inactive low-level liquid radioactive waste underground storage tanks at Oak Ridge National Laboratory, Oak Ridge, Tennessee. Chidambariah, V.; Travis, C.C.; Trabalka, J.R.; Thomas, J.K. Oak Ridge National Lab., TN (United States). Environmental Restoration Div. Sep 1992. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93000553. Source: OSTI; NTIS; INIS; GPO Dep.

The paper presents a risk-based approach for rapid prioritization of low-level liquid radioactive waste underground storage tanks (LLLW USTs), for possible interim corrective

measures and/or ultimate closure. The ranking of LLLW USTs is needed to ensure that tanks with the greatest potential for adverse impact on the environment and human health receive top priority for further evaluation and remediation. Wastes from the LLLW USTs at Oak Ridge National Laboratory were pumped out when the tanks were removed from service. The residual liquids and sludge contain a mixture of radionuclides and chemicals. Contaminants of concern that were identified in the liquid phase of the inactive LLLW USTs include the radionuclides ⁹⁰Sr, ¹³⁷Cs, and ²³³U and the chemicals carbon tetrachloride, trichloroethane, tetrachloroethene, methyl ethyl ketone, mercury, lead, and chromium. The risk-based approach for prioritization of the LLLW USTs is based upon three major criteria: (1) leaking characteristics of the tank, (2) location of the tanks, and (3) toxic potential of the tank contents. Leaking characteristics of LLLW USTs will aid in establishing the potential for the release of contaminants to environmental media. In this study, only the liquid phase was assumed to be released to the environment. Scoring criteria for release potential of LLLW USTs was determined after consideration of the magnitude of any known leaks and the tank type for those that are not known to leak.

1348 (ORNL/ER-121) Upgrade of level instruments in inactive liquid low-level waste tanks at Oak Ridge National Laboratory, Oak Ridge, Tennessee: Environmental Restoration Program. Youngblood, E.L.; Hylton, T.D.; Kendrick, C.M. Oak Ridge National Lab., TN (United States). Nov 1992. 58p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93002706. Source: OSTI; NTIS; INIS; GPO Dep.

The objectives of this low-level liquid wastes study were to (1) determine the requirements for inventory monitoring of inactive (LLLW) tanks at Oak Ridge National Laboratory (ORNL), (2) evaluate the existing inventory of monitoring instruments and determine whether the current requirements for monitoring and leak detection are being met, and (3) recommend improvements or upgrades of the level instruments where needed. The instrumentation was evaluated on the basis of its accuracy, previous experience with the instrumentation, and any other available evaluation data. Instruments were evaluated for their effectiveness in monitoring the liquid inventory. Level instrumentation for 12 of the tanks was considered satisfactory for monitoring liquid inventory and potential leakage. A list of options was provided for monitoring 12 tanks that are either currently empty or scheduled to be emptied during FY 1992 or 1993. Recommendations were also provided for the Group 5 tanks. Instrument upgrades were determined to be needed for the remaining eight tanks. The study examined the capabilities and limitations of the level-monitoring instruments in use at ORNL and other sites for appropriateness for the tanks requiring upgrades.

1349 (ORNL/TM-12417) Function analysis of the single-shell Tank Waste Retrieval Manipulator System: Environmental Restoration and Waste Management Program. Draper, J.V. Oak Ridge National Lab., TN (United States). Aug 1993. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93040592. Source: OSTI; NTIS; GPO Dep.

This document lists the functions likely to be performed by each proposed component of the Tank Waste Retrieval Manipulator System (TWRMS) and the user functions that must be performed to operate each component. While the information contained in this document is tentative because the

systems are still evolving, it provides a foundation for task analysis and control room design efforts. These efforts will support the design of a test-bed control room in the near future and an operational control room later. The information in this document is based on specifications published for the TWRMS.

1350 (PNL-7810) Review of technologies for the pretreatment of retrieved single-shell tank waste at Hanford. Gerber, M.A. Pacific Northwest Lab., Richland, WA (United States). Aug 1992. 174p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92019232. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of the study reported here was to identify and evaluate innovative processes that could be used to pretreat mixed waste retrieved from the 149 single-shell tanks (SSTs) on the US Department of Energy's (DOE) Hanford site. The information was collected as part of the Single Shell Tank Waste Treatment project at Pacific Northwest Laboratory (PNL). The project is being conducted for Westinghouse Hanford Company under their SST Disposal Program.

1351 (PNL-8011) Conceptual models for waste tank mechanistic analysis: Status report, January 1991. Allemann, R.T.; Antoniuk, Z.I.; Eyler, L.L.; Liljegren, L.M.; Roberts, J.S. Pacific Northwest Lab., Richland, WA (United States). Feb 1992. 86p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92009625. Source: OSTI; NTIS; INIS; GPO Dep.

Pacific Northwest Laboratory (PNL) is conducting a study for Westinghouse Hanford Company (Westinghouse Hanford), a contractor for the US Department of Energy (DOE). The purpose of the work is to study possible mechanisms and fluid dynamics contributing to the periodic release of gases from double-shell waste storage tanks at the Hanford Site in Richland, Washington. This interim report emphasizing the modeling work follows two other interim reports, Mechanistic Analysis of Double-Shell Tank Gas Release Progress Report - November 1990 and Collection and Analysis of Existing Data for Waste Tank Mechanistic Analysis Progress Report - December 1990, that emphasized data correlation and mechanisms. The approach in this study has been to assemble and compile data that are pertinent to the mechanisms, analyze the data, evaluate physical properties and parameters, evaluate hypothetical mechanisms, and develop mathematical models of mechanisms.

1352 (PNL-8014) Assessment of dome-fill technology and potential fill materials for the Hanford single-shell tanks. Smyth, J.D.; Shade, J.W.; Somasundaram, S. Pacific Northwest Lab., Richland, WA (United States). May 1992. 50p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92014599. Source: OSTI; NTIS; GPO Dep.

This study is part of a task that will identify dome-fill materials to stabilize and prevent the collapse of the structures of 149 single-shell tanks (SSTs). The SSTs were built at the Hanford Site in Washington State and used between 1944 and 1980 to store radioactive and other hazardous wastes. In addition to identifying suitable fill materials, this task will develop the technology and methods required to fill the tanks with the selected material. To date, basalt is the only candidate fill material with any testing conducted for its suitability as a dome-fill material. Sufficient data do not exist to select or eliminate basalt as a candidate material. This

report documents a review of past dome-fill work at the Hanford Site and of other pertinent literature to establish a baseline for the dome-fill technology. In addition, the report identifies existing dome-fill technology, preliminary performance criteria for dome-fill technology development, potential testing strategies, and potential fill materials. As a part of this study, potential fill materials are qualitatively evaluated and a list of preliminary candidate fill materials is identified. Future work will further screen these materials. The dome-fill task work will ultimately contribute to the development of a final waste form package and the safe isolation of wastes from the Hanford Site SSTs.

1353 (PNL-8170) Preliminary investigation of the potential for transient vapor release events during in situ vitrification based on thermal-hydraulic modeling. Roberts, J.S.; Woosley, S.L.; Lessor, D.L.; Strachan, C. Pacific Northwest Lab., Richland, WA (United States). Jul 1992. 47p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830 ; FG06-89ER75522. Order Number DE92018664. Source: OSTI; NTIS; INIS; GPO Dep.

This study investigates a possible cause of molten glass displacements that occurred during two recent in situ vitrification (ISV) tests. The study was conducted for the US Department of Energy by Pacific Northwest Laboratory. It is hypothesized that these glass displacements are caused by large gas bubbles rising up through the ISV melt and bursting at its surface. These bubbles cause the molten surface to upwell and possibly overflow. When the bubbles burst, molten glass is thrown from the melt surface and the volume of gas contained in the bubble is released into the hood. Both of these phenomena are undesirable because the molten soil ejected from the melt is dangerous to operating personnel and can damage equipment. The sudden gas release can cause a temporary pressurization of the hood, allowing potentially contaminated gas to escape to the atmosphere. This study attempts to explain the conditions necessary for formation of large gas bubbles in the melt so that future glass displacements can be avoided.

1354 (PNL-8295) Mathematical modeling of mixer pump performance for agitation of radioactive slurries in one-million-gallon underground storage tanks at Hanford. Bamberger, J.A.; Eyler, L.L.; Dodge, R.E. Pacific Northwest Lab., Richland, WA (United States). Apr 1993. 85p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93012344. Source: OSTI; NTIS; INIS; GPO Dep.

The objective of this work is to analyze the Hanford Waste Vitrification Project (HWVP) feed preparation tank mixing pump agitation design. This was accomplished by (1) reviewing mixing pump characteristics, (2) performing computer modeling of jet mixing and particulate material transport, (3) evaluating the propensity of the tank and mixing pump design to maintain particulate material in the tank in a uniformly mixed state, and (4) identifying important design parameters required to ensure optimum homogeneity and solids content during batch transfers.

1355 (PNL-8528) Analysis of Tank 241-AN-106 characterization and grout performance criteria. Liebetrau, A.M.; Anderson, C.M. Pacific Northwest Lab., Richland, WA (United States). Feb 1993. 55p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93008950. Source: OSTI; NTIS; INIS; GPO Dep.

This report provides an assessment of how well we can resolve the following issues concerning Tank 241-AN-106 at the Hanford Reservation, given the current state of information: How well we can characterize the contents of 241-AN-106; whether the degree of characterization is sufficient to use 241-AN-106 wastes to develop tests of grout adequacy. The wastes must be characterized not only to ensure grout adequacy but also to provide assurance that the wastes can be successfully and safely transferred. In this report, we evaluate the adequacy of characterization for transfer and tests of grout adequacy, and we evaluate the current status of acceptance criteria and grout formulation experiments.

1356 (PNL-8537) Underground storage tank integrated demonstration: Evaluation of pretreatment options for Hanford tank wastes. Lumetta, G.J.; Wagner, M.J.; Colton, N.G.; Jones, E.O. Pacific Northwest Lab., Richland, WA (United States). Jun 1993. 34p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93016830. Source: OSTI; NTIS; INIS; GPO Dep.

Separation science plays a central role in the pretreatment and disposal of nuclear wastes. The potential benefits of applying chemical separations in the pretreatment of the radioactive wastes stored at the various US Department of Energy sites cover both economic and environmental incentives. This is especially true at the Hanford Site, where the huge volume (>60 Mgal) of radioactive wastes stored in underground tanks could be partitioned into a very small volume of high-level waste (HLW) and a relatively large volume of low-level waste (LLW). The cost associated with vitrifying and disposing of just the HLW fraction in a geologic repository would be much less than those associated with vitrifying and disposing of all the wastes directly. Furthermore, the quality of the LLW form (e.g., grout) would be improved due to the lower inventory of radionuclides present in the LLW stream. In this report, we present the results of an evaluation of the pretreatment options for sludge taken from two different single-shell tanks at the Hanford Site—Tanks 241-B-110 and 241-U-110 (referred to as B-110 and U-110, respectively). The pretreatment options examined for these wastes included (1) leaching of transuranic (TRU) elements from the sludge, and (2) dissolution of the sludge followed by extraction of TRUs and ^{90}Sr . In addition, the TRU leaching approach was examined for a third tank waste type, neutralized cladding removal waste.

1357 (PNL-8557) Calculation of reaction energies and adiabatic temperatures for waste tank reactions: Waste Tank Safety Program. Burger, L.L. Pacific Northwest Lab., Richland, WA (United States). Mar 1993. 50p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93011235. Source: OSTI; NTIS; INIS; GPO Dep.

Continual concern has been expressed over potentially hazardous exothermic reactions that might occur in underground Hanford waste tanks. These tanks contain many different oxidizable compounds covering a wide range of concentrations. Several may be in concentrations and quantities great enough to be considered a hazard in that they could undergo rapid and energetic chemical reactions with nitrate and nitrite salts that are present. The tanks also contain many inorganic compounds inert to oxidation. In this report the computed energy that may be released when various organic and inorganic compounds react is computed as

a function of the reaction mix composition and the temperature. The enthalpy, or integrated heat capacity, of these compounds and various reaction products is presented as a function of temperature, and the enthalpy of a given mixture can then be equated to the energy release from various reactions to predict the maximum temperature that may be reached. This is estimated for several different compositions. Alternatively, the amounts of various diluents required to prevent the temperature from reaching a critical value can be estimated.

1358 (PNL-8559) Numerical simulation of jet mixing concepts in Tank 241-SY-101. Trent, D.S.; Michener, T.E. Pacific Northwest Lab., Richland, WA (United States). Mar 1993. 218p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93012400. Source: OSTI; NTIS; INIS; GPO Dep.

The episodic gas release events (GRES) that have characterized the behavior of Tank 241-SY-101 for the past several years are thought to result from gases generated by the waste material in it that become trapped in the layer of settled solids at the bottom of the tank. Several concepts for mitigating the GRES have been proposed. One concept involves mobilizing the solid particles with mixing jets. The rationale behind this idea is to prevent formation of a consolidated layer of settled solids at the bottom of the tank, thus inhibiting the accumulation of gas bubbles in this layer. Numerical simulations were conducted using the TEMPEST computer code to assess the viability and effectiveness of the proposed jet discharge concepts and operating parameters. Before these parametric studies were commenced, a series of turbulent jet studies were conducted that established the adequacy of the TEMPEST code for this application. Configurations studied for Tank 241-SY-101 include centrally located downward discharging jets, draft tubes, and horizontal jets that are either stationary or rotating. Parameter studies included varying the jet discharge velocity, jet diameter, discharge elevation, and material properties. A total of 18 simulations were conducted and are reported in this document. The effect of gas bubbles on the mixing dynamics was not included within the scope of this study.

1359 (PNL-8589) Preliminary assessment of blending Hanford tank wastes. Geeting, J.G.H.; Kurath, D.E. Pacific Northwest Lab., Richland, WA (United States). Mar 1993. 138p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93010607. Source: OSTI; NTIS; INIS; GPO Dep.

A parametric study of blending Hanford tank wastes identified possible benefits from blending wastes prior to immobilization as a high level or low level waste form. Track Radioactive Components data were used as the basis for the single-shell tank (SST) waste composition, while analytical data were used for the double-shell tank (DST) composition. Limiting components were determined using the existing feed criteria for the Hanford Waste Vitrification Plant (HWVP) and the Grout Treatment Facility (GTF). Results have shown that blending can significantly increase waste loading and that the baseline quantities of immobilized waste projected for the sludge-wash pretreatment case may have been drastically underestimated, because critical components were not considered. Alternatively, the results suggest further review of the grout feed specifications and the solubility of minor components in HWVP borosilicate glass. Future immobilized waste estimates might be

decreased substantially upon a thorough review of the appropriate feed specifications.

1360 (PNL-8813) Physical and hydraulic properties of sediments and engineered materials associated with grouted double-shell tank waste disposal at Hanford. Rockhold, M.L.; Fayer, M.J.; Heller, P.R. Pacific Northwest Lab., Richland, WA (United States). Sep 1993. 88p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94001549. Source: OSTI; NTIS; INIS; GPO Dep.

Numerical models are used to predict the fate of contaminants in the environment for durations of 10,000 years and more. At the Hanford Site, these models are being used to evaluate the potential health effects and environmental impacts associated with the disposal of double-shell tank waste in grouted vaults. These models require information on the properties of the earthen and manufactured materials that compose the vault system and its surroundings. This report documents the physical and hydraulic properties of the materials associated with burial of grouted double-shell tank waste at the Hanford Site.

1361 (PNL-8871) Organic layer sampling for SST 241-C-103 background, and Data Quality Objectives, and analytical plan. Wood, T.W.; Willingham, C.E.; Campbell, J.A. Pacific Northwest Lab., Richland, WA (United States). Aug 1993. 32p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94001555. Source: OSTI; NTIS; INIS; GPO Dep.

A layer of organic material floating on the surface of the high level radioactive waste in single-shell tank 241-C-103 has been declared an Unreviewed Safety Question (USQ). This designation is motivated by concern that a "pool fire" in this layer could release radioactive material from the tank. This layer is believed to consist largely of Tri-Butyl Phosphate (TBP) and Normal Paraffin Hydrocarbon (NPH), but its composition is not known definitively. Resolution of this USQ hinges on a more complete and detailed understanding of the flammability potential of this layer and vapors that could evolve from it, and to a lesser extent on the propagation and energetics of such a pool fire if initiated, and the source-term associated with a release event following a pool fire. This increased understanding of the risk posed by this layer in turn requires better information on its composition. This report documents a Data Quality Objectives (DQO) study conducted to define this information in detail.

1362 (PNL-8876) Computational analysis of fluid flow and zonal deposition in ferrocyanide single-shell tanks: Ferrocyanide Safety Program. McGrail, B.P.; Trent, D.S.; Terrones, G.; Hudson, J.D.; Michener, T.E. Pacific Northwest Lab., Richland, WA (United States). Oct 1993. 65p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94001552. Source: OSTI; NTIS; INIS; GPO Dep.

Safety of single-shell tanks containing ferrocyanide wastes is of concern. Ferrocyanide in the presence of an oxidizer such as NaNO_3 or NaNO_2 is explosively combustible when concentrated and heated. Evaluating the processes that could affect the fuel content of waste and distribution of the tank heat load is important. Highly alkaline liquid wastes were transferred in and out of the tanks over several years. Since $\text{Na}_2\text{NiFe}(\text{CN})_6$ is much more soluble in alkaline media, the ferrocyanide could be dispersed from the tank more easily. If $\text{Cs}_2\text{NiFe}(\text{CN})_6$ or $\text{CsNaNiFe}(\text{CN})_6$ are also soluble in alkaline media, solubilization and transport of ^{137}Cs could

also occur. Transporting this heat generating radionuclide to a localized area in the tanks is a potential mechanism for generating a "hot spot." Fluid convection could potentially speed the transport process considerably over aqueous diffusion alone. A stability analysis was performed for a dense fluid layer overlying a porous medium saturated by a less dense fluid with the finding that the configuration is unconditionally unstable and independent of the properties of the porous medium or the magnitude of the fluid density difference. A parametric modeling study of the buoyancy-driven flow due to a thermal gradient was conducted to establish the relationship between the waste physical and thermal properties and natural convection heat transfer. The effects of diffusion and fluid convection on the redistribution of the ^{137}Cs were evaluated with a 2-D coupled heat and mass transport model. The maximum predicted temperature rise associated with the formation of zones was only 5°C and thus is of no concern in terms of generating a localized "hot spot."

1363 (PNL-8887) Ferrocyanide safety program cyanide speciation studies FY 1993 annual report. Bryan, S.A.; Pool, K.H.; Bryan, S.L.; Sell, R.L.; Thomas, L.M.P. Pacific Northwest Lab., Richland, WA (United States). Sep 1993. 47p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94009007. Source: OSTI; NTIS; INIS; GPO Dep.

This report summarizes Pacific Northwest Laboratory's (PNL) FY 1993 progress toward developing and implementing methods to identify and quantify cyanide species in ferrocyanide tank waste. Currently, there are 24 high-level waste storage tanks at the US Department of Energy's (DOE) Hanford Site that have been placed on a Ferrocyanide Tank Watchlist because they contain an estimated 1000 g-moles or more of precipitated ferrocyanide. This amount of ferrocyanide is of concern because the consequences of a potential explosion may exceed those reported previously in safety analyses. To bound the safety concern, methods are needed to definitively measure and quantify the amount of ferrocyanides present within actual waste tanks to a lower limit of at least 0.1 wt % up to approximately 15 wt %. The target analyte concentration for cyanide in waste is approximately 0.1 to 15 wt % (as CN) in the original undiluted sample. After dissolution of the original sample and appropriate dilutions, the concentration range of interest in the analytical solutions can vary between 0.001 to 0.1 wt % (as CN).

1364 (PNL-8888) Ferrocyanide Safety Project Task 3 Ferrocyanide Aging Studies FY 1993 annual report. Lilga, M.A.; Lumetta, M.R.; Schiefelbein, G.F. Pacific Northwest Lab., Richland, WA (United States). Oct 1993. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94002605. Source: OSTI; NTIS; INIS; GPO Dep.

The Hanford Ferrocyanide Task Team is addressing issues involving ferrocyanide precipitates in single-shell waste storage tanks (SSTs), in particular the storage of waste in a safe manner. This Task Team, composed of researchers from Westinghouse Hanford Company (WHC), Pacific Northwest Laboratory (PNL), and outside consultants, was formed in response to the need for an updated analysis of safety questions about the Hanford ferrocyanide tanks. The Ferrocyanides Safety Project at PNL is part of the Waste Tank Safety Program led by WHC. The overall purpose of the WHC program, sponsored by the US Department of

Energy's Tank Farm Project Office, is to (1) maintain the ferrocyanide tanks with minimal risk of an accident, (2) select one or more strategies to assure safe storage, and (3) close out the unreviewed safety question (USQ). This annual report gives the results of the work conducted by PNL in FY 1993 on Task 3, Ferrocyanides Aging Studies, which deals with the aging behavior of simulated ferrocyanide wastes. Aging processes include the dissolution and hydrolysis of nickel ferrocyanides in high pH aqueous solutions. Investigated were the effects of pH variation; ionic strength and sodium ion concentration; the presence of anions such as phosphate, carbonate, and nitrate; temperature; and gamma radiation on solubility of ferrocyanide materials including In-Farm-IA, Rev. 4 flowsheet-prepared $\text{Na}_2\text{NiFe}(\text{CN})_6$.

1365 (PNL-8998) Experimental logistics plan in support of Extensive Separations for Hanford tank waste remediation systems. Enderlin, W.I.; Swanson, J.L.; Carlson, C.D.; Hirschi, E.J. Pacific Northwest Lab., Richland, WA (United States). Dec 1993. 44p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94006110. Source: OSTI; NTIS; INIS; GPO Dep.

All proposed methods for remediating the radioactive and chemical waste stored in single- and double-shell tanks (SSTs and DSTs) at the Hanford Site require the separation of the waste mixtures in the tank into high-level and low-level fractions, the safe transport of this separated waste to appropriate immobilization facilities, and the long-term disposal of the immobilized waste forms. Extensive experimentation, especially in waste separations, will be required to develop the technologies and to produce the data that support the most effective and safe cleanup processes. As part of this effort, Pacific Northwest Laboratory (PNL) is developing this detailed experimental logistics plan to determine the logistical/resource requirements, and ultimately the critical paths, necessary to effectively and safely conduct the multitude of experiments within the Extensive Separations Development Program, which addresses the experimental needs of a concept that provides a high degree of separation for the high-level and low-level waste fractions. The logistics issues developed for this program are expected to be similar to those for other programs aimed at remediating and disposing of the wastes.

1366 (PNL-9368) Aerosol and vapor characterization of Tank 241-C-103: Data report for in-tank OVS samples obtained December 2, 1993: Waste Tank Safety Program. Ligothe, M.W. (and others); Clauss, T.R.; Fruchter, J.S. Pacific Northwest Lab., Richland, WA (United States). Mar 1994. 33p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94009461. Source: OSTI; NTIS; GPO Dep.

Waste tank vapor space samples for a flammability analysis and characterization were obtained from Tank 241-C-103, referred to as C-103, in early December 1993. The purpose of this report is to describe the analytical results of these samples and the resulting concentration of nominal paraffin hydrocarbons (NPH) in the tank vapor space. Past reports of a thick fog in the vapor space of C-103 led to a concern that an NPH fog could supply fuel to the vapor space in a form that could not be resolved ability measurement procedures. The scope of this study was to utilize a previously validated method to determine actual NPH concentrations. In this method, NPH samples were collected in multi-layer aerosol/vapor sorbent tubes inserted into the

tank vapor space and analyzed by gas chromatography/mass spectrometry.

1367 (PNL-9408) Statistical evaluations of current sampling procedures and incomplete core recovery. Heasler, P.G. (Pacific Northwest Lab., Richland, WA (United States)); Jensen, L. Pacific Northwest Lab., Richland, WA (United States). Mar 1994. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94009878. Source: OSTI; NTIS; INIS; GPO Dep.

This document develops two formulas that describe the effects of incomplete recovery on core sampling results for the Hanford waste tanks. The formulas evaluate incomplete core recovery from a worst-case (i.e., biased) and best-case (i.e., unbiased) perspective. A core sampler is unbiased if the sample material recovered is a random sample of the material in the tank, while any sampler that preferentially recovers a particular type of waste over others is a biased sampler. There is strong evidence to indicate that the push-mode sampler presently used at the Hanford site is a biased one. The formulas presented here show the effects of incomplete core recovery on the accuracy of composition measurements, as functions of the vertical variability in the waste. These equations are evaluated using vertical variability estimates from previously sampled tanks (B110, U110, C109). Assuming that the values of vertical variability used in this study adequately describes the Hanford tank farm, one can use the formulas to compute the effect of incomplete recovery on the accuracy of an average constituent estimate. To determine acceptable recovery limits, we have assumed that the relative error of such an estimate should be no more than 20%.

1368 (PNL-9423) Mitigation of Tank 241-SY-101 by pump mixing: Results of testing phases A and B. Alleman, R.T. (Pacific Northwest Lab., Richland, WA (United States)); Antoniuk, Z.I.; Chvala, W.D.; Friley, J.R.; Gregory, W.B.; Hudson, J.D.; Michener, T.E.; Panisko, F.E.; Stewart, C.W.; Wise, B.M.; Efferding, L.E.; Fadeff, J.G.; Irwin, J.J.; Kirch, N.W. Pacific Northwest Lab., Richland, WA (United States). Mar 1994. 135p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94009843. Source: OSTI; NTIS; GPO Dep.

A spare mixing pump from the Hanford Grout Program was installed in Hanford double-shell waste Tank 241-SY-101 on July 3, 1993, after being modified to take advantage of waste stratification. It was anticipated that pump mixing would prevent large episodic flammable gas releases that had been occurring about every 100-150 days. A cautious initial test plan, called Phase A, was run to find how the pump and tank would behave in response to very brief and gentle pump operation. No large gas releases were triggered, and the pump performed well except for two incidents of nozzle plugging. On October 21, 1993, the next test series, Phase B, began, and the pump was applied more aggressively to mix the tank contents and mitigate uncontrolled gas releases. Orienting the pump in new directions released large volumes of gas and reduced the waste level to a near-record low. Results of the entire period from pump installation to the end of Phase B on December 17, 1993, are presented in detail in this document. Though long-term effects require further evaluation, we conclude from these data that the jet mixer pump is an effective means of controlling flammable gas release and that it has met the success criteria for mitigation in this tank.

1369 (PNL-9426) Preliminary survey of separations technology applicable to the pretreatment of Hanford tank waste (1992-1993). Lawrence, W.E.; Kurath, D.E. Pacific Northwest Lab., Richland, WA (United States). Apr 1994. 40p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94011404. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy has established the Tank Waste Remediation System (TWRS) to manage and dispose of radioactive wastes stored at the Hanford Site. Within this program are evaluations of pretreatment system alternatives through literature reviews. The information in this report was collected as part of this project at Pacific Northwest Laboratory. A preliminary survey of literature on separations recently entered into the Hanford electronic databases (1992-1993) that have the potential for pretreatment of Hanford tank waste was conducted. Separation processes that can assist in the removal of actinides (uranium, plutonium, americium), lanthanides, barium, ^{137}Cs , ^{90}Sr , ^{129}I , ^{63}Ni , and ^{99}Tc were evaluated. Separation processes of interest were identified through literature searches, journal reviews, and participation in separation technology conferences. This report contains brief descriptions of the potential separation processes, the extent and/or selectivity of the separation, the experimental conditions, and observations. Information was collected on both national and international separation studies to provide a global perspective on recent research efforts.

1370 (PNL-9428) Research-scale melter test report. Cooper, M.F.; Elliott, M.L.; Eyler, L.L.; Freeman, C.J.; Higginson, J.J.; Mahoney, L.A.; Powell, M.R. Battelle Pacific Northwest Lab., Richland, WA (United States). May 1994. 301p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94012136. Source: OSTI; NTIS; INIS; GPO Dep.

The Melter Performance Assessment (MPA) activity in the Pacific Northwest Laboratory's (PNL) Hanford Waste Vitrification Plant (HWVP) Technology Development (PHTD) effort is intended to determine the impact of noble metals on the operational life of the reference HWVP melter. As a part of this activity, a parametric melter test was completed using a Research-Scale Melter (RSM). The RSM is a small, approximately 1/100-scale melter, 6-in.-diameter, that allows rapid changing of process conditions and subsequent re-establishment of a steady-state condition. The test matrix contained nine different segments that varied the melter operating parameters (glass and plenum temperatures) and feed properties (oxide concentration, redox potential, and noble metal concentrations) so that the effects of these parameters on noble metal agglomeration on the melter floor could be evaluated. The RSM operated for 48 days and consumed 1,300 L of feed, equating to 153 tank turnovers. The run produced 531 kg of glass. During the latter portion of the run, the resistance between the electrodes decreased. Upon destructive examination of the melter, a layer of noble metals was found on the bottom. This was surprising because the glass residence time in the RSM is only 10% of the HWVP plant melter. The noble metals layer impacted the melter significantly. Approximately 1/3 of one paddle electrode was melted or corroded off. The cause is assumed to be localized heating from short circuiting of the electrode to the noble metal layer. The metal layer also removed approximately 1/2 in. of the refractory on the bottom of the melter. The mechanism for this damage is not presently known.

1371 (PNL-9434) Organic carbon in Hanford single-shell tank waste. Toth, J.J.; Willingham, C.E.; Heasler, P.G.; Whitney, P.D. Pacific Northwest Lab., Richland, WA (United States). Apr 1994. 95p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94012120. Source: OSTI; NTIS; INIS; GPO Dep.

Safety of Hanford single-shell tanks (SSTs) containing organic carbon is a concern because the carbon in the presence of oxidizers (NO_3 or NO_2) is combustible when sufficiently concentrated and exposed to elevated temperatures. A propagating chemical reaction could potentially occur at high temperature (above 200 C). The rapid increase in temperature and pressure within a tank might result in the release of radioactive waste constituents to the environment. The purpose of this study is to gather available laboratory information about the organic carbon waste inventories stored in the Hanford SSTs. Specifically, the major objectives of this investigation are: Review laboratory analytical data and measurements for SST composite core and supernatant samples for available organic data; Assess the correlation of organic carbon estimated utilizing the TRAC computer code compared to laboratory measurements; and From the laboratory analytical data, estimate the TOC content with confidence levels for each of the 149 SSTs.

1372 (PNL-9439) Impact of access port diameter on the long reach manipulator design. Stoughton, R.S. Pacific Northwest Lab., Richland, WA (United States). Apr 1994. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94010670. Source: OSTI; NTIS; GPO Dep.

Many of the single shell storage tanks (SSTs) on the Hanford site appear to have central 42-in. risers which could be used as access ports for the Long Reach Manipulator (LRM). However, about half of the tanks are known to not have a central 42-in. riser and it has recently been discovered that of the tanks whose drawings indicate central 42-in. risers, the majority have been plugged, sealed, or tapered down to a much smaller diameter at ground level. Thus, it can be assumed that a central access port for the LRM will have to be made. There are many issues involved in determining the best diameter for this access port such as radiation exposure, contamination prevention, and availability of remote excavation technology. This report analyzes the relationship between the access port diameter and the performance characteristics of the LRM. Previous work has assumed that the mast diameter would be 80% of the access port diameter. In this report, the maximum mast diameter will be varied rather than the access port diameter, leaving the issue of the required clearance between the mast and the access port open.

1373 (PNL-9459) Status and integration of the gas generation studies performed for the Hydrogen Safety Program: FY 1993, Annual report. Strachan, D.M. Pacific Northwest Lab., Richland, WA (United States). Apr 1994. 33p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94011405. Source: OSTI; NTIS; INIS; GPO Dep.

This document represents the second in a series of documents in which information is summarized and integrated on the chemical mechanisms for gas generation from simulated wastes that mimic the nuclear waste in Tank 241-SY. Over the past year the reliability of the instrumentation that has been installed on Tank 101-SY has been increased dramatically. Gases composed of H_2 , N_2O , N_2 , and NH_3 are

continuously released at low levels and also periodically released from the waste stored in this tank such that the lower flammability limit of 4% H_2 is sometimes exceeded. To better understand the reasons for this phenomenon and with the goal of mitigating the potential safety problem associated with the flammability, instrumentation has been installed on the tank and studies have been carried out to understand the mechanism by which these gases are generated. It is worthwhile to annually summarize this information in a single document, to integrate the information, and to highlight the remaining open questions surrounding the mechanism of gas generation. This is the goal of this document. Information on simulated wastes under thermal and radiation conditions has been collected from work performed at Argonne National Laboratory, Georgia Institute of Technology, and Pacific Northwest Laboratory; this report attempts to correlate the simulated data with that of actual tank waste. This document is lengthier than the former report because so much more information was available this year.

1374 (PNL-9747) Pretreatment of neutralized cladding removal waste sludge: Results of the second design basis experiment. Lumetta, G.J. Pacific Northwest Lab., Richland, WA (United States). May 1994. 36p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94012775. Source: OSTI; NTIS; GPO Dep.

For several years, the Pacific Northwest Laboratory (PNL) has been investigating methods to pretreat Hanford neutralized cladding removal waste (NCRW) sludge. In the past, Zircaloy-clad metallic U fuel was chemically de-cladded using the Zirflex process; NCRW sludge was formed when the de-cladding solution was neutralized for storage in carbon-steel tanks. This sludge, which is currently stored in Tanks 103-AW and 105-AW on the Hanford Site, primarily consists of insoluble Zr hydroxides and/or oxides and NaF. Significant quantities of Al, La, U, as well as other insoluble minor constituents are present in the sludge, along with sodium and potassium nitrates, nitrites, and hydroxides in the interstitial liquid. The sludge contains about 2,000 nCi of transuranic (TRU) material per gram of dry sludge, and mixed fission products. Therefore, the sludge must be handled as high-level waste (HLW). The NCRW sludge must be pretreated before treatment (e.g., vitrification) and disposal, so that the overall cost of disposal can be minimized. The NCRW pretreatment flowsheet was designed to achieve the following objectives: (a) to separate Am and Pu from the major sludge constituents (Na, Zr). (b) to separate Am and Pu from U. (c) to concentrate Am and Pu in a small volume for immobilization in borosilicate glass, based on Hanford Waste Vitrification Plant (HWVP). The flowsheet involves: (1) sludge washing, (2) sludge dissolution, (3) extraction of U with tributyl phosphate (TBP), and (4) extraction of TRUs with octyl(phenyl)-N,N-diisobutylcarbamoylmethyl-phosphine oxide (CMPO). As presented in the flowsheet, the NCRW sludge is first washed with 0.1 M NaOH to remove interstitial liquid and soluble salts from the sludge including sodium and potassium fluorides, carbonates, hydroxides, nitrates, and nitrites. The washed sludge is then subjected to two dissolution steps to achieve near complete dissolution of Zr.

1375 (PNL-SA-20048) Hanford single-shell tank waste-preliminary pretreatment testing of simulated waste. Jones, E.O. (Pacific Northwest Lab., Richland, WA (United States)); Colton, N.G.; Bloom, J.R. Pacific Northwest Lab., Richland, WA (United States). Oct 1991. 19p. Sponsored by USDOE, Washington, DC (United States).

DOE Contract AC06-76RL01830. (CONF-9110168-7: Department of Energy model conference, Oak Ridge, TN (United States), 14-17 Oct 1991). Order Number DE92002740. Source: OSTI; NTIS; INIS; GPO Dep.

Remediation and closure of the Single-Shell Tanks (SSTs) located on the Department of Energy's Hanford Site may depend on innovative waste removal, pretreatment and disposal technologies. This report describes preliminary studies conducted to support pretreatment processing of SST waste. This presentation looks specifically at the following types of activities: development, synthesis and characterization of a nonradioactive simulated SST waste; preliminary sequential dissolutions of simulated tank sludge; and thermochemical reduction of nitrate, a major component in SST waste. 7 refs., 4 figs., 6 tabs.

1376 (PNL-SA-20489) Stakeholder Involvement in redefining Hanford's Double-Shell Tank waste disposal program. Triplett, M.B. (Pacific Northwest Lab., Richland, WA (United States)); Grygiel, M.L. Pacific Northwest Lab., Richland, WA (United States). Mar 1992. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-920307-55: Waste management '92, Tucson, AZ (United States), 1-5 Mar 1992). Order Number DE92010491. Source: OSTI; NTIS; INIS; GPO Dep.

Hanford's Double-Shell Tank (DST) waste disposal program was redefined following serious challenges to the viability of the previous strategy due to increased regulatory requirements and operating expectations. Redefinition of the DST waste disposal program involved a far-reaching set of decisions and actions. A formal stakeholder involvement process was used to bring the concerns of outside groups into the definition and evaluation of alternative tank waste disposal strategies, broadening the participation and ownership of the revised program.

1377 (PNL-SA-20608) Process chemistry for the pretreatment of Hanford tank wastes. Lumetta, G.J. (Pacific Northwest Lab., Richland, WA (United States)); Swanson, J.L.; Barker, S.A. Pacific Northwest Lab., Richland, WA (United States). Aug 1992. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-920815-28: 204. American Chemical Society (ACS) national meeting, Washington, DC (United States), 23-28 Aug 1992). Order Number DE94004591. Source: OSTI; NTIS; INIS; GPO Dep.

Current guidelines for disposing radioactive wastes stored in underground tanks at the US Department of Energy's Hanford Site call for the vitrification of high-level waste in borosilicate glass and disposal of the glass canisters in a deep geologic repository. Low-level waste is to be cast in grout and disposed of on site in shallow burial vaults. Because of the high cost of vitrification and geologic disposal, methods are currently being developed to minimize the volume of high-level waste requiring disposal. Two approaches are being considered for pretreating radioactive tank sludges: (1) leaching of selected components from the sludge and (2) acid dissolution of the sludge followed by separation of key radionuclides. The leaching approach offers the advantage of simplicity, but the acid dissolution/radionuclide extraction approach has the potential to produce the least number of glass canisters. Four critical components (Cr, P, S, and Al) were leached from an actual Hanford tank waste-Plutonium Finishing Plant sludge. The Al, P, and S were removed from the sludge by digestion of the sludge with 0.1 M NaOH at 100°C. The Cr was leached by treating the sludge with alkaline $KMnO_4$ at 100°C.

Removing these four components from the sludge will dramatically lower the number of glass canisters required to dispose of this waste. The transuranic extraction (TRUEX) solvent extraction process has been demonstrated at a bench scale using an actual Hanford tank waste. The process, which involves extraction of the transuranic elements with octyl(phenyl)-N,N-diisobutylcarbamoylmethylphosphine oxide (CMPO), separated 99.9% of the transuranic elements from the bulk components of the waste. Several problems associated with the TRUEX processing of this waste have been addressed and solved.

1378 (PNL-SA-20710) Retrieval technology development for Hanford double-shell tanks. Bamberger, J.A.; Wise, B.M.; Miller, W.C. Pacific Northwest Lab., Richland, WA (United States). May 1992. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-920851-79: Spectrum '92: nuclear and hazardous waste management international topical meeting, Boise, ID (United States), 23-27 Aug 1992). Order Number DE93001310. Source: OSTI; NTIS; INIS; GPO Dep.

This paper describes the combined analytical, computational, and experimental program developed for identifying operating strategies for mobilization and retrieval of radioactive waste stored in double-shell tanks at Hanford. Sludge mobilization, slurry uniformity, and slurry retrieval investigations will produce guidelines for mixer pump and retrieval pump operation based on the physical properties of the waste and the geometric properties of the system (number of operating pumps and pump design and placement).

1379 (PNL-SA-20912) Development of simulated tank wastes for the US Department of Energy's Underground Storage Tank Integrated Demonstration. Elmore, M.R.; Colton, N.G.; Jones, E.O. Pacific Northwest Lab., Richland, WA (United States). Aug 1992. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-920851-73: Spectrum '92: nuclear and hazardous waste management international topical meeting, Boise, ID (United States), 23-27 Aug 1992). Order Number DE92041340. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of the Underground Storage Tank Integrated Demonstration (USTID) is to identify and evaluate technologies that may be used to characterize, retrieve, treat, and dispose of hazardous and radioactive wastes contained in tanks on US Department of Energy sites. Simulated wastes are an essential component of the evaluation process because they provide controlled samples for technology assessment, and minimize costs and risks involved when working with radioactive wastes. Pacific Northwest Laboratory has developed a recipe to simulate Hanford single-shell tank, (SST) waste. The recipe is derived from existing process recipes, and elemental concentrations are based on characterization data from 18 SSTs. In this procedure, salt cake and metal oxide/hydroxide sludge are prepared individually, and mixed together at varying ratios depending on the specific tank, waste to be simulated or the test being conducted. Elemental and physical properties of the stimulant are comparable with analyzed tank samples, and chemical speciation in the stimulant is being improved as speciation data for actual wastes become available. The nonradioactive chemical waste simulant described here is useful for testing technologies on a small scale.

1380 (PNL-SA-20941) Pretreatment process testing of Hanford tank waste for the US Department of

Energy's Underground Storage Tank Integrated Demonstration. Jones, E.O. (Pacific Northwest Lab., Richland, WA (United States)); Colton, N.G.; Bloom, G.R.; Barney, G.S.; Colby, S.A.; Cowan, R.G. Pacific Northwest Lab., Richland, WA (United States). Apr 1992. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-920851-75: Spectrum '92: nuclear and hazardous waste management international topical meeting, Boise, ID (United States), 23-27 Aug 1992). Order Number DE92041328. Source: OSTI; NTIS; INIS; GPO Dep.

Work conducted for the Underground Storage Tank Integrated Demonstration supports technology demonstration for tank remediation operations at the US Department of Energy's (DOE) Hanford Site and other DOE sites. Several technical areas within the demonstration are being investigated by the Waste Pretreatment Technology Development task to support final treatment and disposal of Hanford tank waste. The experimental work includes waste characterizations; dissolution, leaching and extraction tests; bulk salt separations by freeze crystallization; and radiochemical separations with extraction chromatography resins. Chemical species and particle size data provide background information for interpreting waste leaching and dissolution data. Tie major crystalline phases in one single-shell tank (SST) waste are sodium nitrate and bismuth phosphate, while the major phases in another SST waste are boehmite, gibbsite, and sodium nitrate. A scanning electron microscopy (SEM) method of particle size analysis shows that many of the sub-micron particles in the two SST wastes appear to be aggregates of smaller, spheroidal particles. In turn, leaching, dissolution, and extraction studies, performed with tank wastes, provide fundamental information needed to evaluate existing pretreatment technologies. Preliminary results from the dissolution of one SST waste indicate that 2M nitric acid may effectively leach enough transuranic material that the sludge could be disposed of as low level waste.

1381 (PNL-SA-21009) Radioactive waste vitrification technology. Burkholder, H.C.; Chapman, C.C.; Ross, W.A.; Thompson, L.E. Pacific Northwest Lab., Richland, WA (United States). Sep 1992. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9209108-2: 3. annual meeting of USSR Nuclear Society: future of nuclear technology, St. Petersburg (Russian Federation), 14-18 Sep 1992). Order Number DE93001516. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses the involvement of the Pacific Northwest Laboratory in the development of vitrification technology for the treating of radioactive, chemical and mixed wastes since the 1960's.

1382 (PNL-SA-21233) Resolution of safety issues associated with the storage of high-level radioactive waste at the Hanford Site. Mellinger, G.B. (Pacific Northwest Lab., Richland, WA (United States)); Tseng, J.C. Pacific Northwest Lab., Richland, WA (United States). Aug 1992. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-920808-10: American Institute of Chemical Engineers (AIChE) summer national meeting, Minneapolis, MN (United States), 9-12 Aug 1992). Order Number DE92041332. Source: OSTI; NTIS; INIS; GPO Dep.

A number of high-level radioactive waste (HLW) safety issues have been identified at the Hanford Site in southeastern Washington State. Resolution of these issues is one of the Highest Priorities of the US Department of Energy. The most urgent issues are the potential for explosions in certain

tanks (due to periodic venting of large quantities of flammable gases, or the presence of substantial quantities of ferrocyanide and/or organic compounds in combination with nitrates-nitrites). Other safety issues have been identified as well, such as the requirement for periodic water additions to one tank to control its temperature and the release of noxious vapors from a number of tanks. Substantial progress has been made toward safety issue resolution. Potential mechanisms have been identified for the generation, retention and periodic venting of flammable gas mixtures; potential methods for controlling the periodic release behavior have been identified and in-tank testing will be initiated in 1992. Research is being conducted to determine the initiation temperatures, energetics, reaction sequences and effects of catalysts and initiators on ferrocyanide-nitrate/nitrite reactions; waste characterization on a tank-by-tank basis will be required to identify whether ferrocyanide-containing wastes are safe to store as-is or will require further treatment to eliminate safety concerns. Resolution of all of the Hanford Site HLW safety issues will be accomplished as an integral part of the Hanford Tank Waste Remediation System, that has been established to manage the storage of these wastes and their preparation for disposal.

1383 (PNL-SA-21452) Hanford ferrocyanide reactivity: Effects of other tank constituents. Scheele, R.D.; Burger, L.L.; Tingey, J.M.; Johnston, J.W.; Sell, R.L. Pacific Northwest Lab., Richland, WA (United States). Apr 1993. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-930408-76: 10. international high-level radioactive waste management conference, Las Vegas, NV (United States), 25-29 Apr 1993). Order Number DE93015672. Source: OSTI; NTIS; INIS; GPO Dep.

This paper presents results of studies using synthetic chemicals to determine the effect of other potential waste constituents on the reactivity and explosivity of Hanford ferrocyanide wastes. These studies have shown that either individually or in combination some of the tested additives (sodium ethylenediaminetetraacetate and the hydroxide precipitates of iron (III), chromium (III), and nickel) can at a concentration of 0.03 mole/mole ferrocyanide reduce the time to explosion of a near-stoichiometric mixture of sodium nickel ferrocyanide and equimolar sodium nitrate and nitrite. These studies also found no reduction in observed minimum explosion temperature of 293°C.

1384 (PNL-SA-21463) Tank waste chemistry: A new understanding of waste aging. Babad, H. (Westinghouse Hanford Co., Richland, WA (United States)); Camaioni, D.M.; Lilga, M.A.; Samuels, W.D.; Strachan, D.M. Pacific Northwest Lab., Richland, WA (United States). Feb 1993. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-930205-31: Waste management '93, Tucson, AZ (United States), 28 Feb - 4 Mar 1993). Order Number DE93009475. Source: OSTI; NTIS; INIS; GPO Dep.

There is concern about the risk of uncontrolled exothermic reactions(s) in Hanford Site waste tanks containing $\text{NO}_3^-/\text{NO}_2^-$ based salts and/or metal hydroxide sludges in combination with organics or ferrocyanides. However, gradual oxidation of the waste in the tanks to less reactive species appears to have reduced the risk. In addition, wastes sampled to date contain sufficiently large quantities of water so that propagation reactions are highly unlikely. This report details an investigation into the risk of an uncontrolled

exothermic reaction in Hanford Site high-activity water tanks.

1385 (PNL-SA-21511) Study of physical properties, gas generation and gas retention in simulated Hanford waste. Bryan, S.A.; Pederson, L.R.; Scheele, R.D. Pacific Northwest Lab., Richland, WA (United States). Apr 1993. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-930408-71: 10. international high-level radioactive waste management conference, Las Vegas, NV (United States), 25-29 Apr 1993). Order Number DE93013164. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this study was to establish the chemical and physical processes responsible for the generation and retention of gases within high-level waste from Tank 101-SY on the Hanford Site. This research, conducted using simulated waste on a laboratory scale, supports the development of mitigation/remediation strategies for Tank 101-SY. Simulated waste formulations are based on actual waste compositions. Selected physical properties of the simulated waste are compared to properties of actual Tank 101-SY waste samples. Laboratory studies using aged simulated waste show that significant gas generation occurs thermally at current tank temperatures (~60°C). Gas compositions include the same gases produced in actual tank waste, primarily N_2 , N_2O , and H_2 . Gas stoichiometries have been shown to be greatly influenced by several organic and inorganic constituents within the simulated waste. Retention of gases in the simulated waste is in the form of bubble attachment to solid particles. This attachment phenomenon is related to the presence of organic constituents (HEDTA, EDTA, and citrate) of the simulated waste. A mechanism is discussed that relates the gas bubble/particle interactions to the partially hydrophobic surface produced on the solids by the organic constituents.

1386 (PNL-SA-21559) Waste glass melting stages. Anderson, L.D.; Dennis, T.; Elliott, M.L.; Hrma, P. Pacific Northwest Lab., Richland, WA (United States). Apr 1993. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-930438-15: 95. annual meeting of the American Ceramic Society, Cincinnati, OH (United States), 18-22 Apr 1993). Order Number DE93013166. Source: OSTI; NTIS; INIS; GPO Dep.

Three different simulated nuclear waste glass feeds, consisting of dried waste and glass frit, were heat treated for 1 hour in a gradient furnace at temperatures ranging from approximately 600°C–1000°C. Simulated melter feeds from the Hanford Waste Vitrification Plant (HWVP), the Defense Waste Processing Facility (DWPF), and Kernforschungszentrum Karlsruhe (KfK) in Germany were used. The samples were thin-sectioned and examined by optical microscopy to investigate the stages of the conversion from feed to glass. Various phenomena were seen, such as frit softening, bubble formation, foaming, bubble motion and removal, convective mixing, and homogenization. Behavior of different feeds was similar, although the degree of gas generation and melt homogenization varied.

1387 (PNL-SA-21560) Noble metal behavior during melting of simulated high-level nuclear waste glass feeds. Anderson, L.D.; Dennis, T.; Elliott, M.L.; Hrma, P. Pacific Northwest Lab., Richland, WA (United States). Apr 1993. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-930438-7: 95. annual meeting of the American Ceramic Society,

Cincinnati, OH (United States), 18-22 Apr 1993). Order Number DE93013168. Source: OSTI; NTIS; INIS; GPO Dep.

Noble metals and their oxides can settle in waste glass melters and cause electrical shorting. Simulated waste feeds from Hanford, Savannah River, and Germany were heat treated for 1 hour in a gradient furnace at temperatures ranging from approximately 600°C–1000°C and examined by electron microscopy to determine shapes, sizes, and distribution of noble metal particles as a function of temperature. Individual noble metal particles and agglomerates of rhodium (Rh), ruthenium (RuO₂), and palladium (Pd), as well as their alloys, were seen. The majority of particles and agglomerates were generally less than 10 microns; however, large agglomerations (up to 1 mm) were found in the German feed. Detailed particle distribution and characterization was performed for a Hanford waste to provide input to computer modeling of particle settling in the melter.

1388 (PNL-SA-21829) Separation of strontium-90 from Hanford high-level radioactive waste. Lumetta, G.J.; Wagner, M.J.; Jones, E.O. Pacific Northwest Lab., Richland, WA (United States). Oct 1993. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-931043-10: 8. symposium on separation science and technology for energy applications, Knoxville, TN (United States), 24-28 Oct 1993). Order Number DE94007487. Source: OSTI; NTIS; INIS; GPO Dep.

Current guidelines for disposing of high-level radioactive wastes stored in underground tanks at the US Department of Energy's Hanford Site call for vitrifying high-level waste (HLW) in borosilicate glass and disposing the glass canisters in a deep geologic repository. Disposition of the low-level waste (LLW) is yet to be determined, but it will likely be immobilized in a glass matrix and disposed of on site. To lower the radiological risk associated with the LLW form, methods are being developed to separate ⁹⁰Sr from the bulk waste material so this isotope can be routed to the HLW stream. A solvent extraction method is being investigated to separate ⁹⁰Sr from acid-dissolved Hanford tank wastes. Results of experiments with actual tank waste indicate that this method can be used to achieve separation of ⁹⁰Sr from the bulk waste components. Greater than 99% of the ⁹⁰Sr was removed from an acidic dissolved sludge solution by extraction with di-*t*-butylcyclohexano-18-crown-6 in 1-octanol (the SREX process). The major sludge components were not extracted.

1389 (PNL-SA-21856) Results of vitrifying Fernald OU-4 wastes. Merrill, R.A. (Pacific Northwest Lab., Richland, WA (United States)); Janke, D.S. Pacific Northwest Lab., Richland, WA (United States). Feb 1993. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-930205-50: Waste management '93, Tucson, AZ (United States), 28 Feb - 4 Mar 1993). Order Number DE93010167. Source: OSTI; NTIS; INIS; GPO Dep.

Three silos in Operable Unit 4 (OU-4) at the Feed Materials Production Center in Fernald, Ohio, contain residues from the processing of pitchblende ores. Silos 1 and 2, designated as K-65, contain the depleted ore with a BentoGrout cap over the material to reduce radon emanation, while Silo 3 contains calcined residue from processing solutions. The residues in the three silos contain radium, uranium, uranium daughters, and heavy metals (primarily lead). Vitrification tests were carried out on various mixtures of the above materials and the resulting glasses were analyzed. The vitrified

residues all tested "non-hazardous" by the Toxicity Characteristic Leachate Procedure (TCLP) and demonstrated a high degree of durability by the Product Consistency Test (PCT). The specific gravity and radon emanation of both the vitrified and non-vitrified residue were measured. Volume reductions ranging from 50 to 68 percent were obtained while the radon emanation rate was reduced by a factor of about 500,000. Radon emanation from the vitrified residue is of the same order of magnitude as emanation from natural building materials such as brick or concrete.

1390 (PNL-SA-22076) Processing constraints on high-level nuclear waste glasses for Hanford Waste Vitrification Plant. Hrma, P.R. Pacific Northwest Lab., Richland, WA (United States). Sep 1993. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-930906-17: '93 international conference on nuclear waste management and environmental remediation, Prague (Czech Republic), 5-11 Sep 1993). Order Number DE94004358. Source: OSTI; NTIS; INIS; GPO Dep.

The work presented in this paper is a part of a major technology program supported by the U.S. Department of Energy (DOE) in preparation for the planned operation of the Hanford Waste Vitrification Plant (HWVP). Because composition of Hanford waste varies greatly, processability is a major concern for successful vitrification. This paper briefly surveys general aspects of waste glass processability and then discusses their ramifications for specific examples of Hanford waste streams.

1391 (PNL-SA-22303) Crystallization in simulated glasses from Hanford high-level nuclear waste composition range. Kim, Dong-Sang; Hrma, P.; Smith, D.E.; Schweiger, M.J. Pacific Northwest Lab., Richland, WA (United States). Apr 1993. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-930438-18: 95. annual meeting of the American Ceramic Society, Cincinnati, OH (United States), 18-22 Apr 1993). Order Number DE93013504. Source: OSTI; NTIS; INIS; GPO Dep.

Glass crystallization was investigated as part of a property-composition relationship study of Hanford waste glasses. Non-radioactive glass samples were heated in a gradient furnace over a wide range of temperatures. The liquidus temperature was measured, and primary crystalline phases were determined using optical microscopy and Scanning Electron Microscopy with Energy Dispersive Spectrometry (SEM/EDS). Samples have also been heat treated according to a simulated canister centerline cooling curve. The crystalline phases in these samples have been identified by optical microscopy, SEM/EDS, and X-ray diffraction (XRD). Major components of the borosilicate glasses that were melted at approximately 1150°C were SiO₂, B₂O₃, Na₂O, Li₂O, CaO, MgO, Fe₂O₃, Al₂O₃, ZrO₂, and "Others" (sum of minor components). The major crystalline phases identified in this study were zircon, nepheline, calcium silicate, lithium silicate, and a range of solid solutions from clinopyroxenes, orthopyroxenes, olivines, and spiners.

1392 (PNL-SA-22322) Effect of composition and temperature on viscosity and electrical conductivity of borosilicate glasses for Hanford nuclear waste immobilization. Hrma, P.; Piepel, G.F.; Smith, D.E.; Redgate, P.E.; Schweiger, M.J. Pacific Northwest Lab., Richland, WA (United States). Apr 1993. 9p. Sponsored by USDOE,

Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-930438-16: 95. annual meeting of the American Ceramic Society, Cincinnati, OH (United States), 18-22 Apr 1993). Order Number DE93013505. Source: OSTI; NTIS; INIS; GPO Dep.

Viscosity and electrical conductivity of 79 simulated borosilicate glasses in the expected range of compositions to be produced in the Hanford Waste Vitrification Plant were measured within the temperature span from 950 to 1250°C. The nine major oxide components were SiO₂, B₂O₃, Li₂O, Na₂O, CaO, MgO, Fe₂O₃, Al₂O₃, and ZrO₂. The test compositions were generated statistically. The data were fitted by Fulcher and Arrhenius equations with temperature coefficients being multilinear functions of the mass fractions of the oxide components. Mixture models were also developed for the natural logarithm of viscosity and that of electrical conductivity at 1150°C. Least squares regression was used to obtain component coefficients for all the models.

1393 (PNL-SA-22596) Preliminary estimates of cost savings for defense high level waste vitrification options. Merrill, R.A.; Chapman, C.C.-Pacific Northwest Lab., Richland, WA (United States). Sep 1993. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-930906-13: '93 international conference on nuclear waste management and environmental remediation, Prague (Czech Republic), 5-11 Sep 1993). Order Number DE94001670. Source: OSTI; NTIS; INIS; GPO Dep.

The potential for realizing cost savings in the disposal of defense high-level waste through process and design modifications has been considered. Proposed modifications range from simple changes in the canister design to development of an advanced melter capable of processing glass with a higher waste loading. Preliminary calculations estimate the total disposal cost (not including capital or operating costs) for defense high-level waste to be about \$7.9 billion dollars for the reference conditions described in this paper, while projected savings resulting from the proposed process and design changes could reduce the disposal cost of defense high-level waste by up to \$5.2 billion.

1394 (PNL-SA-22721) Developing a scarfier to retrieve radioactive waste from Hanford single-shell tanks. Bamberger, J.A. (Pacific Northwest Lab., Richland, WA (United States)); Steele, D.E. Pacific Northwest Lab., Richland, WA (United States). Aug 1993. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9308109-2: 7. American water jet technology conference, Seattle, WA (United States), 28-31 Aug 1993). Order Number DE94004286. Source: OSTI; NTIS; INIS; GPO Dep.

Radioactive waste is stored in 149 3,785 m³ (million gal) single-shell tanks on the US Department of Energy's Hanford Reservation in eastern Washington. To minimize leakage as the tanks age, the free liquid has been pumped out, leaving concentrated solidified salt cake and sludge deposits. Now methods to dislodge and remove this waste are being developed so that the waste can be retrieved and processed for permanent storage. This paper presents research and development on ultrahigh-pressure water-jet technology to fracture and dislodge the wastes in these tanks. A water-based prototype scarfier with an integral conveyance system is being developed, and its performance demonstrated in a coupled analytical and experimental investigation. This paper describes experimental objectives

and approach and results of the single jet experiments. Previous testing indicates that the method can be readily applied to salt cake waste forms; retrieval and conveyance of sludge and viscous fluid waste forms may present additional challenges.

1395 (PNL-SA-23007) Pre-design safety analyses of cesium ion-exchange compact processing unit. Richmond, W.G.; Ballinger, M.Y. Pacific Northwest Lab., Richland, WA (United States). Nov 1993. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-931121-35: Annual winter meeting of the American Society of Mechanical Engineers, New Orleans, LA (United States), 28 Nov - 3 Dec 1993). Order Number DE94004786. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes an innovative radioactive waste pretreatment concept. This cost-effective, highly flexible processing approach is based on the use of Compact Processing Units (CPUs) to treat highly radioactive tank wastes in proximity to the tanks themselves. The units will be designed to treat tank wastes at rates from 8 to 20 liters per minute and have the capacity to remove cesium, and ultimately other radionuclides, from 4,000 cubic meters of waste per year. This new concept is being integrated into waste per year. This new concept is being integrated into Hanford's tank farm management plans by a team of PNL and Westinghouse Hanford Company scientists and engineers. The first CPU to be designed and deployed will be used to remove cesium from Hanford double-shell tank (DST) supernatant waste. Separating Cs from the waste would be a major step toward lowering the radioactivity in the bulk of the waste, allowing it to be disposed of as a low-level solid waste form (e.g., grout), while concentrating the more highly radioactive material for processing as high-level solid waste.

1396 (PNL-SA-23098) Nuclear Waste Analytical Round Robins 1-6 summary report. Smith, G.L.; Marschman, S.C. Pacific Northwest Lab., Richland, WA (United States). [1993]. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-931108-27: Fall meeting of the Materials Research Society (MRS), Boston, MA (United States), 29 Nov - 3 Dec 1993). Order Number DE94004776. Source: OSTI; NTIS; INIS; GPO Dep.

The MCC has conducted six round robins for the waste management, research, and development community from 1987 to present. The laboratories participating regularly are Ames, Argonne, Catholic University, Lawrence Livermore, Pacific Northwest Laboratory, Savannah River, and West Valley Nuclear. Glass types analyzed in these round robins all have been simulated nuclear waste compositions expected from vitrification of high-level nuclear waste. A wide range of analytical procedures have been used by the participating laboratories including Atomic Absorption spectroscopy, inductively coupled plasma-atomic emission spectroscopy, direct current plasma-emission spectroscopy, and inductively coupled plasma-mass spectroscopy techniques. Consensus average relative error for Round Robins 1 through 6 is 5.4%, with values ranging from 9.4 to 1.1%. Trend on the average improved with each round robin. When the laboratories analyzed samples over longer periods of time, the intralaboratory variability increased. Lab-to-lab variation accounts for most of the total variability found in all the round robins. Participation in the radiochemistry portion has been minimal, and analytical results poor

compared to nonradiochemistry portion. Additional radiochemical work is needed in future round robins.

1397 (PNL-SA-23181) Preliminary conceptual design for the destruction of organic/ferrocyanide constituents in the Hanford tank waste with low-temperature hydrothermal processing. Schmidt, A.J. (Pacific Northwest Lab., Richland, WA (United States)); Jones, E.O.; Orth, R.J.; Cox, J.L.; Elmore, M.E.; Neuen-schwander, G.G.; Hart, T.R.; Meng, C.D. Pacific Northwest Lab., Richland, WA (United States). May 1993. 77p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94008733. Source: OSTI; NTIS; INIS; GPO Dep.

Hydrothermal processing (HTP) is a thermal-chemical processing method that can be employed to destroy organic and ferrocyanide constituents in Hanford tank waste by using the abundant existing oxidants in the tank waste such as nitrite and nitrate. Use-temperature HTP effectively destroys organics at temperatures from 250°C to 400°C to eliminate safety hazards and improve further processing. This proposal describes a conceptual design of a low-temperature HTP system (including a preliminary flow diagram and plot plan, equipment descriptions and sizes, utility requirements, and costs); the experimental work supporting this effort at Pacific Northwest Laboratory (PNL); the reaction chemistry and kinetics; the technical maturity of the process; and a preliminary assessment of maintenance, operation, and safety of a system. Nitrate destruction using organic reductants is also described. The low-temperature hydrothermal program at PNL was initiated in January 1993. It is part of an overall program to develop organic destruction technologies, which was originally funded by Hanford's Tank Waste Remediation System program and then was transferred to the Initial Pretreatment (IPM) project. As described in the document, low-temperature HTP (1) meets or exceeds system requirements in organic, ferrocyanide, and nitrate destruction, and processing rate; (2) is technically mature with little additional technology development required; (3) is a simple process with good operational reliability; (4) is flexible and can be easily integrated in the system; (5) has reasonable costs and utility requirements; and (6) is safe and environmentally-benign.

1398 (PNL-SA-23271) Evacuated canister system for removal of molten radioactive glass. Ketner, G.L. (Pacific Northwest Lab., Richland, WA (United States)); Berger, D.N.; Liu, K.J. Pacific Northwest Lab., Richland, WA (United States). Nov 1993. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-931160-36: American Nuclear Society (ANS) winter meeting, San Francisco, CA (United States), 14-18 Nov 1993). Order Number DE94004771. Source: OSTI; NTIS; INIS; GPO Dep.

Pacific Northwest Laboratory (PNL) has prepared a preliminary design for the West Valley Demonstration Project evacuated canister system. The function of the evacuated canister is to permit the remote removal of radioactive molten glass from a hot cell melter cavity during a planned melter shutdown. The proposed evacuated canister system consists of an L-shaped 4-in. 304L stainless steel (SS) schedule 40 pipe, sealed at one end with an aluminum plug and attached at the other end to a canister. Previous developments of evacuated canister drain systems at Hanford, the Savannah River Site and West Valley have been considered. Previous techniques to model glass flow have been evaluated. An upright design, that stationed the canister

next to the melter, was originally proposed. Modifications to this design include supporting the canister horizontally above the melter using cranes, using an explosively bonded aluminum melt plug, and adding an internal structural reinforcement to the canister. While the canister is being filled, it is positioned and held above the melter at approximately 15° from horizontal by two turntable-mounted cranes. Because a limited amount of data exist on the performance of glass and stainless steel at high temperatures, testing is proposed to verify the canister's performance under high temperature conditions.

1399 (PNL-SA-23357) Radioactive waste vitrification offgas analysis proposal. Nelson, C.W.; Morrey, E.V. Pacific Northwest Lab., Richland, WA (United States). Nov 1993. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94004600. Source: OSTI; NTIS; INIS; GPO Dep.

Further validation of the Hanford Waste Vitrification Plant (HWVP) feed simulants will be performed by analyzing off-gases during crucible melting of actual waste glasses and simulants. The existing method of vitrifying radioactive laboratory-scale samples will be modified to allow offgas analysis during preparation of glass for product testing. The analysis equipment will include two gas chromatographs (GC) with thermal conductivity detectors (TCD) and one NO/NO_x analyzer. This equipment is part of the radioactive forming offgas system. The system will provide real-time analysis of H₂, O₂, N₂, NO, N₂O, NO₂, CO, CO₂, H₂O, and SO₂. As with the prior melting method, the product glass will be compatible with durability testing, i.e., Product Consistency Test (PCT) and Material Characterization Center (MCC-1), and crystallinity analysis. Procedures have been included to ensure glass homogeneity and quenching. The radioactive glass will be adaptable to Fe⁺²/ΣFe measurement procedures because the atmosphere above the melt can be controlled. The 325 A-hot cell facility is being established as the permanent location for radioactive offgas analysis during forming, and can be easily adapted to crucible melt tests. The total costs necessary to set up and perform offgas measurements on the first radioactive core sample is estimated at \$115K. Costs for repeating the test on each additional core sample are estimated to be \$60K. The schedule allows for performing the test on the next available core sample.

1400 (PNL-SA-23793) Waste Tank Safety Screening Module: An aspect of Hanford Site tank waste characterization. Hill, J.G. (Pacific Northwest Lab., Richland, WA (United States)); Wood, T.W.; Babad, H.; Redus, K.S. Pacific Northwest Lab., Richland, WA (United States). [1994]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-940225-107: Waste management '94, Tucson, AZ (United States), 27 Feb - 3 mar 1994). Order Number DE94012245. Source: OSTI; NTIS; INIS; GPO Dep.

Forty-five (45) of the 149 Hanford single-shell tanks have been designated as Watch-List tanks for one or more high-priority safety issues, which include significant concentrations of organic materials, ferrocyanide salts, potential generation of flammable gases, high heat generation, criticality, and noxious vapor generation. While limited waste characterization data have been acquired on these wastes under the original Tri-Party Agreement, to date all of the tank-by-tank assessments involved in these safety issue designations have been based on historical data rather than waste on data. In response to guidance from the Defense Nuclear Facilities Safety Board (DNFSB finding 93-05) and

related direction from the US Department of Energy (DOE), Westinghouse Hanford Company, assisted by Pacific Northwest Laboratory, designed a measurements-based screening program to screen all single-shell tanks for all of these issues. This program, designated the Tank Safety Screening Module (TSSM), consists of a regime of core, supernatant, and auger samples and associated analytical measurements intended to make first-order discriminations of the safety status on a tank-by-tank basis. The TSSM combines limited tank sampling and analysis with monitoring and tank history to provide an enhanced measurement-based categorization of the tanks relative to the safety issues. This program will be implemented beginning in fiscal year (FY) 1994 and supplemented by more detailed characterization studies designed to support safety issue resolution.

1401 (SAND-92-0556) Evaluation of alternatives for high-level and transuranic radioactive waste disposal standards. Klett, R.D. (Sandia National Labs., Albuquerque, NM (United States)); Gruebel, M.M. Sandia National Labs., Albuquerque, NM (United States). Dec 1992. 134p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93006986. Source: OSTI; NTIS; INIS; GPO Dep.

The remand of the US Environmental Protection Agency's long-term performance standards for radioactive-waste disposal provides an opportunity to suggest modifications that would make the regulation more defensible and remove inconsistencies yet retain the basic structure of the original rule. Proposed modifications are in three specific areas: release and dose limits, probabilistic containment requirements, and transuranic-waste disposal criteria. Examination of the modifications includes discussion of the alternatives, demonstration of methods of development and implementation, comparison of the characteristics, attributes, and deficiencies of possible options within each area, and analysis of the implications for performance assessments. An additional consideration is the impact on the entire regulation when developing or modifying the individual components of the radiological standards.

1402 (SAND-93-1403C) Remediating hazardous waste robotically using a high-level control system and real-time sensors. Davies, B.R. Sandia National Labs., Albuquerque, NM (United States). 1 Jul 1993. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9309199-1: Society of Photo-Optical Instrumentation Engineer's (SPIE) international symposium on optical tools for manufacturing and advanced automation, Boston, MA (United States), 7-10 Sep 1993). Order Number DE93017490. Source: OSTI; NTIS; GPO Dep.

Robotics technology is being developed to assist in remediating high-level radioactive wastes stored in large tanks at the Department of Energy's Hanford, Washington facility. Remediation activities will likely employ a remotely controlled long reach manipulator, capable of extending over 40 feet from its base, to deploy remediation end-effectors and sensors. Waste inside the tanks consists of hazardous vapor, liquid, sludge, solidified crystal, and various steel pipes and miscellaneous hardware. On November 10-12, 1992, a demonstration by Sandia National Laboratories of environmental sensor scanning and robot manipulated steel pipe cutting was performed on a tank mockup located at the Hanford facility. This paper describes the Sandia developed technology implemented at this demonstration.

1403 (SAND-94-0065) Decision and systems analysis for underground storage tank waste retrieval systems and tank waste remediation system. Berry, D.L. (Sandia National Labs., Albuquerque, NM (United States)); Jardine, L.J. Sandia National Labs., Albuquerque, NM (United States); Lawrence Livermore National Lab., CA (United States). Oct 1993. 60p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000 ; W-7405-ENG-48. Order Number DE94008313. Source: OSTI; NTIS; INIS; GPO Dep.

Hanford's underground storage tanks (USTs) pose one of the most challenging hazardous and radioactive waste problems for the Department of Energy (DOE). Numerous schemes have been proposed for removing the waste from the USTs, but the technology options for doing this are largely unproven. To help assess the options, an Independent Review Group (IRG) was established to conduct a broad review of retrieval systems and the tank waste remediation system. The IRG consisted of the authors of this report. The IRG's Preliminary Report assessed retrieval systems for underground storage tank wastes at Hanford in 1992. Westinghouse Hanford Company (WHC) concurred with the report's recommendation that a tool should be developed for evaluating retrieval concepts. The report recommended that this tool include (1) important considerations identified previously by the IRG, (2) a means of documenting important decisions concerning retrieval systems, and (3) a focus on evaluations and assessments for the Tank Waste Remediation System (TWRS) and the Underground Storage Tank-Integrated Demonstration (UST-ID).

1404 (SAND-94-0680C) Ion-exchange performance of crystalline silico-titanates for cesium removal from Hanford Tank Waste Simulants. Klavetter, E.A. (Sandia National Labs., Albuquerque, NM (United States)); Brown, N.E.; Trudell, D.; Anthony, R.G.; Gu, D.; Thibaud-Erkey, C. Sandia National Labs., Albuquerque, NM (United States). [1994]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-940225-90: Waste management '94, Tucson, AZ (United States), 27 Feb - 3 mar 1994). Order Number DE94009555. Source: OSTI; NTIS; GPO Dep.

A new class of inorganic ion exchangers, called crystalline silicotitanates (CSTs), has been prepared at Sandia National Laboratories and Texas A&M University. CSTs have been determined to have high selectivity for the adsorption of Cs and Sr, and several other radionuclides from highly alkaline, high-sodium supernate solutions such as those found at Westinghouse Hanford (WHC). An extensive program has been conducted to assess the applicability of CSTs for treating Hanford wastes. Continuous flow, ion-exchange columns are expected to be used to remove Cs and other radionuclides from the Hanford tank supernate. The proposed application for the CST would be Cs removal from highly alkaline salt solutions in a single pass process with interim storage of the Cs loaded CST until the glass vitrification plant is operational. This paper presents test results which address the important chemical, physical, and radiological properties which are expected to be relevant for Hanford radwaste processing. Results indicate that CSTs have a large distribution coefficient ($K_d > 2000$ mL/g in NCAW simulants) for adsorbing ppm concentrations of Cs. These wastes are highly alkaline ($>0.6M OH^-$) with high sodium ($>5M Na^+$) concentrations. CSTs exhibit very high K, values ($>20,000$ mL/g) for Cs in neutral solutions and K, values of $>2,000$ mL/g in solutions containing $2M HNO_3$. Presented are results from initial experimental efforts that describe the

potential performance of the CSTs in laboratory-scale ion-exchange columns. Included are results showing the stability of the CST material in basic solutions and in radiation doses up to 10^9 rads (Si). The status on the commercialization of the CST powder and engineered-form is discussed. Sufficient material for expanded testing and evaluation is expected to become available during 1994.

1405 (WHC-EP-0182-23) Tank farm surveillance and waste status summary report for February 1990. Hanlon, B.M. Westinghouse Hanford Co., Richland, WA (United States). Apr 1990. 42p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE90013647. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report is Westinghouse Hanford Company's official inventory for high-level radioactive waste stored in underground tanks at the Hanford Site. Data that depict the status of stored, high-level waste and tank vessel integrity are contained within the report. The intent of the report is to provide data on each of the existing 177 underground waste tanks and provide supplemental information regarding tank anomalies and ongoing investigations.

1406 (WHC-EP-0182-24) Tank farm surveillance and waste status summary report for March 1990. Hanlon, B.M. Westinghouse Hanford Co., Richland, WA (United States). Jun 1990. 44p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE90013863. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report is Westinghouse Hanford Company's official inventory for high-level radioactive waste stored in underground tanks at the Hanford Site. Data that depict the status of stored, high-level waste and tank vessel integrity are contained within the report. The intent of the report is to provide data on each of the existing 177 underground waste tanks and provide supplemental information regarding tank anomalies and ongoing investigations. 1 tab.

1407 (WHC-EP-0182-25) Tank farm surveillance and waste status summary report for April 1990. Hanlon, B.M. Westinghouse Hanford Co., Richland, WA (United States). Jun 1990. 48p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE90015477. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report is Westinghouse Hanford Company's official inventory for high-level radioactive waste stored in underground tanks at the Hanford Site. Data that depict the status of stored, high-level waste and tank vessel integrity are contained within the report. The intent of the report is to provide data on each of the existing 177 underground waste tanks and provide supplemental information regarding tank anomalies and ongoing investigation. 1 tab.

1408 (WHC-EP-0182-27) Tank farm surveillance and waste status summary report for June 1990. Hanlon, B.M. Westinghouse Hanford Co., Richland, WA (United States). Sep 1990. 51p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91000553. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

This report is Westinghouse Hanford Company's official inventory for radioactive waste stored in the 200 Areas underground tanks at the Hanford Site. Data that depict the status of stored radioactive waste and tank vessel integrity are contained within the report. The intent of the report is to

provide data on each of the existing 177 large underground waste storage tanks and 56 smaller catch tanks, and to provide supplemental information regarding tank surveillance anomalies and ongoing investigations. 1 fig., 1 tab.

1409 (WHC-EP-0182-28) Tank farm surveillance and waste status summary report for July 1990. Hanlon, B.M. Westinghouse Hanford Co., Richland, WA (United States). Nov 1990. 51p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91009161. Source: OSTI; NTIS; GPO Dep.

This report is Westinghouse Hanford Company's official inventory for radioactive waste stored in the 200 Areas underground tanks at the Hanford Site. Data that depict the status of stored radioactive waste and tank vessel integrity are contained within the report. The intent of the report is to provide data on each of the existing 177 large underground waste storage tanks and 56 smaller catch tanks, and to provide supplemental information regarding tank surveillance anomalies and ongoing investigations. 2 figs., 3 tabs.

1410 (WHC-EP-0182-29) Tank farm surveillance and waste status summary report for August 1990. Hanlon, B.M. Westinghouse Hanford Co., Richland, WA (United States). Jan 1991. 55p. Sponsored by USDOE, Washington, DC (USA). DOE Contract AC06-87RL10930. Order Number DE91009159. Source: OSTI; NTIS; GPO Dep.

This report is Westinghouse Hanford Company's official inventory for radioactive waste stored in underground tanks in the 200 Areas at the Hanford Site. Data that depict the status of stored radioactive waste tank vessel integrity are contained within the report. The intent of the report is to provide data on each of the existing 177 large underground waste storage tanks and 48 smaller catch tanks and to provide supplemental information regarding tank surveillance anomalies and ongoing investigations. 2 figs., 5 tabs.

1411 (WHC-EP-0182-30) Tank farm surveillance and waste status summary for September 1990. Hanlon, B.M. Westinghouse Hanford Co., Richland, WA (United States). Feb 1991. 62p. Sponsored by USDOE, Washington, DC (USA). DOE Contract AC06-87RL10930. Order Number DE91009347. Source: OSTI; NTIS; GPO Dep.

This is report Westinghouse Hanford Company's official inventory for radioactive waste stored in underground tanks in the 200 Areas at the Hanford Site. Data that depict the status of stored radioactive waste and tank vessel integrity are contained within the report. The intent of the report is to provide data on each of the existing 177 large underground waste storage tanks and 48 smaller catch tanks and to provide supplemental information regarding tank surveillance anomalies and ongoing investigations. 3 figs., 5 tabs.

1412 (WHC-EP-0182-31) Tank farm surveillance and waste status summary for October 1990. Hanlon, B.M. Westinghouse Hanford Co., Richland, WA (United States). Feb 1991. 59p. Sponsored by USDOE, Washington, DC (USA). DOE Contract AC06-87RL10930. Order Number DE91009348. Source: OSTI; NTIS; GPO Dep.

This report is Westinghouse Hanford Company's official inventory for radioactive waste stored in underground tanks in the 200 Areas at the Hanford Site. Data that depict the status of stored radioactive waste tank vessel integrity are contained within the report. The intent of the report is to provide data on each of the existing 177 large underground waste storage tanks and 48 smaller catch tanks and to provide supplemental information regarding tank surveillance anomalies and ongoing investigations. 3 figs., 5 tabs.

1413 (WHC-EP-0182-32) Tank farm surveillance and waste status summary report for November 1990. Hanlon, B.M. Westinghouse Hanford Co., Richland, WA (United States). Jan 1991. 61p. Sponsored by USDOE, Washington, DC (USA). DOE Contract AC06-87RL10930. Order Number DE91009349. Source: OSTI; NTIS; GPO Dep.

This report is Westinghouse Hanford Company's official inventory of radioactive waste stored in underground tanks in the 200 Areas at the Hanford Site. Data that depict the status of stored radioactive waste and tank vessel integrity are contained within the report. The intent of the report is to provide data on each of the existing 177 large underground waste storage tanks and 49 smaller catch tanks and to provide supplemental information regarding tank surveillance anomalies and ongoing investigations.

1414 (WHC-EP-0182-33) Tank farm surveillance and waste status report for December 1990. Hanlon, B.M. Westinghouse Hanford Co., Richland, WA (United States). Apr 1991. 69p. Sponsored by USDOE, Washington, DC (USA). DOE Contract AC06-87RL10930. Order Number DE91011065. Source: OSTI; NTIS; INIS; GPO Dep.

This report is Westinghouse Hanford Company's official inventory for radioactive waste stored in underground tanks in the 200 Areas at the Hanford Site. Data that depict the status of stored radioactive waste and tank vessel integrity are contained within the report. The intent of the report is to provide data on each of the existing 177 large underground waste storage tanks and 49 smaller catch tanks and to provide supplemental information regarding tank surveillance anomalies and ongoing investigations. 3 figs., 8 tabs.

1415 (WHC-EP-0182-34) Tank farm surveillance and waste status report for January 1991. Hanlon, B.M. Westinghouse Hanford Co., Richland, WA (United States). Feb 1991. 61p. Sponsored by USDOE, Washington, DC (USA). DOE Contract AC06-87RL10930. Order Number DE91011059. Source: OSTI; NTIS; INIS; GPO Dep.

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1416 (WHC-EP-0182-35) Tank farm surveillance and waste status report for February 1991. Hanlon, B.M. Westinghouse Hanford Co., Richland, WA (United States). May 1991. 74p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91018148. Source: OSTI; NTIS; GPO Dep.

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1417 (WHC-EP-0182-36) Tank farm surveillance and waste status report for March 1991. Hanlon, B.M. Westinghouse Hanford Co., Richland, WA (United States). Jun

1991. 97p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91018143. Source: OSTI; NTIS; INIS; GPO Dep.

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1418 (WHC-EP-0182-37) Tank farm surveillance and waste status report for April 1991. Hanlon, B.M. Westinghouse Hanford Co., Richland, WA (United States). Jul 1991. 88p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91018138. Source: OSTI; NTIS; INIS; GPO Dep.

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1419 (WHC-EP-0182-38) Tank farm surveillance and waste status report for May 1991. Hanlon, B.M. Westinghouse Hanford Co., Richland, WA (United States). Aug 1991. 98p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91018135. Source: OSTI; NTIS; GPO Dep.

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1420 (WHC-EP-0182-39) Tank farm surveillance and waste status report for June 1991. Hanlon, B.M. Westinghouse Hanford Co., Richland, WA (United States). Sep 1991. 97p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92002260. Source: OSTI; NTIS; INIS; GPO Dep.

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1421 (WHC-EP-0182-40) Tank farm surveillance and waste status report for July 1991. Hanlon, B.M. Westinghouse Hanford Co., Richland, WA (United States). Sep

1991. 98p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92002234. Source: OSTI; NTIS; INIS; GPO Dep.

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1422 (WHC-EP-0182-41) Tank farm surveillance and waste status report for August 1991. Hanlon, B.M. Westinghouse Hanford Co., Richland, WA (United States). Oct 1991. 97p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92008576. Source: OSTI; NTIS; INIS; GPO Dep.

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1423 (WHC-EP-0182-42) Tank farm surveillance and waste status report for September 1991. Hanlon, B.M. Westinghouse Hanford Co., Richland, WA (United States). Nov 1991. 94p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92014041. Source: OSTI; NTIS; GPO Dep.

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1424 (WHC-EP-0182-43) Tank farm surveillance and waste status summary report for October 1991. Hanlon, B.M. Westinghouse Hanford Co., Richland, WA (United States). Jan 1992. 113p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92014219. Source: OSTI; NTIS; GPO Dep.

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1425 (WHC-EP-0182-44) Tank farm surveillance and waste status summary report for November 1991. Hanlon, B.M. Westinghouse Hanford Co., Richland, WA (United States). Feb 1992. 109p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930.

Order Number DE92014210. Source: OSTI; NTIS; GPO Dep.

This report is the official inventory for radioactive waste stored in underground tanks in the 200 Areas at the Hanford Site. Data that depict the status of stored radioactive waste and tank vessel integrity are contained within the report. The intent of the report is to provide data on each of the existing 177 large underground waste storage tanks and 49 smaller catch tanks and special surveillance facilities, and to provide supplemental information regarding tank surveillance anomalies and ongoing investigations.

1426 (WHC-EP-0182-45) Tank farm surveillance and waste status summary report for December 1991. Hanlon, B.M. Westinghouse Hanford Co., Richland, WA (United States). Mar 1992. 111p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92014218. Source: OSTI; NTIS; GPO Dep.

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1427 (WHC-EP-0182-46) Tank farm surveillance and waste status summary report for January 1992. Hanlon, B.M. Westinghouse Hanford Co., Richland, WA (United States). Apr 1992. 105p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92015826. Source: OSTI; NTIS; GPO Dep.

This report is the official inventory for radioactive waste stored in underground tanks in the 200 Areas at the Hanford Site. Data that depict the status of stored radioactive waste and tank vessel integrity are contained within the report. The intent of the report is to provide data on each of the existing 177 large underground waste storage tanks and 49 smaller catch tanks and special surveillance facilities, and to provide supplemental information regarding tank surveillance anomalies and ongoing investigations.

1428 (WHC-EP-0182-47) Tank farm surveillance and waste status summary report for February 1992. Hanlon, B.M. Westinghouse Hanford Co., Richland, WA (United States). May 1992. 110p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92015828. Source: OSTI; NTIS; GPO Dep.

This report is the official inventory for radioactive waste stored in underground tanks in the 200 Areas at the Hanford Site. Data that depict the status of stored radioactive waste and tank vessel integrity are contained within the report. The intent of the report is to provide data on each of the existing 177 large underground waste storage tanks and 49 smaller catch tanks and special surveillance facilities, and to provide supplemental information regarding tank surveillance anomalies and ongoing investigations.

1429 (WHC-EP-0182-48) Tank farm surveillance and waste status summary report for March 1992. Hanlon, B.M. Westinghouse Hanford Co., Richland, WA (United States). Jun 1992. 108p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930.

Order Number DE93001754. Source: OSTI; NTIS; GPO Dep.

This report is the official inventory for radioactive waste stored in underground tanks in the 200 Areas at the Hanford Site. Data that depict the status of stored radioactive waste and tank vessel integrity are contained within the report. The intent of the report is to provide data on each of the existing 177 large underground waste storage tanks and 49 smaller catch tanks and special surveillance facilities, and to provide supplemental information regarding tank surveillance anomalies and ongoing investigations.

1430 (WHC-EP-0182-49) Tank farm surveillance and waste status summary report for April 1992. Hanlon, B.M. Westinghouse Hanford Co., Richland, WA (United States). Jul 1992. 109p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92040793. Source: OSTI; NTIS; GPO Dep.

This report is the official inventory for radioactive waste stored in underground tanks in the 200 Areas at the Hanford Site. Data that depict the status of stored radioactive waste and tank vessel integrity are contained within the report. The intent of the report is to provide data on each of the existing 177 large underground waste storage tanks and 49 smaller catch tanks and special surveillance facilities, and to provide supplemental information regarding tank surveillance anomalies and ongoing investigations.

1431 (WHC-EP-0182-50) Tank Farm surveillance and waste status summary report for May 1992. Hanlon, B.M. Westinghouse Hanford Co., Richland, WA (United States). Aug 1992. 111p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93001666. Source: OSTI; NTIS; GPO Dep.

This report is the official inventory for radioactive waste stored in underground tanks in the 200 Areas at the Hanford Site. Data that depict the status of stored radioactive waste and tank vessel integrity are contained within the report. This report provides data on each of the existing 177 large underground waste storage tanks and 49 smaller catch tanks and special surveillance facilities, and provides supplemental information regarding tank surveillance anomalies and ongoing investigations. This report is intended to meet the requirement of US Department of Energy-Richland Operations Office Order 5820.2A, Chapter I, Section 3.e.(3) (DOE-RL, 1990, Radioactive Waste Management, US Department of Energy-Richland Operations Office, Richland, Washington) requiring the reporting of waste inventories and space utilization for Hanford Tank Farm Tanks.

1432 (WHC-EP-0182-51) Tank Farm surveillance and waste status summary report for June 1992. Hanlon, B.M. Westinghouse Hanford Co., Richland, WA (United States). Sep 1992. 108p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93001755. Source: OSTI; NTIS; GPO Dep.

This report is the official inventory for radioactive waste stored in underground tanks in the 200 Areas at the Hanford Site. Data that depict the status of stored radioactive waste and tank vessel integrity are contained within the report. This report provides data on each of the existing 177 large underground waste storage tanks and 49 smaller catch tanks and special surveillance facilities, and provides supplemental information regarding tank surveillance anomalies and ongoing investigations. This report is intended to meet

the requirement of US Department of Energy-Richland Operations Office Order 5820.24, Chapter I, Section 3.e.(3) (DOE-RL, 1990, Radioactive Waste Management, O.S. Department of Energy-Richland Operations Office, Richland, Washington) requiring the reporting of waste inventories and space utilization for Hanford Tank Farm Tanks.

1433 (WHC-EP-0182-52) Tank farm surveillance and waste status summary report for July 1992. Hanlon, B.M. Westinghouse Hanford Co., Richland, WA (United States). Oct 1992. 105p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93004979. Source: OSTI; NTIS; INIS; GPO Dep.

This report is the official inventory for radioactive waste stored in underground tanks in the 200 Areas at the Hanford Site for July 1992. Data that depict the status of stored radioactive waste and tank vessel integrity are contained within the report. This report provides data on each of the existing 177 large underground waste storage tanks and 49 smaller catch tanks and special surveillance facilities, and provides supplemental information regarding tank surveillance anomalies and ongoing investigations. This report is intended to meet the requirement of US Department of Energy-Richland Operations Office Order 5820.2A, Chapter I, Section 3.e.(3) (DOE-RL, 1990, Radioactive Waste Management, US Department of Energy-Richland Operations Office, Richland, Washington) requiring the reporting of waste inventories and space utilization for Hanford Tank Farm Tanks.

1434 (WHC-EP-0182-53) Tank farm surveillance and waste status summary report for August 1992. Hanlon, B.M. Westinghouse Hanford Co., Richland, WA (United States). Nov 1992. 111p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93004982. Source: OSTI; NTIS; GPO Dep.

This report is the official inventory for radioactive waste stored in underground tanks in the 200 Areas at the Hanford Site for August 1992. Data that depict the status of stored radioactive waste and tank vessel integrity are contained within the report. This report provides data on each of the existing 177 large underground waste storage tanks and 49 smaller catch tanks and special surveillance facilities, and provides supplemental information regarding tank surveillance anomalies and ongoing investigations. This report is intended to meet the requirement of US Department of Energy-Richland Operations Office Order 5820.2A, Chapter 1, Section 3.e.(3) (DOE-RL, 1990, Radioactive Waste Management, US Department of Energy-Richland Operations Office, Richland, Washington) requiring the reporting of waste inventories and space utilization for Hanford Tank Farm Tanks.

1435 (WHC-EP-0182-54) Tank Farm surveillance and waste status summary report for September 1992. Hanlon, B.M. Westinghouse Hanford Co., Richland, WA (United States). Dec 1992. 137p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93008145. Source: OSTI; NTIS; INIS; GPO Dep.

This report is the official inventory for radioactive waste stored in underground tanks in the 200 Areas at the Hanford Site. Data that depict the Date status of stored radioactive waste and tank vessel integrity are contained within the report. This report provides data on each of the existing 177 large underground waste storage tanks and 49 smaller

catch tanks and special surveillance facilities, and supplemental information regarding tank surveillance anomalies and ongoing investigations. This report is intended to meet the requirement of US Department of Energy-Richland Operations Office Order 5820.2A, Chapter I, Section 3.e. (3) (DOE-RL, 1990, Radioactive Waste Management, US Department of Energy-Richland Operation Office, Richland, Washington) requiring the reporting of waste inventories and space utilization for Hanford Tank Farm Tanks.

1436 (WHC-EP-0182-55) Tank farm surveillance and waste status summary report for October 1992. Hanlon, B.M. Westinghouse Hanford Co., Richland, WA (United States). Jan 1993. 119p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93014633. Source: OSTI; NTIS; INIS; GPO Dep.

This report is the official inventory for radioactive waste stored in underground tanks in the 200 Areas at the Hanford Site. Data that depict the status of stored radioactive waste and tank vessel integrity are contained within the report. This report provides data on each of the existing 177 large underground waste storage tanks and 49 smaller catch tanks and special surveillance facilities, and supplemental information regarding tank surveillance anomalies and ongoing investigations. This report is intended to meet the requirement of US Department of Energy-Richland Operations Office Order 5820.2A, Chapter 1, Section 3.e. (3) (DOE-RL, 1990, Radioactive Waste Management, US Department of Energy-Richland Operation Office, Richland, Washington) requiring the reporting of waste inventories and space utilization for Hanford Tank Farm Tanks.

1437 (WHC-EP-0182-56) Tank farm surveillance and waste status summary report for November 1992. Hanlon, B.M. Westinghouse Hanford Co., Richland, WA (United States). Feb 1993. 120p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93014504. Source: OSTI; NTIS; INIS; GPO Dep.

This report is the official inventory for radioactive waste stored in underground tanks in the 200 Areas at the Hanford Site. Data that depict the status of stored radioactive waste and tank vessel integrity are contained within the report. This report provides data on each of the existing 177 large underground waste storage tanks and 49 smaller catch tanks and special surveillance facilities, and supplemental information regarding tank surveillance anomalies and ongoing investigations. This report is intended to meet the requirement of US Department of Energy-Richland Operations Office Order 5820.2A, Chapter 1, Section 3.e. (3) (DOE-RL, 1990, Radioactive Waste Management, US Department of Energy-Richland Operation Office, Richland, Washington) requiring the reporting of waste inventories and space utilization for Hanford Tank Farm Tanks.

1438 (WHC-EP-0182-57) Tank farm surveillance and waste status summary report for December 1992. Hanlon, B.M. Westinghouse Hanford Co., Richland, WA (United States). Feb 1993. 122p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93014506. Source: OSTI; NTIS; INIS; GPO Dep.

This report is the official inventory for radioactive waste stored in underground tanks in the 200 Areas at the Hanford Site. Data that depict the status of stored radioactive waste and tank vessel integrity are contained within the report.

This report provides data on each of the existing 177 large underground waste storage tanks and 49 smaller catch tanks and special surveillance facilities, and supplemental information regarding tank surveillance anomalies and ongoing investigations. This report is intended to meet the requirement of US Department of Energy-Richland Operations Office Order 5820.2A, Chapter I, Section 3.e. (3) (DOE-RL, 1990, Radioactive Waste Management, US Department of Energy-Richland Operation Office, Richland, Washington) requiring the reporting of waste inventories and space utilization for Hanford Tank Farm Tanks.

1439 (WHC-EP-0182-58) Tank farm surveillance and waste status summary report for January 1993. Hanlon, B.M. Westinghouse Hanford Co., Richland, WA (United States). Mar 1993. 115p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93014632. Source: OSTI; NTIS; INIS; GPO Dep.

This report is the official inventory for radioactive waste stored in underground tanks in the 200 Areas at the Hanford Site. Data that depict the status of stored radioactive waste and tank vessel integrity are contained within the report. This report provides data on each of the existing 177 large underground waste storage tanks and 49 smaller catch tanks and special surveillance facilities, and supplemental information regarding tank surveillance anomalies and ongoing investigations. This report is intended to meet the requirement of US Department of Energy-Richland Operations Office Order 5820.2A, Chapter I, Section 3.e. (3) (DOE-RL, 1990, Radioactive Waste Management, US Department of Energy-Richland Operation Office, Richland, Washington) requiring the reporting of waste inventories and space utilization for Hanford Tank Farm Tanks.

1440 (WHC-EP-0182-60) Tank Farm surveillance and waste status summary report for March 1993. Hanlon, B.M. Westinghouse Hanford Co., Richland, WA (United States). May 1993. 114p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93018060. Source: OSTI; NTIS; INIS; GPO Dep.

This report is the official inventory for radioactive waste stored in underground tanks in the 200 Areas at the Hanford Site. Data that depict the status of stored radioactive waste and tank vessel integrity are contained within the report. This report provides data on each of the existing 177 large underground waste storage tanks and 49 smaller catch tanks and special surveillance facilities, and supplemental information regarding tank surveillance anomalies and ongoing investigations. This report is intended to meet the requirement of US Department of Energy-Richland Operations Office Order 5820.2A, Chapter I, Section 3.e. (3) (DOE-RL, 1990, Radioactive Waste Management, US Department of Energy-Richland Operation Office, Richland, Washington) requiring the reporting of waste inventories and space utilization for Hanford Tank Farm Tanks.

1441 (WHC-EP-0182-61) Tank Farm surveillance and waste status summary report for April 1993. Hanlon, B.M. Westinghouse Hanford Co., Richland, WA (United States). Jul 1993. 112p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93018064. Source: OSTI; NTIS; INIS; GPO Dep.

This report is the official inventory for radioactive waste stored in underground tanks in the 200 Areas at the Hanford Site. Data that depict the status of stored radioactive waste

and tank vessel integrity are contained within the report. This report provides data on each of the existing 177 large underground waste storage tanks and 49 smaller catch tanks and special surveillance facilities, and supplemental information regarding tank surveillance anomalies and ongoing investigations.

1442 (WHC-EP-0182-62) Tank farm surveillance and waste status summary report for May 1993. Hanlon, B.M. Westinghouse Hanford Co., Richland, WA (United States). Aug 1993. 117p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94002397. Source: OSTI; NTIS; INIS; GPO Dep.

This report is the official inventory for radioactive waste stored in underground tanks in the 200 Areas at the Hanford Site. Data that depict the status of stored radioactive waste and tank vessel integrity are contained within the report. This report provides data on each of the existing 177 large underground waste storage tanks and 49 smaller catch tanks and special surveillance facilities, and supplemental information regarding tank surveillance anomalies and ongoing investigations.

1443 (WHC-EP-0182-63) Tank farm surveillance and waste status summary report for June 1993. Hanlon, B.M. Westinghouse Hanford Co., Richland, WA (United States). Oct 1993. 132p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94002426. Source: OSTI; NTIS; INIS; GPO Dep.

This report is the official inventory for radioactive waste stored in underground tanks in the 200 Areas at the Hanford Site. Data that depict the status of stored radioactive waste and tank vessel integrity are contained within the report. This report provides data on each of the existing 177 large underground waste storage tanks and 49 smaller catch tanks and special surveillance facilities, and supplemental information regarding tank surveillance anomalies and ongoing investigations. This report is intended to meet the requirement of US Department of Energy-Richland Operations Office Order 5820.2A, Chapter I, Section 3.e. (3) (DOE-RL, 1990, Radioactive Waste Management, US Department of Energy-Richland Operation Office, Richland, Washington) requiring the reporting of waste inventories and space utilization for Hanford Tank Farm Tanks.

1444 (WHC-EP-0182-64) Tank Farm surveillance and waste status summary report for July 1993. Hanlon, B.M. Westinghouse Hanford Co., Richland, WA (United States). Nov 1993. 141p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94004254. Source: OSTI; NTIS; INIS; GPO Dep.

This report is the official inventory for radioactive waste stored in underground tanks in the 200 Areas at the Hanford Site. Data that depict the status of stored radioactive waste and tank vessel integrity are contained within the report. This report provides data on each of the existing 177 large underground waste storage tanks and 49 smaller catch tanks and special surveillance facilities, and supplemental information regarding tank surveillance anomalies and ongoing investigations. This report is intended to meet the requirement of US Department of Energy-Richland Operations Office Order 5820.2A, Chapter I, Section 3.e. (3) (DOE-RL, 1990, Radioactive Waste Management, US Department of Energy-Richland Operation Office, Richland,

Washington) requiring the reporting of waste inventories and space utilization for Hanford Tank Farm Tanks.

1445 (WHC-EP-0182-66) Tank Farm surveillance and waste status summary report for September 1993. Hanlon, B.M. Westinghouse Hanford Co., Richland, WA (United States). Jan 1994. 146p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94005986. Source: OSTI; NTIS; INIS; GPO Dep.

This report is the official inventory for radioactive waste stored in underground tanks in the 200 Areas at the Hanford Site. Data that depict the status of stored radioactive waste and tank vessel integrity are contained within the report. This report provides data on each of the existing 177 large underground waste storage tanks and 49 smaller catch tanks and special surveillance facilities, and supplemental information regarding tank surveillance anomalies and ongoing investigations. This report is intended to meet the requirement of US Department of Energy-Richland Operations Office Order 5820.2A, Chapter 1, Section 3.e. (3) (DOE-RL, 1990, Radioactive Waste Management, US Department of Energy-Richland Operation Office, Richland, Washington) requiring the reporting of waste inventories and space utilization for Hanford Tank Farm Tanks.

1446 (WHC-EP-0182-68) Tank farm surveillance and waste status summary report for November 1993. Hanlon, B.M. Westinghouse Hanford Co., Richland, WA (United States). Feb 1994. 152p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94010345. Source: OSTI; NTIS; GPO Dep.

This report is the official inventory for radioactive waste stored in underground tanks in the 200 Areas at the Hanford Site. Data that depict the status of stored radioactive waste and tank vessel integrity are contained within the report. This report provides data on each of the existing 177 large underground waste storage tanks and 49 smaller catch tanks and special surveillance facilities, and supplemental information regarding tank surveillance anomalies and ongoing investigations. This report is intended to meet the requirement of US Department of Energy-Richland Operations Office Order 5820.2A, Chapter I, Section 3.e. (3) (DOE-RL, 1990, Radioactive Waste Management, US Department of Energy-Richland Operation Office, Richland, Washington) requiring the reporting of waste inventories and space utilization for Hanford Tank Farm Tanks.

1447 (WHC-EP-0182-69) Tank farm surveillance and waste status summary report for December 1993. Hanlon, B.M. Westinghouse Hanford Co., Richland, WA (United States). [1994]. 164p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94011395. Source: OSTI; NTIS; GPO Dep.

This report is the official inventory for radioactive waste stored in underground tanks in the 200 Areas at the Hanford Site. Data that depict the status of stored radioactive waste and tank vessel integrity are contained within the report. This report provides data on each of the existing 177 large underground waste storage tanks and 49 smaller catch tanks and special 9 surveillance facilities, and supplemental information regarding tank surveillance anomalies and ongoing investigations. This report is intended to meet the requirement of U.S. Department of Energy-Richland Operations Office Order 5820.2A, Chapter I, Section 3.e. (3)

(DOE-RL, 1990, Radioactive Waste Management, U.S. Department of Energy-Richland Operation Office, Richland, Washington) requiring the reporting of waste inventories and space utilization for Hanford Tank Farm Tanks.

1448 (WHC-EP-0210-Rev.3-App.D) **Waste Characterization Plan for the Hanford Site single-shell tanks: Appendix D, Quality Assurance Project Plan for characterization of single-shell tanks: Revision 3.** Hill, J.G. (Westinghouse Hanford Co., Richland, WA (United States)); Winters, W.I.; Simpson, B.C.; Buck, J.W.; Chamberlain, P.J.; Hunter, V.L. Westinghouse Hanford Co., Richland, WA (United States). Sep 1991. 104p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92008571. Source: OSTI; NTIS; GPO Dep.

This section of the single-shell tank (SST) Waste Characterization Plan describes the quality control (QC) and quality assurance (QA) procedures and information used to support data that is collected in the characterization of SST wastes. The section addresses many of the same topics discussed in laboratory QA project plans (QAPJP) (WHC 1989, PNL 1989) and is responsive to the requirements of QA program plans (QAPP) (WHC 1990) associated with the characterization of the waste in the SSTs. The level of QC for the project depends on how the data is used. Data quality objectives (DQOs) are being developed to support decisions made using this data. It must be recognized that the decisions and information related to this part of the SST program deal with the materials contained within the tank only and not what may be in the environment/area surrounding the tanks. The information derived from this activity will be used to determine what risks may be incurred by the environment but are not used to define what actual constituents are contained within the soil surrounding the tanks. The phases defined within the DQOs on this Waste Characterization Plan follow the general guidance of the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) yet are pertinent to analysis of the contents of the tanks and not the environment.

1449 (WHC-EP-0210-Rev.3-App.I) **Waste characterization plan for the Hanford Site single-shell tanks: Appendix I, Test plan for sampling and analysis of ten single-shell tanks.** Hill, J.G. (Westinghouse Hanford Co., Richland, WA (United States)); Winters, W.I.; Simpson, B.C.; Buck, J.W.; Chamberlain, P.J.; Hunter, V.L. Westinghouse Hanford Co., Richland, WA (United States). Sep 1991. 125p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92008630. Source: OSTI; NTIS; INIS; GPO Dep.

This appendix describes the sampling and analysis of the next ten single-shell tanks (SST) following the successful of SSTs B-201 and B-202. SST T-203 shall not be core sampled sequentially after B-201 and B-202, as originally planned, because this tank would not have provided information on tank safety issues and it contains an identical waste type as the previous two SSTs. Therefore, sampling and analysis of T-203 at the present time was considered repetitious and not an efficient utilization of the limited available resources. This test plan will outline methodology for characterization of the next ten SSTs, summarize lessons learned in the laboratory during Phase IA/IB, identify criteria for tank selection, and detail the analysis to be performed during the characterization of each tank. The sampling, analysis, and data collection, detailed by the this test plan, are being performed to support the final SST closure date of

2,018 identified in the Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement).

1450 (WHC-EP-0288) **Single-shell tank systems technical support program plan.** Klem, M.J. (Westinghouse Hanford Co., Richland, WA (USA)); Golberg, C.E.; Gibby, R.D.; Giese, K.A.; Ruck, F.A.; Sonnichsen, J.C.; Wanner, D.D.; Wing, N.R.; Woodworth, K.A.; Fletcher, J.F. Westinghouse Hanford Co., Richland, WA (United States). Jun 1990. 346p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE90015373. Source: NTIS, PC A15/MF A01 - OSTI; GPO Dep.

This Single-Shell Tank Systems Technical Support Program Plan (TSPP) provides documentation of the required technology, resources, equipment, program funding, and plans for closure of the six single-shell tank (SST) operable units (OU). The SST OUs comprise treatment, storage, and disposal units (wastes, tanks, and soil contaminated by leaks) and past practice units (ancillary units and soil contaminated by spills). A systems engineering approach is being used as a management tool to assist in reaching a final disposal decision for the SST OUs. The systems approach is a structured process to define and solve a problem. It is useful for large programs that involve multiple scientific and engineering disciplines and span long time periods. The systems approach ensures that development activities are conducted in an integrated, efficient, thorough, logical, defensible, auditable, and verifiable manner. It will allow the US Department of Energy to meet Hanford Federal Facility Agreement and Consent Order milestones and develop the technology required for the supplemental environmental impact statement for SST waste. 19 refs., 41 figs., 46 tabs.

1451 (WHC-EP-0333-Draft) **Single-shell tank systems analysis description: Draft.** Garfield, J.S. Westinghouse Hanford Co., Richland, WA (United States). Jun 1990. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE90014062. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This document provides an overview of the systems analysis work planned for closure of six operable units that make up the single-shell tank (SST) system. The facilities to be closed are defined in Appendix C of the Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement). The operable units include 149 SSTs and other ancillary units such as diversion boxes, catch tanks, spills, cribs, valve pits, vaults, and septic tanks. The significant Tri-Party Agreement milestones pertaining to SSTs are summarized in Appendix A. 12 refs., 5 figs.

1452 (WHC-EP-0338-Draft) **Functional requirements baseline for the closure of single-shell tanks: Draft.** Boomer, K.D.; Garfield, J.S.; Giese, K.A.; Higley, B.A.; Layman, J.S.; Boldt, A.L.; Croskey, N.R.; Golberg, C.E.; Johnson, L.J.; Parazin, R.J. Westinghouse Hanford Co., Richland, WA (United States). Jun 1990. 137p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE90014061. Source: NTIS, PC A07/MF A01 - OSTI; GPO Dep.

This document compiles a baseline of the functional requirements that will guide the conceptual design and development of single-shell tank (SST) system closure facilities. The functional requirements baseline is part of a larger

systems engineering approach. These requirements will provide a framework for closure alternative selection. The Westinghouse Hanford Company (Westinghouse Hanford) will update this baseline to incorporate new technology as it is identified, developed, and demonstrated and as the range of alternatives is narrowed. 39 refs., 21 figs., 12 tabs.

1453 (WHC-EP-0347) Summary of single-shell tank waste stability. Borsheim, G.L.; Kirch, N.W. Westinghouse Hanford Co., Richland, WA (United States). Mar 1991. 84p. Sponsored by USDOE, Washington, DC (USA). DOE Contract AC06-87RL10930. Order Number DE91011061. Source: OSTI; NTIS; INIS; GPO Dep.

Summary evaluations of the chemical stability of radioactive wastes stored in the Hanford Site single-shell tanks are provided. Potentially hazardous reactions are identified and related information and analyses are presented. Conclusions regarding the stability of wastes are stated and additional ongoing or planned work in support of waste stability investigations is noted. This report received the normal Westinghouse Hanford Company (Westinghouse Hanford) peer and functional review process. The report was also reviewed by the Westinghouse Hanford Senior Chemists Panel and the consultant Tank Waste Science Panel chaired by Pacific Northwest Laboratory. The report was revised to incorporate comments from these reviews. 96 refs., 4 figs., 4 tabs.

1454 (WHC-EP-0347-Suppl.) Summary of single-shell waste tank stability: Supplement. Wodrich, D.D. (Westinghouse Hanford Co., Richland, WA (United States)); Barney, G.S.; Borsheim, G.L.; Becker, D.L.; Carlos, W.C.; Klem, M.J.; Van der Cook, R.E.; Ryan, J.L. Westinghouse Hanford Co., Richland, WA (United States). May 1992. 130p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92015829. Source: OSTI; NTIS; INIS; GPO Dep.

The radioactive waste stored in Hanford's underground tanks was primarily generated in chemical processes where it was made alkaline before being sent to the waste tanks. A summary evaluation was made of a recent issue concerning the storage of radioactive waste with a pH of about 7 in some of these tanks. This document supplements the information presented in Summary of Single-Shell Tank Waste Stability, WHC-EP-0347, March 1991, which evaluates several issues. The evaluation was done by reviewing the issues and conclusions in the Summary Report and determining if the conclusions would be changed if some of the waste was as low as pH 6. This evaluation only considered the safety significance of a lower pH, it did not reevaluate the original work and conclusions reported in the March 1991 document. No changes with safety significance were found.

1455 (WHC-EP-0347-Suppl.2) Ferrocyanide tank waste stability: Supplement 2. Fowler, K.D. Westinghouse Hanford Co., Richland, WA (United States). Jan 1993. 36p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93008156. Source: OSTI; NTIS; INIS; GPO Dep.

Ferrocyanide wastes were generated at the Hanford Site during the mid to late 1950s as a result of efforts to create more tank space for the storage of high-level nuclear waste. The ferrocyanide process was developed to remove ¹³⁷CS from existing waste and newly generated waste that resulted from the recovery of valuable uranium in Hanford Site waste tanks. During the course of research associated with

the ferrocyanide process, it was recognized that ferrocyanide materials, when mixed with sodium nitrate and/or sodium nitrite, were capable of violent exothermic reaction. This chemical reactivity became an issue in the 1980s, when safety issues associated with the storage of ferrocyanide wastes in Hanford Site tanks became prominent. These safety issues heightened in the late 1980s and led to the current scrutiny of the safety issues associated with these wastes, as well as current research and waste management programs. Testing to provide information on the nature of possible tank reactions is ongoing. This document supplements the information presented in Summary of Single-Shell Tank Waste Stability, WHC-EP-0347, March 1991 (Borsheim and Kirch 1991), which evaluated several issues. This supplement only considers information particular to ferrocyanide wastes.

1456 (WHC-EP-0352) Single-shell tank waste retrieval study. Krieg, S.A.; Jenkins, W.W.; Leist, K.J.; Squires, K.G.; Thompson, J.F. Westinghouse Hanford Co., Richland, WA (United States). Jun 1990. 267p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE90015397. Source: NTIS, PC A12/MF A01 - OSTI; GPO Dep.

The single-shell tank waste retrieval study describes efforts in support of the Hanford Federal Facility Agreement and Consent Order milestone M-06-01: "Identify Waste Retrieval Technologies to be Tested in Scale-Model Tank, October 1990." Descriptions of the single-shell tanks and the wastes they contain are summarized in this study. The tanks contain hazardous chemical and nuclear wastes generated during plutonium production operations at the Hanford Site. Waste retrieval technologies related to pumping, sluicing, air transport, and mechanical mining are reviewed. Recommendations are presented for testing and developing equipment for pumping, sluicing, conveying, and mechanical mining of the waste in the single-shell tanks. Three types of positive displacement pumps, air jets, and water jets are recommended for testing. One air conveyance system and one mechanical conveyor system are also recommended for testing for transporting waste out of the single-shell tanks. Development of a mechanical arm and related mining and general use tools is recommended for breakup and removal of saltcake, riser pipes, and miscellaneous debris. The mechanical arm will also be used to position pumps or other equipment within the single-shell tank. 12 refs., 51 figs., 12 tabs.

1457 (WHC-EP-0365) Annual report of tank waste treatability. Karnesky, R.A. Westinghouse Hanford Co., Richland, WA (United States). Sep 1990. 151p. Sponsored by USDOE, Washington, DC (USA). DOE Contract AC06-87RL10930. Order Number DE91009162. Source: OSTI; NTIS; GPO Dep.

This report has been prepared as part of the Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement) and constitutes completion of Tri-Party Agreement Milestone M-04-00. This report provides a summary of treatment activities for newly generated waste, existing double-shell tank (DST) waste, and existing single-shell tank (SST) waste. Existing waste in DSTs will be treated in B Plant to separate DST waste into high-level waste (HLW), transuranic (TRU) waste, and low-level waste (LLW) fractions. The HLW and TRU waste fractions will be vitrified in the Hanford Waste Vitrification Plant (HWVP) for permanent disposal in a national geologic repository. The LLW fraction will be treated in the Grout Treatment Facility (GTF) to make

a solid waste form suitable for near-surface disposal in concrete vaults. The Tri-Party Agreement provides schedules for future HWVP and GTF activity. Existing waste in SSTs is being characterized to enable appropriate treatment options to be developed. This information is needed for a supplemental environmental impact statement (SEIS) leading to a decision on final SST waste disposal. Historical reviews of the process by which the grout waste form and the glass waste form were chosen are provided. A compilation of historical reports and abstracts is provided. 25 refs., 4 figs., 5 tabs.

1458 (WHC-EP-0365-1) Annual report of tank waste treatability. Giese, K.A. Westinghouse Hanford Co., Richland, WA (United States). Sep 1991. 100p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92002236. Source: OSTI; NTIS; INIS; GPO Dep.

This report has been prepared as part of the Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement) and constitutes completion of Tri-Party Agreement Milestone M-04-00 for fiscal year 1991. This report provides a summary of treatment activities for newly generated waste, existing double-shell tank waste, and existing single-shell tank waste, as well as a summary of grout disposal feasibility, glass disposal feasibility, alternate methods of disposal, and safety issues which may impact the treatment and disposal of existing defense nuclear wastes. This report is an update of the 1990 report and is intended to provide traceability for the documentation of the areas listed above by statusing the studies, activities, and issues which occurred in these areas over the period of March 1, 1990, through February 28, 1991. Therefore, ongoing studies, activities, and issues which were documented in the previous (1990) report are addressed in this subsequent (1991) report. 40 refs., 4 figs., 3 tabs.

1459 (WHC-EP-0365-2) Annual report of tank waste treatability. Barker, S.A. (Westinghouse Hanford Co., Richland, WA (United States)); Lane, A.G. Westinghouse Hanford Co., Richland, WA (United States). Sep 1992. 124p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93004985. Source: OSTI; NTIS; INIS; GPO Dep.

This report has been prepared as part of the Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement) and constitutes completion of Tri-Party Agreement milestone M-04-00C for fiscal year 1992. This report provides a summary of treatment activities for newly generated waste, existing double-shell tank waste, and existing single-shell tank waste, as well as a summary of grout disposal feasibility, glass disposal feasibility, alternate methods for disposal, and safety issues which may impact the treatment and disposal of existing defense nuclear wastes. This report is an update of the 1991 report and is intended to provide traceability for the documentation of the areas listed above by statusing the studies, activities, and issues which occurred in these areas over the period of March 1, 1991, through February 29, 1992.

1460 (WHC-EP-0365-3) Annual report of tank waste treatability. Lane, A.G. (Los Alamos Technical Associates, Inc., NM (United States)); Kirkbride, R.A. Westinghouse Hanford Co., Richland, WA (United States). Sep 1993. 178p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94002355. Source: OSTI; NTIS; INIS; GPO Dep.

This report has been prepared as part of the Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) and constitutes completion of Tri-Party Agreement milestone M-04-00D for fiscal year 1993. This report provides a summary of treatment activities for newly generated waste, existing double-shell tank waste, and existing single-shell tank waste, as well as a summary of grout disposal feasibility, glass disposal feasibility, alternate methods for disposal, and safety issues which may impact the treatment and disposal of existing defense nuclear wastes. This report is an update of the 1992 report and is intended to provide traceability for the documentation by statusing the studies, activities, and issues which occurred in these areas listed above over the period of March 1, 1992, through February 28, 1993. Therefore, ongoing studies, activities, and issues which were documented in the previous (1992) report are addressed in this (1993) report.

1461 (WHC-EP-0373) Summary status on the seismic evaluations of Hanford Site radioactive waste storage tanks. Becker, D.L.; Marusich, R.A.; Ryan, J.A.; Smith, D.A.; Tallman, A.M.; Wagenblast, G.R. Westinghouse Hanford Co., Richland, WA (United States). Sep 1990. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91006809. Source: OSTI; NTIS; GPO Dep.

Radioactive defense waste, resulting from the chemical processing of spent nuclear fuel, has been accumulating at the Hanford Site since 1944. This waste is stored in underground waste storage tanks. This paper provides a summary status of the seismic evaluations of the tanks and a summary of past safety assessments of the safety-related equipment that may be required to maintain safe operation subsequent to a postulated seismic event. 42 refs., 6 figs., 2 tabs.

1462 (WHC-EP-0377-Rev.1) Safety improvement plan: Hydrogen in waste tanks: Revision 1. Westinghouse Hanford Co., Richland, WA (United States). Sep 1990. 79p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91001287. Source: NTIS; PC A05/MF A01 - OSTI; GPO Dep.

There are 161 waste tanks located in tank farms in the 200 East and West Areas on the Hanford Site ranging in capacity from approximately 500,000 to 1,000,000 gal and another 16 tanks have a capacity of 55,000 gal. The hazards associated with radioactive waste storage demand continuous review. In March of 1990 the potential for a large quantity of hydrogen and nitrous oxide to exist as an explosive mixture within the waste was declared an unreviewed safety question. The Waste Tank Safety Task Team was established in late March to carry out safety evaluations and plan the means of mitigating the hydrogen hazard. Action was promptly taken to identify the tanks with the highest hazard and to implement interim operating requirements to minimize ignition sources. Work in and around the 23 tanks identified now requires special training, special tools, special supervision, and, for nonroutine activity, an exhaustive safety analysis and high-level authorization. The scope of this plan includes work to evaluate the hazard of the hydrogen and nitrous oxide mixture, identify the means to mitigate this hazard, and implement the mitigations. The scope also includes gathering and analyzing information about the wastes and waste tanks to ensure that the hazard is fully understood, that the means of mitigation will be productive,

and that the mitigation will be effectively implemented. 4 refs., 15 figs., 4 tabs.

1463 (WHC-EP-0379) Preliminary performance assessment strategy for single-shell tank waste disposal. Sonnichsen, J.C. Jr. Westinghouse Hanford Co., Richland, WA (United States). Oct 1991. 59p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92002912. Source: OSTI; NTIS; INIS; GPO Dep.

The disposal of the waste stored in single-shell tanks at the Hanford Site is recognized as a major environmental concern. A comprehensive program has been initiated to evaluate the various alternatives available for disposal of these wastes. These wastes will be disposed of in a manner consistent with applicable laws and regulations. Long-term waste isolation is one measure of performance that will be used for purposes of selection. The performance of each disposal alternative will be simulated using numerical models. Contained herein is a discussion of the strategy that has and continues to evolve to establish a general analytical framework to evaluate this performance. This general framework will be used to construct individual models of each waste disposal alternative selected for purposes of evaluation. 30 refs., 3 figs.

1464 (WHC-EP-0392) Tank Farm Upgrades Program Plan. Henderson, J.M. Westinghouse Hanford Co., Richland, WA (United States). Jun 1991. 244p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91018146. Source: OSTI; NTIS; INIS; GPO Dep.

The Tank Farm Upgrades Program Plan provides a summary description of work plans for the W1R End Function, Tank Farms Upgrade Program. This program was established to renovate the Tank Farm infrastructure with upgrades in equipment, systems, and facilities. The program also includes development of a configuration control database consisting of as-built drawings and a uniform equipment tag number and labeling system. The final segment of the upgrade program is a contamination zone reduction program to prevent the spread of surface contamination within the Tank Farms. These upgrades are based on current requirements from US Department of Energy (DOE) Orders, Washington State regulations, and the result of finding and observations from recent audits and surveillances of Tank Farm facilities and operations. Additional items were identified based on the results of a self-assessment of Tank Farm upgrades necessary to accomplish the Tank Farm mission. This plan will serve as the technical basis for the annual budget submittal for the new Tank Farms End Function W1R, Tank Farm Upgrades Plan. 94 refs., 20 figs., 7 tabs.

1465 (WHC-EP-0392-Rev.1) Tank Farms Restoration and Upgrades Program Plan: Revision 1. Bigbee, J.D. (Westinghouse Hanford Co., Richland, WA (United States)); Bouchey, G.D. Westinghouse Hanford Co., Richland, WA (United States). Jan 1993. 283p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93008164. Source: OSTI; NTIS; INIS; GPO Dep.

The Tank Farm Restoration and Upgrades Program Plan provides a summary description of action plans to renovate various Tank Farm management control programs, equipment, systems, and facilities. The Tank Farm upgrades

identified in this plan are required (1) to ensure safe, environmentally compliant, and efficient operation of the facilities or (2) to support the waste cleanup mission at the Hanford Site. The program plan identifies planned Tank Farm upgrades through the Year 2000. This document summarizes the need basis (i.e., the justification) for planned upgrades and major uncertainties in upgrade planning. Summary-level schedules and interdependencies between projects and upgrade tasks are presented.

1466 (WHC-EP-0399-Rev.2) Fiscal year 1992 program plan for evaluation of ferrocyanide in the Hanford Site waste tanks: Revision 2. Cash, R.J.; Dukelow, G.T. Westinghouse Hanford Co., Richland, WA (United States). Jul 1992. 113p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92040413. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this document is to provide a description of the fiscal year (FY) 1992 priorities, logic, work breakdown structure (WBS), and task descriptions for the Ferrocyanide Waste Tank Safety Program. The Ferrocyanide Safety Program was established in 1990 to provide resolution of a major safety issue identified for 24 high-level waste tanks at the Hanford Site. Radioactive wastes from defense operations have accumulated at the Hanford Site in underground waste tanks since the early 1940s. During the 1950s, additional tank disposal space was required to support the defense mission. Two procedures were used to obtain this additional volume within a short period of time while minimizing the construction of additional tanks. One procedure involved the use of evaporators to concentrate the waste by removing water. The second procedure involved a process for scavenging radiocesium from tank waste liquids and pumping the resulting liquids to disposal cribs. In implementing this process, approximately 140 metric tons of ferrocyanide were added to wastes that were later routed to 24 single-shell tanks.

1467 (WHC-EP-0403) Waste tank properties and contents program plan: Waste Tank Safety Program. DeFigh-Price, C. Westinghouse Hanford Co., Richland, WA (United States). Jun 1991. 104p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91016732. Source: OSTI; NTIS; INIS; GPO Dep.

The activities that will occur through 1997 related to Hanford Site waste tank safety include: develop criteria for safety evaluation and tank content evaluation; tank structural and seismic evaluation; tank content stability evaluation (excluding ferrocyanide, hydrogen and organics); and support for the tank safety evaluation database. The evaluation criteria will allow continued safe operation of double shell tanks and remediation of single shell tanks, and a formal review process will be developed for all 177 tanks to insure there are no unresolved safety issues, outline the process used to determine which tanks can be removed from the formal tank watch list. Results from the tank-by-tank reviews will support future Safety Analysis Reports. Two issues, determination of tank safe operating life and characterization of tank contents, will be addressed and closed as part of this program. 28 refs., 10 figs., 8 tabs. (MHB)

1468 (WHC-EP-0403A) Waste tank structural evaluation program: Waste Tank Safety Programs. DeFigh-Price, C.; Reep, I.E. Westinghouse Hanford Co., Richland, WA (United States). Oct 1991. 54p. Sponsored by USDOE, Washington, DC (United States). DOE Contract

AC06-87RL10930. Order Number DE92019877. Source: OSTI; NTIS; INIS; GPO Dep.

This program is part of the overall Waste Tank Safety Programs for the Hanford Site, Richland, Washington. It is managed by Westinghouse Hanford Company (Westinghouse Hanford) for the Tank Farm Project Office (TFPO) of the US Department of Energy Field Office, Richland (RL). Waste Tank Safety Programs (Gasper 1991) is responsible for identifying, addressing, and closing all major safety issues related to the 177 single- and double-shell tanks (SST and DST) on the Hanford Site. This program plan covers waste tank structural and seismic evaluations necessary to support determination of tank structural life expectancy for updating safety analysis reports. The key component of this program is to adequately review all 177 waste tanks from a structural standpoint to ensure that there are no unresolved safety issues related to tank structure, and, if safety issues are identified, what information must be obtained to resolve them. During the first year, the process and criteria will be developed by Westinghouse Hanford staff, reviewed by external organizations, and approved by the US Department of Energy (DOE). Parallel with the review of the criteria, data for the review will be compiled and the formal review of all tanks will begin (depending on funding availability). Reviews will be completed after the criteria are finalized. These reviews will not impact the process already underway for resolving specific issues (e.g., flammable gas generation and ferrocyanides). These specific studies will continue as part of the overall Waste Tank Safety Programs (Gasper 1991).

1469 (WHC-EP-0404-Rev.1) **Regulatory compliance analysis for the closure of single-shell tanks: Revision 1.** Smith, E.H. (Westinghouse Hanford Co., Richland, WA (United States)); Boomer, K.D.; Letourneau, M.; Oakes, L.; Lorang, R. Westinghouse Hanford Co., Richland, WA (United States). Aug 1991. 118p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92002046. Source: OSTI; NTIS; INIS; GPO Dep.

This document provides a regulatory compliance analysis of the baseline environmental protection requirements for the closure of single-shell tanks. In preparing this document, the Westinghouse Hanford Company has analyzed the regulatory pathways and decision points that have been identified to date through systems engineering and related studies as they relate to environmental protection. This regulatory compliance analysis has resulted in several conclusions that will aid the US Department of Energy in managing the single-shell tank waste and in developing strategies for the closure of these tanks. These conclusions include likely outcomes of current strategies, regulatory rulings that are required for future actions, variances and exemptions to be pursued, where appropriate, and potential rulings that may affect systems engineering and other portions of the single-shell tank closure effort. The conclusions and recommendations presented here are based on analysis of current regulations, regulatory exemptions and variances, and federal facility agreements. Because the remediation of the single-shell tanks will span 30 years, regulations that have yet to be promulgated and future interpretations of existing laws and regulations may impact the recommendations and conclusions presented here. 50 refs., 22 figs.

1470 (WHC-EP-0405-Draft.A-Vol.1) **Systems engineering study for the closure of single-shell tanks: Draft A, Volume 1.** Boomer, K.D.; Baker, S.K.; Boldt, A.L.; Britton, M.D.; Engelsman, L.E.; Galbraith, J.D.; Garfield, J.S.;

Giese, K.A.; Golberg, C.E.; Higley, B.A.; Hull, K.J.; Johnson, L.J.; Knight, R.P.; Layman, J.S.; Marusich, R.S.; Parazin, R.J.; Piepho, M.G.; Slaathaugh Westinghouse Hanford Co., Richland, WA (United States). Aug 1991. 101p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92002919. Source: OSTI; NTIS; GPO Dep.

This document, Volume 1 provides the technical basis and recommended alternatives to be included in the Supplemental Environmental Impact Statement for single-shell tank closure at the US Department of Energy's Hanford Site in Washington State. In preparing this document the Westinghouse Hanford Company has used systems engineering to provide a balanced approach for solving the complicated problem of single-shell tank closure. This systems engineering study has developed several conclusions that will aid the US Department of Energy in managing the single-shell tank waste. These conclusions include recommended alternatives for closure, characterization requirements, closure schedule, development requirements, facility requirements, and integration of double-shell tank and single-shell tank waste processing. The preferred alternative for single-shell tank closure will be determined in the Supplemental Environmental Impact Statement based on further evaluation of recommended alternatives. 4 refs., 13 figs., 24 tabs.

1471 (WHC-EP-0405-Draft.A-Vol.2) **Systems engineering study for the closure of single-shell tanks: Draft A, Volume 2.** Boomer, K.D.; Baker, S.K.; Boldt, A.L.; Britton, M.D.; Engelsman, L.E.; Galbraith, J.D.; Garfield, J.S.; Giese, K.A.; Golberg, C.E.; Higley, B.A.; Hull, K.J.; Johnson, L.J.; Knight, R.P.; Layman, J.S.; Marusich, R.S.; Parazin, R.J.; Piepho, M.G.; Slaathaugh Westinghouse Hanford Co., Richland, WA (United States). Aug 1991. 238p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92002920. Source: OSTI; NTIS; INIS; GPO Dep.

This document provides the technical basis and recommended alternatives to be included in the Supplemental Environmental Impact Statement for single-shell tank closure at the US Department of Energy's Hanford Site in Washington State. In preparing this document the Westinghouse Hanford Company has used systems engineering to provide a balanced approach for solving the complicated problem of single-shell tank closure. This systems engineering study has developed several conclusions that will aid the US Department of Energy in managing the single-shell tank waste. These conclusions include recommended alternatives for closure, characterization requirements, closure schedule, development requirements, facility requirements, and integration of double-shell tank and single-shell tank waste processing. The preferred alternative for single-shell tank closure will be determined in the Supplemental Environmental Impact Statement based on further evaluation of recommended alternatives.

1472 (WHC-EP-0405-Draft.A-Vol.3) **Systems engineering study for the closure of single-shell tanks: Draft A, Volume 3.** Boomer, K.D.; Baker, S.K.; Boldt, A.L.; Britton, M.D.; Engelsman, L.E.; Galbraith, J.D.; Garfield, J.S.; Giese, K.A.; Golberg, C.E.; Higley, B.A.; Hull, K.J.; Johnson, L.J.; Knight, R.P.; Layman, J.S.; Marusich, R.S.; Parazin, R.J.; Piepho, M.G.; Slaathaugh Westinghouse Hanford Co., Richland, WA (United States). Aug 1991. 369p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92003140. Source: OSTI; NTIS; INIS; GPO Dep.

Disposal alternatives of single shell tank wastes (SSTs), high-level and transuranic wastes, are being evaluated at the Hanford Reservation. This report, volume 3, draft a, contains appendices on the following: public involvement; incremental impact of double-shell tank waste to SST waste functions; SST radionuclide and chemical information; evaluation of alternatives and; waste retrieval and transfer. (CBS)

1473 (WHC-EP-0405-DraftA-Vol.4-Pt.1) **Systems engineering study for the closure of single-shell tanks: Draft A, Volume 4, Part 1.** Boomer, K.D.; Boldt, A.L.; Britton, M.D.; Engelsman, L.E.; Galbraith, J.D.; Garfield, J.S.; Giese, K.A.; Golberg, C.E.; Higley, B.A.; Hull, K.J.; Johnson, L.J.; Knight, R.P.; Layman, J.S.; Marusich, R.S.; Parazin, R.J.; Piepho, M.G.; Slaathaug, E.J.; WaldoWestinghouse Hanford Co., Richland, WA (United States). Aug 1991. 341p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92003552. Source: OSTI; NTIS; INIS; GPO Dep.

This document provides the technical basis and recommended alternatives to be included in the Supplemental Environmental Impact Statement for single-shell tank closure at the US Department of Energy's Hanford Site in Washington State. In preparing this document the Westinghouse Hanford Company has used systems engineering to provide a balanced approach for solving the complicated problem of single-shell tank closure. This systems engineering study has developed several conclusions that will aid the US Department of Energy in managing the single-shell tank waste. These conclusions include recommended alternatives for closure, characterization requirements, closure schedule, development requirements, facility requirements, and integration of double-shell tank and single-shell tank waste processing. The preferred alternative for single-shell tank closure will be determined in the Supplemental Environmental Impact Statement based on further evaluation of recommended alternatives. This report, appendix F to volume 4, part 1 of draft A, provides information on waste receipt, storage, and partitioning.

1474 (WHC-EP-0405-DraftA-Vol.4-Pt.2) **Systems engineering study for the closure of single-shell tanks: Draft A, Volume 4, Part 2.** Boomer, K.D.; Baker, S.K.; Boldt, A.L.; Britton, M.D.; Engelsman, L.E.; Galbraith, J.D.; Garfield, J.S.; Giese, K.A.; Golberg, C.E.; Higley, B.A.; Hull, K.J.; Johnson, L.J.; Knight, R.P.; Layman, J.S.; Marusich, R.S.; Parazin, R.J.; Piepho, M.G.; SlaathaugWestinghouse Hanford Co., Richland, WA (United States). Aug 1991. 345p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92002972. Source: OSTI; NTIS; INIS; GPO Dep.

This document provides the technical basis and recommended alternatives to be included in the Supplemental Environmental Impact Statement for single-shell tank closure at the US Department of Energy's Hanford Site in Washington State. In preparing this document the Westinghouse Hanford Company has used systems engineering to provide a balanced approach for solving the complicated problem of single-shell tank closure. This systems engineering study has developed several conclusions that will aid the US Department of Energy in managing the single-shell tank waste. These conclusions include recommended alternatives for closure, characterization requirements, closure schedule, development requirements, facility requirements, and integration of double-shell tank and single-shell tank waste processing. The preferred alternative for single-shell

tank closure will be determined in the Supplemental Environmental Impact Statement based on further evaluation of recommended alternatives. This report contains appendix F of volume 4, part 2, on waste receipt, storage, and partitioning. Process flowsheets on the Truex process are included.

1475 (WHC-EP-0405-DraftA-Vol.5) **Systems engineering study for the closure of single-shell tanks: Draft A, Volume 5.** Boomer, K.D.; Boldt, A.L.; Britton, M.D.; Engelsman, L.E.; Galbraith, J.D.; Garfield, J.S.; Giese, K.A.; Golberg, C.E.; Higley, B.A.; Hull, K.J.; Johnson, L.J.; Knight, R.P.; Layman, J.S.; Marusich, R.S.; Parazin, R.J.; Piepho, M.G.; Slaathaug, E.J.; WaldoWestinghouse Hanford Co., Richland, WA (United States). Aug 1991. 502p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92003071. Source: OSTI; NTIS; INIS; GPO Dep.

Several radioactive waste processing technologies, for the processing of Hanford single-shell tank wastes, are presented. Technologies presented include: ceramic grout processing; ceramic pellet facility; in-situ vitrification; a glass in sulfur facility; a containerized glass facility; mineral grout facility; salt polyethylene process; and the salt grout process. Interim storage facilities are also discussed. (CBS)

1476 (WHC-EP-0405-DraftA-Vol.6) **Systems engineering study for the closure of single-shell tanks: Draft A, Volume 6.** Boomer, K.D.; Baker, S.K.; Boldt, A.L.; Britton, M.D.; Engelsman, L.E.; Galbraith, J.D.; Garfield, J.S.; Giese, K.A.; Golberg, C.E.; Higley, B.A.; Hull, K.J.; Johnson, L.J.; Knight, R.P.; Layman, J.S.; Marusich, R.S.; Parazin, R.J.; Piepho, M.G.; SlaathaugWestinghouse Hanford Co., Richland, WA (United States). Aug 1991. 584p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92003141. Source: OSTI; NTIS; INIS; GPO Dep.

This systems engineering study has developed several conclusions that will aid the US Department of Energy in managing the single-shell tank waste. These conclusions include recommended alternatives for closure, characterization requirements, closure schedule, development requirements, facility requirements, and integration of double-shell tank and single-shell tank waste processing. The preferred alternative for single-shell tank closure will be determined in the Supplemental Environmental Impact Statement based on further evaluation of recommended alternatives. This report provides appendices on the following information: occupational safety, environmental releases, in-situ treatment of empty tanks, soil and past practice units, in place treatment and disposal, removal of empty tanks, leaks, and practice units, treatment and disposal of soil and debris wastes, cost estimates, and correspondence.

1477 (WHC-EP-0415-Rev.1) **Implementation plan for the Defense Nuclear Facilities Safety Board Recommendation 90-7: Revision 1.** Borsheim, G.L.; Cash, R.J.; Dukelow, G.T. Westinghouse Hanford Co., Richland, WA (United States). Dec 1992. 94p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94003873. Source: OSTI; NTIS; INIS; GPO Dep.

This document revises the original plan submitted in March 1991 for implementing the recommendations made by the Defense Nuclear Facilities Safety Board in their Recommendation 90-7 to the US Department of Energy. Recommendation 90-7 addresses safety issues of concern

for 24 single-shell, high-level radioactive waste tanks containing ferrocyanide compounds at the Hanford Site. The waste in these tanks is a potential safety concern because, under certain conditions involving elevated temperatures and low concentrations of nonparticipating diluents, ferrocyanide compounds in the presence of oxidizing materials can undergo a runaway (propagating) chemical reaction. This document describes those activities underway by the Hanford Site contractor responsible for waste tank safety that address each of the six parts of Defense Nuclear Facilities Safety Board Recommendation 90-7. This document also identifies the progress made on these activities since the beginning of the ferrocyanide safety program in September 1990. Revised schedules for planned activities are also included.

1478 (WHC-EP-0416) Program plan for evaluation and remediation of the generation and release of flammable gases in Hanford Site waste tanks. Johnson, G.D. (comp.). Westinghouse Hanford Co., Richland, WA (United States). Aug 1991. 254p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92003025. Source: OSTI; NTIS; INIS; GPO Dep.

This program plan describes the activities being conducted for the resolution of the flammable gas problem that is associated with 23 high-level waste tanks at the Hanford Site. The classification of the wastes in all of these tanks is not final and some wastes may not be high-level wastes. However, until the characterization and classification is complete, all the tanks are treated as if they contain high-level waste. Of the 23 tanks, Tank 241-SY-101 (referred to as Tank 101-SY) has exhibited significant episodic releases of flammable gases (hydrogen and nitrous oxide) for the past 10 years. The major near-term focus of this program is for the understanding and stabilization of this tank. An understanding of the mechanism for gas generation and the processes for the episodic release will be obtained through sampling of the tank contents, laboratory studies, and modeling of the tank behavior. Additional information will be obtained through new and upgraded instrumentation for the tank. A number of remediation, or stabilization, concepts will be evaluated for near-term (2 to 3 years) applications to Tank 101-SY. Detailed safety assessments are required for all activities that will occur in the tank (sampling, removal of equipment, and addition of new instruments). This program plan presents a discussion of each task, provides schedules for near-term activities, and gives a summary of the expected work for fiscal years 1991, 1992, and 1993. 16 refs., 7 figs., 8 tabs.

1479 (WHC-EP-0424-Rev.) Vapor space sampling criteria for single-shell tanks containing ferrocyanide waste: Revision. Klem, M.J. Westinghouse Hanford Co., Richland, WA (United States). Jul 1991. 64p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91018134. Source: OSTI; NTIS; INIS; GPO Dep.

This document defines the criteria for sampling the vapor space of the twenty-four single-shell tanks at the Hanford Site that contain ferrocyanide waste. The criteria include identification of the chemicals to be monitored for fire and health hazards, required action and detection levels of these chemicals, sampling positions inside the tanks, sampling order of the tanks, and most favorable sampling time period. Safety, quality assurance, and environmental compliance information is included. 19 refs., 5 tabs.

1480 (WHC-EP-0426) Waste tank safety programs overview plan: W1W end function. Gasper, K.A.; Reep, I.E. Westinghouse Hanford Co., Richland, WA (United States). Jul 1991. 169p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91016627. Source: OSTI; NTIS; INIS; GPO Dep.

This W1W End Function plan includes proposed corrective action strategies for remediation/mitigation of the 4 highest priority safety issues involving 5 double shell tanks and 48 single shell tanks: flammable gas generation, potentially explosive ferrocyanide mixtures, potential organic-nitrate reactions, and cooling of heat-generating tanks. Five lower priority safety issues are also addressed: increasing effort to characterize the contents of all tanks, increasing the level of safety documentation, determination of the safe operating lifetime for tanks, investigation of excessive hydroxide consumption in Tank 107-AN, and resolving the issue of intertank ventilation connections. The schedule for remediation/mitigation of these issues is six to eight years, assuming that alternatives for out-of-tank remediation are limited to pumping of liquids and dilution of waste. 23 refs., 23 figs., 15 tabs. (MHB)

1481 (WHC-EP-0426-Rev.2) Waste Tank Safety Programs overview plan: N2 End Function (formerly W1W). Gasper, K.A.; Reep, I.E. Westinghouse Hanford Co., Richland, WA (United States). Jan 1992. 219p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92008364. Source: OSTI; NTIS; INIS; GPO Dep.

Waste Tank Safety Programs was established in mid-1990 to address the hazards associated with storage of radioactive mixed waste in the large underground radioactive waste storage tanks at the Hanford Site. Waste Tank Safety Programs and the associated N2 End Function serves as a focal point for the Waste Tank Safety and Operations (N) Program for identification and resolution of all waste tank safety issues. An initial goal is to ensure safety of the tanks and their contents during the interim period before final disposal operations begin. The purpose of this plan is to present an overview of the Waste Tank Safety Programs activities for the planning period of fiscal year (FY) 1992 through FY 1997 and to present the FY 1992 workscope, milestones, and priorities for a baseline FY 1992 budget of \$29.2 million expense and \$3.2 million capital. This plan is based on more detailed planning contained in Activity Data Sheets of the US Department of Energy Environmental Restoration and Waste Management FY 1993 Five-Year Plan. The scope of this plan is to define the Waste Tank Safety Programs objectives, strategy, scope, interfaces, resource requirements, and schedules for remediating/mitigating waste tank safety issues for which the N2 End Function is responsible.

1482 (WHC-EP-0426-Rev.3) Waste Tank Safety Programs overview plan: N2 End Function: Revision 3. Gasper, K.A.; Reep, I.E. Westinghouse Hanford Co., Richland, WA (United States). May 1992. 199p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93008148. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this plan is to present an overview of the Waste Tank Safety Programs (WTSP) (N2 End Function) activities for the planning period of fiscal year (FY) 1992 through FY 1998 and to present the FY 1992 workscope, milestones, and priorities for a baseline FY 1992 budget of \$29.0 million expense and \$6.1 million capital. This plan is based on more detailed planning contained in Activity Data

Sheets 1110 of the US Department of Energy Draft Environmental Restoration and Waste Management FY 1994 Five-Year Plan.

1483 (WHC-EP-0428) Gamma scans in the annulus of Tank 241-SY-101. Leggett, W.D.; White, W.F.; Crowe, R.D.; Schmittroth, F.A.; Troyer, G.L. Westinghouse Hanford Co., Richland, WA (United States). Apr 1991. 81p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91016394. Source: OSTI; NTIS; GPO Dep.

Hanford Site Tank 241-SY-101 (referred to as Tank 101-SY), a double-shell tank (DST), has been releasing a flammable mixture of hydrogen and nitrous oxide at approximately 3-month intervals. Correcting this unacceptable condition requires an improved understanding of the tank's contents and behavior. However, direct measurements in the wastes have been delayed because of concerns over the possibility of causing an explosion. Consequently, indirect measurements of waste properties have been pursued. Vertical gamma scans were taken in the annulus (the space between the first and second liners) between October 1990 and March 1991. The scans were made at five positions around the tank at approximately 3-week intervals and generally covered the full 10.36-m (34 ft) depth of the waste. To better understand the scans, gamma spectroscopy measurements and gamma rays transport calculations (Monte Carlo) were done. 1 ref., 23 figs., 2 tabs.

1484 (WHC-EP-0431) Underground storage tank-integrated demonstration technical task plan master schedule. Cruse, J.M. (Westinghouse Hanford Co., Richland, WA (United States)); Heffner, P.M. Westinghouse Hanford Co., Richland, WA (United States). Jan 1992. 48p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92007723. Source: OSTI; NTIS; INIS; GPO Dep.

The Underground Storage Tank-Integrated Demonstration Technical Task Plan Master Schedule has been developed to present milestone summary schedules for all currently active projects within this program. Enhancements will continue with focus on adding information for the participant sites' underground storage tank remediation programs. The participant site information will include Federal Facility Consent Agreement, Environmental Restoration and Waste Management milestones. The ultimate goal is development of the Program Master Schedule, which will combine this information and show potential relationships between technologies developed by the demonstration and their use in remediation programs.

1485 (WHC-EP-0436) Action plan for response to abnormal conditions in Hanford Site radioactive waste tanks containing flammable gases. Thurman, J.M. Westinghouse Hanford Co., Richland, WA (United States). May 1991. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91016389. Source: OSTI; NTIS; INIS; GPO Dep.

This action plan defines (1) the criteria and specification limits required for ensuring that the tanks are maintained in a safe condition, (2) the organizations responsibilities, and (3) the response actions for prevention or mitigation of excessive temperature or pressure or a release from any hydrogen or flammable gas-generating tank. 15 refs., 1 tab.

1486 (WHC-EP-0436-Rev.1) Action plan for response to abnormal conditions in Hanford high level radioactive liquid waste storage tanks containing

flammable gases: Revision 1. Sherwood, D.J. Westinghouse Hanford Co., Richland, WA (United States). Mar 1994. 34p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94011394. Source: OSTI; NTIS; INIS; GPO Dep.

Radioactive liquid waste tends to produce hydrogen as a result of the interaction of gamma radiation and water. In tanks containing organic chelating agents, additional hydrogen gas as well as nitrous oxide and ammonia can be produced by thermal and radiolytic decomposition of these organics. Several high-level radioactive liquid waste storage tanks, located underground at the Hanford Site, contain waste that retains the gases produced in them until large quantities are released rapidly to the tank vapor space. Tanks filled to near capacity have relatively little vapor space; therefore, if the waste suddenly releases a large amount of hydrogen and nitrous oxide, a flammable gas mixture may result. The most notable waste tank with a flammable gas problem is tank 241-SY-101. Waste in this tank has occasionally released enough flammable gas to burn if an ignition source had been present inside of the tank. Several other waste tanks exhibit similar behavior to a lesser magnitude. Administrative controls have been developed to assure that these Flammable Gas Watch List tanks are safely maintained. Responses have also been developed for off-normal conditions which might develop in these tanks. In addition, scientific and engineering studies are underway to further understand and mitigate the behavior of the Flammable Gas Watch List tanks.

1487 (WHC-EP-0451) Candidate reagents and procedures for the dissolution of Hanford Site single-shell tank sludges. Schulz, W.W.; Kupfer, M.J. Westinghouse Hanford Co., Richland, WA (United States). Oct 1991. 34p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92002257. Source: OSTI; NTIS; INIS; GPO Dep.

At least some of the waste in the 149 single-shell tanks (SST) at the US Department of Energy (DOE) Hanford Site will be retrieved, treated, and disposed of. Although the importance of devising efficient and cost-effective sludge dissolution procedures has long been recognized, a concerted bench-scale effort to devise and test such procedures with actual solids representative of those in Hanford Site SSTs has not been performed. Reagents that might be used, either individually or serially, to dissolve sludges include HNO₃, HNO₃-oxalic acid, and HNO₃-HF. This report consolidates and updates perspectives and recommendations concerning reagents and procedures for dissolving Hanford Site SST and selected double-shell tank (DST) sludges. The principal objectives of this report are as follows: (1) Compile and review existing experimental data on dissolution of actual Hanford Site SST and DST sludges. (2) Further inform Hanford Site engineers and scientists concerning the utility of combinations of thermally unstable complexants (TUCS) reagents and various reducing agents for dissolving SST and DST sludges. (This latter technology has recently been explored at the Argonne National Laboratory.) (3) Provide guidance in laying out a comprehensive experimental program to develop technology for dissolving all types of Hanford Site SST and DST sludges. 6 refs., 1 fig., 4 tabs.

1488 (WHC-EP-0461) Action plan for responses to abnormal conditions in Hanford Site radioactive waste tanks with high organic content. Turner, D.A. Westinghouse Hanford Co., Richland, WA (United States). Feb 1993. 24p. Sponsored by USDOE, Washington, DC (United

States). DOE Contract AC06-87RL10930. Order Number DE93014487. Source: OSTI; NTIS; INIS; GPO Dep.

This action plan describes the criteria and the organizational responsibilities required for ensuring that waste tanks with high organic content are maintained in a safe condition at the Hanford Site. Additionally, response actions for prevention or mitigation of excessive temperature or a material release from any waste tank with high organic content have been outlined. Other response actions may be defined by Westinghouse Hanford Company Systems Engineering if a waste tank parameter goes out of specification. Trend analysis indicates the tank parameters have seasonal variation but are otherwise stable.

1489 (WHC-EP-0461-Rev.1) Action plan for responses to abnormal conditions in Hanford Site radioactive waste tanks with high organic content: Revision 1. Fowler, K.D. Westinghouse Hanford Co., Richland, WA (United States). Jul 1993. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93040315. Source: OSTI; NTIS; INIS; GPO Dep.

This action plan describes the criteria and the organizational responsibilities required for ensuring that waste storage tanks with high organic contents are maintained in a safe condition at the Hanford Site. In addition, response actions are outlined for (1) prevention or mitigation of excessive temperatures; or (2) a material release from any waste tank with high organic content. Other response actions may be defined by Westinghouse Hanford Company Systems Engineering if a waste tank parameter goes out of specification. Trend analysis indicates the waste tank parameters have seasonal variations, but are otherwise stable.

1490 (WHC-EP-0473) Action plan for response to excessive temperature in high heat source waste tank 241-C-106 at the Hanford Site. DeFigh-Price, C.; Wang, O.S. Westinghouse Hanford Co., Richland, WA (United States). Dec 1992. 35p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93008244. Source: OSTI; NTIS; INIS; GPO Dep.

This document defines the actions that will be taken if increasing temperatures, or other conditions that could lead to increased temperatures (such as a leaking tank), are observed in single-shell waste tank 241-C-106 at the Hanford Site. This tank contains a high-heat source (strontium) and requires forced cooling, including water additions. This action plan identifies (1) the criteria and specification limits required for ensuring that tank 241-C-106 is maintained in a safe condition; (2) the responsible organizations for tank 241-C-106; (3) the response actions to prevent or mitigate anomalies; and (4) the immediate and long-term actions that would be necessary if tank 241-C-106 were to leak. The action plan identifies immediate, preplanned actions that can be used in response to an excessive temperature scenario in waste tank 241-C-106.

1491 (WHC-EP-0475-Rev.0) Tank Waste Disposal Program redefinition. Grygiel, M.L. (Westinghouse Hanford Co., Richland, WA (United States)); Augustine, C.A.; Cahill, M.A.; Garfield, J.S.; Johnson, M.E.; Kupfer, M.J.; Meyer, G.A.; Roecker, J.H.; Holton, L.K.; Hunter, V.L.; Triplett, M.B. Westinghouse Hanford Co., Richland, WA (United States). Oct 1991. 617p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91004544. Source: OSTI; NTIS; INIS; GPO Dep.

The record of decision (ROD) (DOE 1988) on the Final Environmental Impact Statement, Hanford Defense High-Level, Transuranic and Tank Wastes, Hanford Site, Richland Washington identifies the method for disposal of double-shell tank waste and cesium and strontium capsules at the Hanford Site. The ROD also identifies the need for additional evaluations before a final decision is made on the disposal of single-shell tank waste. This document presents the results of systematic evaluation of the present technical circumstances, alternatives, and regulatory requirements in light of the values of the leaders and constituents of the program. It recommends a three-phased approach for disposing of tank wastes. This approach allows mature technologies to be applied to the treatment of well-understood waste forms in the near term, while providing time for the development and deployment of successively more advanced pretreatment technologies. The advanced technologies will accelerate disposal by reducing the volume of waste to be vitrified. This document also recommends integration of the double- and single-shell tank waste disposal programs, provides a target schedule for implementation of the selected approach, and describes the essential elements of a program to be baselined in 1992.

1492 (WHC-EP-0501) Waste Tank Safety, Operations, and Remediation Strategic Plan: Fiscal year 1992 through Fiscal year 2002. Ohl, P.C.; Optiz, B.E. Westinghouse Hanford Co., Richland, WA (United States). Sep 1991. 74p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92008572. Source: OSTI; NTIS; INIS; GPO Dep.

This document describes the Waste Tank Safety, Operations, and Remediation (WT) Organization strategy for safe operation of the Hanford Site Tank Farms. This document discusses the WT Organization mission and vision for the next 10 yr. This includes the challenges, the strategies to meet them, and a descriptive schedule for achieving these goals. An initial work breakdown structure (WBS) is described which will be the strategy implementation tool during fiscal year (FY) 1992 to accomplish the vision. The WT Organization is responsible for the operating and maintenance of the Hanford Site waste tanks and associated support facilities. The WT mission is: Manage the Hanford Site waste tanks in a safe, efficient, and environmentally responsible manner in compliance with codes, standards, and regulatory requirements. Through evaluation, mitigation/remediation, and verification ensure that the contents of Hanford's 177 large underground waste storage tanks are safely stored until they can be disposed. The WT Program was created to operate the Hanford Site Tank Farms and to resolve waste tank safety issues in a timely and cost effective manner. Once the safety issues are resolved and mitigation/remediation actions are implemented, the WT Organization will transition itself into a more traditionally operational-based division.

1493 (WHC-EP-0501-Rev.1-Draft) Strategy plan for management of Hanford tank wastes: Revision 1: Draft. Humphreys, L.L.; Morgan, S.R. Westinghouse Hanford Co., Richland, WA (United States). 31 Mar 1993. 55p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93011937. Source: OSTI; NTIS; INIS; GPO Dep.

The Secretary of Energy in 1992 directed Hanford to plan for the retrieval and processing of all stored high level waste at Hanford for disposal at an offsite repository. This substantial change in the tank disposal program's assignment has

resulted in a reevaluation of the entire Tank Waste Remediation System (TWRS) strategy. This strategic plan covers that portion of the TWRS strategy related to management of stored tank waste until it is retrieved, processed, and disposed by the disposal program and covers the responsibilities assigned to the "manage tank waste" function. The "manage tank waste" function is one of the level 2 functions as set forth in the Tank Waste Remediation System Mission Analysis Report (Baynes et al. 1993) and depicted in Figure 1. The following level 3 functions have been developed below the level 2, "manage tank waste" function: (1) Store waste; (2) Transfer waste; (3) Characterize, surveil and monitor waste; (4) Restore and upgrade systems; (5) Manage tank waste management system.

1494 (WHC-EP-0504-Vol.1) Soil structure interaction analysis for the Hanford Site 241-SY-101 double-shell waste storage tanks: Volume 1. Giller, R.A.; Weiner, E.O. Westinghouse Hanford Co., Richland, WA (United States). Sep 1991. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92003013. Source: OSTI; NTIS; INIS; GPO Dep.

The 241-SY-101 tank is a double-shell waste storage tank buried in the 241-SY tank farm in the 200 West Area of the Hanford Site. This analysis addresses the effects of seismic soil-structure interaction on the tank structure and includes a parametric soil-structure interaction study addressing three configurations: two-dimensional soil structure, a two-dimensional structure-soil-structure, and a three-dimensional soil-structure interaction. This study was designed to determine an optimal method for addressing seismic-soil effects on underground storage tanks. The computer programs calculate seismic-soil pressures on the double-shell tank walls and seismic acceleration response spectra in the tank. The results of this soil-structure interaction parametric study as produced by the computer programs are given in terms of seismic soil pressures and response spectra. The conclusions of this soil-structure interaction evaluation are that dynamically calculated soil pressures in the 241-SY-101 tank are significantly reduced from those using standard hand calculation methods and that seismic evaluation of underground double-shell waste storage tanks must consider soil-structure interaction effects in order to predict conservative structural response. Appendixes supporting this study are available in Volume 2 of this report.

1495 (WHC-EP-0504-Vol.2) Soil structure interaction analysis for the Hanford Site 241-SY-101 double-shell waste storage tanks: Volume 2. Giller, R.A.; Weiner, E.O. Westinghouse Hanford Co., Richland, WA (United States). Sep 1991. 145p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92003070. Source: OSTI; NTIS; GPO Dep.

The 241-SY-101 tank is a double-shell waste storage tank buried in the 241-SY tank farm in the 200 West Area of the Hanford Site. This analysis addresses the effects of seismic soil-structure interaction on the tank structure and includes a parametric soil-structure interaction study addressing three configurations: two-dimensional soil structure, a two-dimensional structure-soil-structure, and a three-dimensional soil-structure interaction. This study was designed to determine an optimal method for addressing seismic-soil effects on underground storage tanks. The computer programs calculate seismic-soil pressures on the double-steel tank walls and seismic acceleration response spectra in the tank. The results of this soil-structure interaction parametric study as produced by the computer programs are given in terms of

seismic soil pressures and response spectra. The conclusions of this soil-structure interaction evaluation are that dynamically calculated soil pressures in the 241-SY-101 tank are significantly reduced from those using standard hand calculation methods and that seismic evaluation of underground double-shell waste storage tanks must consider soil-structure interaction effects in order to predict conservative structural response. Appendixes supporting this study are available in Volume 2 of this report.

1496 (WHC-EP-0505) Inservice inspection of double-shell storage tanks at the Hanford Site. Blackburn, L.D.; Benny, H.L. Westinghouse Hanford Co., Richland, WA (United States). Mar 1992. 43p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92012205. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents a technical rationale for developing requirements for future inservice inspection of Hanford Site double-shell tanks containing radioactive waste. The focus is on identification of examinations and tests needed to confirm structural integrity of the tank for continued operations. A review of codes and standards for other areas, such as nuclear power plant components, boilers and pressure vessels, and concrete structures, led to the conclusion that such documents are not directly applicable to double-shell tanks. A comparison of potential modes of degradation of tank materials and information from laboratory or field simulation tests used for design and construction revealed no significant weaknesses in the intended protection against deterioration that might challenge structural integrity. Consideration of potential degradation modes and structural loadings on the tanks led to the identification of locations to be examined and examination or test methods to be employed. The establishment of an inspection frequency and of evaluation standards for examinations or tests are also discussed.

1497 (WHC-EP-0508-Vol.1) Parametric studies to support inspection criteria of the Hanford Site double-shell waste storage tanks: Volume 1. Shurrab, M.S. (Westinghouse Hanford Co., Richland, WA (United States)); Thomson, M.D.; Friley, J.R.; Granich, M.R.; Rinker, M.W.; Simonen, F.A. Westinghouse Hanford Co., Richland, WA (United States). Sep 1991. 62p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930 ; AC06-76RL01830. Order Number DE92003022. Source: OSTI; NTIS; INIS; GPO Dep.

Radioactive waste from the chemical processing of spent nuclear fuel has been stored in double-shell tanks at the Hanford Site since 1970. A program to assure that the tanks maintain their structural integrity requires an inspection plan. To support planning, this report provides results of calculations of stress, stress intensity factors, and concrete creep rates. Stresses and stress intensity factors are for a tank subjected to normal loads. Results identify locations of the highest stress and where cracks, if present, would be most detrimental to tank integrity. The report contains three evaluations of tank stresses, two evaluations of stress intensity factors, and an evaluation of the effects of concrete creep. Each evaluation is presented as an independent study in a separate section of this report. Calculational details appear in the appendixes. (see Volume 2).

1498 (WHC-EP-0516) Mitigation/remediation concepts for Hanford Site flammable gas generating waste tanks. Babad, H. (Westinghouse Hanford Co., Richland, WA (United States)); Deichman, J.L.; Johnson, B.M.; Lemon,

D.K.; Strachan, D.M. Westinghouse Hanford Co., Richland, WA (United States). Apr 1992. 150p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93001676. Source: OSTI; NTIS; GPO Dep.

This report presents a preliminary assessment of concepts for the mitigation and/or remediation of the hydrogen gas generation, storage, and periodic release in Tank 241-SY-101 (101-SY) and 22 other tanks. The 22 other tanks exhibit much less hydrogen generation (volume and concentration of released flammable gases) than Tank 101-SY and have not had the focus nor attention that has been given to Tank 101-SY. These tanks have been listed as potential hydrogen gas-generating tanks from analysis of tank performance and data from flowsheets and Track Radioactive Constituents Reports (TRAC). These lesser hydrogen-generating tanks will also need to be revisited and revalidated. Of the 23 hydrogen class tanks, 5 are double-shell tanks (DST) and 18 are single-shell tanks (SST). Options for mitigation or remediation are different for the two types of tanks because of age, configuration, and waste form. While this document principally focuses on Tank 101-SY, the information presented has been useful to address other tanks containing hydrogen-generating waste.

1499 (WHC-EP-0517) Evaluation of the generation and release of flammable gases in tank 241-SY-101. Babad, H. (Westinghouse Hanford Co., Richland, WA (United States)); Johnson, G.D.; Lechelt, J.A.; Reynolds, D.A.; Pederson, L.R.; Strachan, D.M.; Meisel, D.; Jonah, C.; Ashby, E.C. Westinghouse Hanford Co., Richland, WA (United States). Nov 1991. 41p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92008366. Source: OSTI; NTIS; GPO Dep.

Tank 241-SY-101 is a double shell, high-level waste tank located in the 200 West Area of the Hanford Site. This tank contains about 1 million gallons of waste that was concentrated at the 242-S Evaporator. Shortly after the waste was put in the tank, the waste began to expand because the generation of gases. In 1990 this tank was declared to have an unreviewed safety question because of the periodic release of hydrogen and nitrous oxide. A safety program was established to conduct a characterization of the waste and vented gases and to determine an effective means to prevent the accumulation of flammable gases in the tank dome space and ventilation system. Results of the expanded characterization conducted in fiscal year 1991 are presented. The use of gas chromatographs, mass spectrometers, and hydrogen-specific monitors provided a greater understanding of the vented gases. Additional instrumentation placed in the tank also helped to provide more detailed information on tank temperatures, gas pressure, and gas flow rates. An extensive laboratory study involving the Westinghouse Hanford Company, Pacific Northwest Laboratory, Argonne National Laboratory, and the Georgia Institute of Technology was initiated for the purpose of determining the mechanisms responsible for the generation of various gases. These studies evaluate both radiolytic and thermochemical processes. Results of the first series of experiments are described.

1500 (WHC-EP-0521) Single-shell tank 104-BY thermal-hydraulic analysis. McLaren, J.M. Westinghouse Hanford Co., Richland, WA (United States). Oct 1991. 52p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92006522. Source: OSTI; NTIS; INIS; GPO Dep.

A computer analysis of a single-shell waste storage tank containing ferrocyanide (tank 104-BY) was conducted to determine if the heat load and thermal characteristics of the waste could be determined by thermal analysis. In addition, the consequences of local regions of high heat generation, or "hot spots," with local regions of low thermal conductivity and voids, were evaluated. Two-dimensional models were created and run utilizing the HEATING5 and HEATING7 codes to determine the heat load and thermal conductivities of the waste in the tank. It was determined from the analysis that the heat load could be bounded by the use of computer modeling but could not be closely determined without ventilation data. The thermal characteristics of the waste are not very sensitive with respect to the heat load and can therefore be closely determined. Three-dimensional models were created and run utilizing the same computer codes to analyze the effect of voids and of heat source concentrations under various conditions. The analyses of the waste storage tank 104-BY with uneven heat source distribution under present and dried out conditions, showed that heat sources resulting in temperatures high enough to cause undesired chemical reactions would require unreasonable concentrations of the heat source. Voids do not constitute a condition of concern.

1501 (WHC-EP-0524) Waste Tank Safety and Operations Program management plan. Mares, E.F. Westinghouse Hanford Co., Richland, WA (United States). Jan 1992. 553p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92040479. Source: OSTI; NTIS; INIS; GPO Dep.

This document establishes the Waste Tank Safety and Operations Program; the basis for the program; the procedures for managing the work and the policies to be followed when changing the scope of work. It presents the fiscal year 1992 scope of work, schedule, and cost baselines in the form of a Revised Fiscal Year 1992 Work Plan which is a requirement of the Site Management System. Likewise, it establishes the program objectives, quality assurance requirements, defines internal and external program interfaces; establishes the program management procedures; defines the change control policy; and presents the milestones to be accomplished.

1502 (WHC-EP-0531-Rev.1) Current understanding of the safety of storing high-level waste containing ferrocyanide at the Hanford Site: Revision 1. Postma, A.K. (Benton City Technology, WA (United States)); Babad, H.; Cash, R.J.; Deichman, J.L. Westinghouse Hanford Co., Richland, WA (United States). Jun 1992. 83p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93001753. Source: OSTI; NTIS; GPO Dep.

This report provides an overview of the safety of continued in situ storage of ferrocyanide-containing wastes in underground tanks at the Hanford Site. Available information has been reviewed and analyzed with regard to tank storage safety for this report. Based on data to-date, a preliminary conclusion is that most (if not all) of the tanks contain waste that is nonreactive in its present form. Studies indicate that significant tank dryout can be prevented, thus keeping waste forms nonreactive. However, additional information is needed to confirm these initial conclusions and to develop surveillance and control systems. Of particular importance is the need to (1) sample tanks to characterize the waste; (2) to conduct laboratory studies on real waste; and (3) to continue to test simulants to better define physical and chemical properties of stored waste.

1503 (WHC-EP-0532) High heat tank safety issue resolution program plan. DeFigh-Price, C.; Wang, O.S. Westinghouse Hanford Co., Richland, WA (United States). Feb 1993. 50p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93014489. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this program plan is to provide a guide for selecting corrective actions that will mitigate and/or resolve the single-shell tank 241-C-106 high-heat tank safety issue. This program plan also outlines the steps necessary to implement corrective actions. The postulated hazard for the high-heat tank safety issue involves the release of nuclear waste to the environment as the result of heat-induced structural damage to the tank's concrete, should forced cooling be interrupted for extended periods. The heat generation originates from the radioactive decay of waste material (primarily ^{90}Sr) that was inadvertently transferred into the tank in the late 1960s. Cooling to prevent waste temperatures in excess of the 300°F operating limit is currently accomplished by evaporative cooling through active filtered altered ventilation. This is supported by periodic water additions to maintain a liquid cover over the sludge, and for enhanced thermal conductivity for heat transfer.

1504 (WHC-EP-0532-Rev.1) High-heat tank safety issue resolution program plan: Revision 1. Wang, O.S. Westinghouse Hanford Co., Richland, WA (United States). Dec 1993. 54p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94005980. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this program plan is to provide a guide for selecting corrective actions that will mitigate and/or remediate the high-heat waste tank safety issue for single-shell tank (SST) 241-C-106. This program plan also outlines the logic for selecting approaches and tasks to mitigate and resolve the high-heat safety issue. The identified safety issue for high-heat tank 241-C-106 involves the potential release of nuclear waste to the environment as the result of heat-induced structural damage to the tank's concrete, if forced cooling is interrupted for extended periods. Currently, forced ventilation with added water to promote thermal conductivity and evaporation cooling is used to cool the waste. At this time, the only viable solution identified to resolve this safety issue is the removal of heat generating waste in the tank. This solution is being aggressively pursued as the permanent solution to this safety issue and also to support the present waste retrieval plan. Tank 241-C-106 has been selected as the first SST for retrieval. The program plan has three parts. The first part establishes program objectives and defines safety issues, drivers, and resolution criteria and strategy. The second part evaluates the high-heat safety issue and its mitigation and remediation methods and alternatives according to resolution logic. The third part identifies major tasks and alternatives for mitigation and resolution of the safety issue. Selected tasks and best-estimate schedules are also summarized in the program plan.

1505 (WHC-EP-0539) Regulatory analysis of the Underground Storage Tank-Integrated Demonstration Program. Smith, E.H. Westinghouse Hanford Co., Richland, WA (United States). [1992]. 56p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92012161. Source: OSTI; NTIS; INIS; GPO Dep.

The Underground Storage Tank-Integrated Demonstration (UST-ID) Program has been developed to identify, demonstrate, test, and evaluate technologies that will provide

alternatives to the current underground storage tank remediation program. The UST-ID Program is a national program that consists of five participating US Department of Energy (DOE) sites where technologies can be developed and ultimately demonstrated. Once these technologies are demonstrated, the UST-ID Program will transfer the developed technology system to industry (governmental or industrial) for application or back to Research and Development for further evaluation and modification, as necessary. In order to ensure that the UST-ID Program proceeds without interruption, it will be necessary to identify regulatory requirements along with associated permitting and notification requirements early in the technology development process. This document serves as a baseline for identifying certain federal and state regulatory requirements that may impact the UST-ID Program and the demonstration of any identified technologies.

1506 (WHC-EP-0539-Rev.1) Regulatory analysis of the Underground Storage Tank-Integrated Demonstration Program: Revision 1. Smith, E.H. Westinghouse Hanford Co., Richland, WA (United States). Jul 1992. 104p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92019781. Source: OSTI; NTIS; INIS; GPO Dep.

The Underground Storage Tank-Integrated Demonstration Program has been developed to identify, demonstrate, test, and evaluate technologies that will provide alternatives to the current underground storage tank remediation program. The Underground Storage Tank-Integrated Demonstration Program is a national program that consists of five participating US Department of Energy sites where technologies can be developed and ultimately demonstrated. Once these technologies are demonstrated, the Underground Storage Tank-Integrated Demonstration Program will transfer the developed technology system to industry (governmental or industrial) for application or back to Research and Development for further evaluation and modification, as necessary. In order to ensure that the Underground Storage Tank-Integrated Demonstration Program proceeds without interruption, it will be necessary to identify regulatory requirements along with associated permitting and notification requirements early in the technology development process. This document serves as a baseline for identifying certain federal regulatory requirements that may impact the Underground Storage Tank-Integrated Demonstration Program and the demonstration of any identified technologies.

1507 (WHC-EP-0550) Tank 101-SY flammable gas mitigation test project plan. Lentsch, J.W. Westinghouse Hanford Co., Richland, WA (United States). May 1992. 157p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93001672. Source: OSTI; NTIS; GPO Dep.

This document presents the proposed project plan for selection, design, analysis, fabrication, installation, and testing of Tank 241-101-SY flammable gas mitigation system equipment. It also includes the project organization and management structure and system. This document is not meant to identify the full range of accident scenarios associated with various mitigation techniques, nor to provide a determinative analysis of risks; these activities will be addressed in safety assessments developed in support of the mitigation tests. This work represents the collaborative efforts of the Westinghouse Hanford Company, Pacific Northwest Laboratory, and the Los Alamos National Laboratory, with input from the US Department of Energy

Headquarters, Richland Field Office, and consultants from Science Applications International Company.

1508 (WHC-EP-0560) Miscellaneous underground radioactive waste tanks. Neilsen, E.H. Westinghouse Hanford Co., Richland, WA (United States). Dec 1992. 79p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93005014. Source: OSTI; NTIS; INIS; GPO Dep.

Many small, inactive underground tanks contain radioactive and chemical wastes on the Hanford Site. These tanks, known as auxiliary tanks, served a variety of purposes. Some tanks were used for settling precipitates and others were used for neutralization of acidic wastes before discharge to cribs or french drains. Other tanks were used to capture drainage from valve boxes, pipe chases, diversion boxes, and other spills from the high-level waste tanks. This report describes these tanks and vaults and discusses information and data on waste volume, chemistry, and radionuclide content and current status.

1509 (WHC-EP-0562) Program plan for the resolution of tank vapor issues. Osborne, J.W. Westinghouse Hanford Co., Richland, WA (United States). Sep 1992. 109p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93001661. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this document is to provide a detailed description of the priorities, logic, work breakdown structure (WBS), task descriptions, and program milestones required for the resolution of tank vapor issues associated with the single-shell tanks (SST) and double-shell tanks (DST). The primary objective of this plan is to determine whether a health (personnel exposure) and/or safety (flammability) hazard exists. This plan is focused upon one waste tank, 241-C-103, but contains all elements required to bring the vapor issues to resolution.

1510 (WHC-EP-0563) Upgrade activities for the Criticality Safety Program of Hanford High-Level Radioactive Waste Tank Farm. Vail, T.S. Westinghouse Hanford Co., Richland, WA (United States). Sep 1992. 47p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93001667. Source: OSTI; NTIS; INIS; GPO Dep.

This document describes the plan for implementing the findings and recommendations made by a team of experts for the US Department of Energy in their Nuclear Criticality Safety Review Of Hanford High-Level Radioactive Waste Tank Farms. The team was chartered to review the nuclear criticality safety of the tank farms and recommend programmatic changes where appropriate, including the specific incident leading to an Unusual Occurrence Report filed in June 1991 on the 241-C-104 specification violation. Although no imminent risks of criticality were found, the review team identified several problems with respect to nuclear criticality safety. Primary among the problems is the lack of definitive knowledge of the fissile material inventory and distribution within the tanks. The lack of good characterization data prompted Westinghouse Hanford Company to declare an Unreviewed Safety Question with respect to criticality safety. Activities by the responsible Hanford Site contractor that address each of the findings, recommendations, and activities required to resolve the Unreviewed Safety Question are described. Schedules and estimated costs are also included with the plan.

1511 (WHC-EP-0566) Underground Storage Tank: Integrated demonstration participant site characteristic summary. Rouse, J.K. (Bovay Northwest, Inc., Richland, WA (United States)); McLaughlin, T.J.; Airhart, S.P.; Jensen, E.J.; Lindberg, S.L.; Robinson, D.D.; Cruse, J.M. Westinghouse Hanford Co., Richland, WA (United States). Jan 1993. 319p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93009362. Source: OSTI; NTIS; INIS; GPO Dep.

This document serves as a baseline information resource for activities associated with the US Department of Energy Underground Storage Tank - Integrated Demonstration Program. Technologies being developed by the program are targeted toward tank waste remediation actions at the following participant sites: Hanford, Savannah River, Oak Ridge, Idaho, and Fernald. The primary focus of the document is to provide information regarding expected environments in which Underground Storage Tank - Integrated Demonstration-developed technologies must function. This document should aid principal investigators in determining if technology concepts may have application to underground storage tank and near-field environments, given site baseline characteristics and conditions. A summary of each participant site's history, description, and process history; climatic conditions; retrieval facilities (if any); waste characterization capabilities; and underground storage tank physical, chemical, radiological, and geologic conditions is provided. Detailed information is provided for a total of 334 underground storage tanks distributed among the five participant sites (Hanford, 177; Savannah River, 51; Oak Ridge, 91; Idaho, 11; Fernald, 4), including type, location, operating history, construction materials, capacity, waste type, environmental status, and radiological and chemical characteristics.

1512 (WHC-EP-0566-DRAFT) Underground Storage Tank: Integrated demonstration functional requirements. Rouse, J.K. (Bovay Northwest, Inc., Richland, WA (United States)); McLaughlin, T.J.; Airhart, S.P.; Jensen, E.E.; Lindberg, S.L.; Robinson, D.R.; Cruse, J.M. Westinghouse Hanford Co., Richland, WA (United States). Apr 1992. 290p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92015548. Source: OSTI; NTIS; INIS; GPO Dep.

This document serves as a baseline information resource for activities associated with the US Department of Energy Underground Storage Tank - Integrated Demonstration Program. Technologies being developed by the program are targeted toward tank waste remediation actions at the following participant sites: Hanford Site, Savannah River Site, Oak Ridge Reservation, Idaho National Engineering Laboratory, and Feed Materials Production Center. The primary focus of the document is to provide information regarding expected environments in which Underground Storage Tank - Integrated Demonstration-developed technologies must function. This is to aid principal investigators in determining if technology concepts may have application to underground storage tank and near-field environments, given site baseline characteristics and conditions. A summary of each participant site's history, description, and process history; climatic conditions; retrieval facilities (if any); waste characterization capabilities; and underground storage tank physical, chemical, radiological, and geologic conditions is provided.

1513 (WHC-EP-0572) Initial Implementation of Defense Nuclear Facilities Safety Board Recommendation

90-2 for Hanford Site high-level waste tanks: Identification of codes and standards. Ryan, J.A.; McCoy, R.M.; Pfluger, D.C.; Harman, D.G. Westinghouse Hanford Co., Richland, WA (United States). Aug 1992. 81p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93002050. Source: OSTI; NTIS; INIS; GPO Dep.

This report documents the initial implementation of the Defense Nuclear Facilities Safety Board Recommendation 90-2 for the Hanford Site high level waste (HLW) tanks. The Defense Nuclear Facilities Safety Board issued Recommendation 90-2. Recommendation 90-2 requires review and evaluation of the content and implementation of standards relating to the design, construction, operation, and decommissioning of selected US Department of Energy defense nuclear facilities (including the Hanford Site HLW tanks). This report tabulates the results of two activities: (1) the development of a listing of the codes and standards used in the design and construction of the existing HLW tanks on the Hanford Site; (2) and, a listing of applicable codes and standards that will cover design, construction, operation, and decommissioning of HLW tanks on the Hanford Site.

1514 (WHC-EP-0576) Assessment of gas accumulation and retention - Tank 241-SY-101. Alleman, R.T. (Pacific Northwest Lab., Richland, WA (US)); Burke, T.M.; Reynolds, D.A.; Simpson, D.E. Westinghouse Hanford Co., Richland, WA (United States). Mar 1993. 66p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93014503. Source: OSTI; NTIS; INIS; GPO Dep.

An approximate analysis has been carried out to assess and estimate the maximum quantity of gas that is likely to be accumulated within waste tank 241-SY-101, and the maximum quantity which is likely to be retained after gas release events (GRE). According to the phenomenological models used for this assessment, based on interpretation of current and recent operational data, the estimated gas generation rate in the tank is approximately 4 m³/day (147 ft³/day). About half of this gas is released as it is generated, which is (essentially) continuously. The remainder is accumulated within the slurry layer of settled solids at the bottom of the tank, and released episodically in GREs, known as "burps," that are induced by unstable buoyant conditions which develop when sufficient gas accumulates in the slurry. Calculations based on gas volumes to cause neutral buoyancy in the slurry predict the following: the maximum gas accumulation (at 1 atm pressure) that can occur without triggering a GRE is in the range of 606 to 1,039 m³ (21,400 to 36,700 ft³); and the maximum gas retention immediately after a GRE is equal to the maximum accumulation minus the gas released in the GRE. GREs do not necessarily involve all of the slurry. In the largest GREs, which are assumed to involve all of the slurry, the minimum gas release (at 1 atm pressure) is calculated to be in the range of 193 to 328 m³ (6,800 to 11,600 ft³). The corresponding maximum gas retention would be 413 to 711 m³ (14,600 to 25,100 ft³).

1515 (WHC-EP-0578) Flammable gas safety issue review tank 241-SY-101. Simpson, D.E.; Anantatmula, R.P.; Christensen, G.M.; Leach, C.E.; Stepnewski, D.D. Westinghouse Hanford Co., Richland, WA (United States). Feb 1993. 249p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93008838. Source: OSTI; NTIS; INIS; GPO Dep.

Flammable gases are produced and accumulated and are sporadically released from some Hanford Site high-level nuclear waste storage tanks, particularly the tank designated 241-SY-101, known generally as tank 101-SY. This condition has existed since this tank was first filled in the time period 1977-1980. During a general review of waste tank chemical stability in 1988-1989, this situation was re-examined and, in March 1990, the condition was declared to be an unreviewed safety question (USQ). Tank 101-SY was placed under special operating restrictions, and a program of investigation was begun to evaluate the condition and determine appropriate courses of action. This report summarizes the understanding of tank 101-SY, which has been developed as of this date, and outlines the criteria and program of additional work to resolve the flammable gas issue with respect to this tank. This report deals with the hazard of flammable gas fire or explosion, and the consequent potential for radioactive material release. Safety evaluations for tank 101-SY operations incorporate consideration of toxic hazardous materials as well; but this topic is not included in the scope of this report.

1516 (WHC-EP-0584) Status of tank 241-SY-101 data analyses. Anantatmula, R.P. Westinghouse Hanford Co., Richland, WA (United States). Sep 1992. 99p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93004996. Source: OSTI; NTIS; INIS; GPO Dep.

The Waste Tank Flammable Gas Stabilization Program was established in 1990 to provide for resolution of a major safety issue identified for 23 of the high-level waste tanks at the Hanford Site. The safety issue involves the production, accumulation, and periodic release from these tanks of flammable gases in concentrations exceeding the lower flammability limits. This document deals primarily with tank 241-SY-101 from the SY Tank Farm. The flammable gas condition has existed for this tank since the tank was first filled in the time period from 1977 to 1980. During a general review of waste tank chemical stability in 1988-1989, this situation was re-examined and, in March 1990, the condition was declared to be an unreviewed safety question. Tank 241-SY-101 was placed under special operating restrictions, and a program of investigation was begun to evaluate the condition and determine appropriate courses of action. This report summarizes the data that have become available on tank 241-SY-101 since it was declared as an unreviewed safety question and updates the information reported in an earlier document (WHC-EP-0517). The report provides a technical basis for use in the evaluation of safety risks of the tank and subsequent resolution of the unreviewed safety question.

1517 (WHC-EP-0586) Tank selection criteria and retrieval recommendations for Tri-Party Agreement milestone M-07. Harris, J.P. Westinghouse Hanford Co., Richland, WA (United States). Dec 1992. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93008161. Source: OSTI; NTIS; INIS; GPO Dep.

Between 1943 and 1964, 149 SSTs were built for the storage of high-level liquid radioactive wastes at the Hanford Site. These SSTs are located in 12 tank farms of 4 to 18 tanks each in the 200 East and 200 West Areas on the Hanford Site (see Figure 1). No wastes have been added to any of these tanks since November 1980. A total of 67 of the SSTs are now known or suspected leakers. Pumpable interstitial liquid and supernate wastes have been removed from

105 SSTs and transferred to double-shell tanks (DST) in a jet pumping program. The 28 DSTs are a tank-in-tank design and were placed in service beginning in 1971. In accordance with Public Law 101-510, Section 3137 (the Wyden Amendment), a total of 53 tanks (48 SSTs and 5 DSTs) have been identified by the US Department of Energy (DOE) as having potential for releases of high-level waste due to uncontrolled increases in temperature or pressure. These tanks have been designated as "watch list" tanks by DOE. The Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement) (Ecology et al. 1990) interim milestone M-07-01 states "Submit tank selection criteria, retrieval options and recommended tank selection to Ecology for concurrence." This document provides the applicable criteria, discusses the various retrieval options available, and recommends a single-shell tank (SST) for demonstration of SST retrieval technology.

1518 (WHC-EP-0589) Tank 101-SY Window C core sample results and interpretation. Reynolds, D.A. Westinghouse Hanford Co., Richland, WA (United States). Sep 1992. 67p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93004986. Source: OSTI; NTIS; INIS; GPO Dep.

A full-depth core sample was taken of Tank 241-SY-101 a double shell, high-level waste tank in May 1991, during the time period called "Window C." Analysis of this core sample included extensive measurements of both the physical and chemical properties of the waste. The physical measurements clearly showed that the waste in the tank is separated into two different layers. The chemical analyses did not show clear differences in the chemical makeup of the layers. The information obtained from the core sample supported the theoretical mechanism for the process by which tank contents roll over.

1519 (WHC-EP-0591) Ferrocyanide Safety Program: Thermal analysis of Tank 241-BY-106. McLaren, J.M. Westinghouse Hanford Co., Richland, WA (United States). May 1993. 38p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93016228. Source: OSTI; NTIS; INIS; GPO Dep.

An analysis was conducted of tank 241-BY-106 to determine the conditions required for an uneven distribution of heat generation (e.g., a hotspot) that would produce temperatures of concern (considered to be 220°C [418°F]). Two types of hotspots were investigated. One was 1 meter square, 7.62 cm (3 in.) thick, that was placed on the bottom of the tank two-thirds of the radial distance from the center to the edge of the tank. The other was a 1 meter cube placed in the same location. It was found that the concentrations of heat-producing material required to reach a maximum temperature of 220°C (418°F) were greater than 160 times that of the material surrounding the hotspot. A transient case was also studied, where a hotspot was formed over 5 years. The 1 meter cube hotspot was used. It was determined that the maximum temperature reached was less than the steady-state analysis under the same conditions. The maximum temperature was reached in 5.5 years. The change in the surface temperature was slow enough that the hotspot could not be detected in less than 3 years. The steady-state analysis showed that a large pattern of thermocouple trees would be required to detect a hotspot by this means. The steady-state analysis showed that a hotspot with temperatures that approached 220°C (418°F) could probably be detected by surface temperature measurements.

1520 (WHC-EP-0606) An overview of progress made toward resolving priority one safety issues: Fiscal year 1992. Babad, H. Westinghouse Hanford Co., Richland, WA (United States). Dec 1992. 48p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93008160. Source: OSTI; NTIS; INIS; GPO Dep.

High-activity radioactive waste has been stored in large underground storage tanks at the US Department of Energy's Hanford Site in eastern Washington State since 1944. Since then, more than 227,000 m³ (60 Mgal) of waste have accumulated in 177 tanks. The caustic waste forms consist of many different chemicals and include liquids, slurries, saltcakes, and sludges. A number of safety issues have been raised about these waste forms, and resolution of these safety issues is a top priority of the US Department of Energy. The Waste Tank Safety Program has been established to resolve tank waste high-priority safety issues at the Hanford Site. This report provides a brief general summary of the accomplishments made toward resolving the following safety issues associated with Hanford Site high-activity single and double-shell waste tanks: Flammable gas tanks; Ferrocyanide containing tanks; Organic tanks; Tank vapor concerns; High-heat tanks.

1521 (WHC-EP-0616) Tank waste technical options report. Boomer, K.D.; Baker, S.K.; Boldt, A.L.; Galbraith, J.D.; Garfield, J.S.; Golberg, C.E.; Higley, B.A.; Johnson, L.J.; Kupfer, M.J.; Marusich, R.M.; Parazin, R.J.; Praga, A.N.; Reddick, G.W.; Reddick, J.A.; Slaathaug, E.J.; Swanson, L.M.; Waldo, T.L.; WorcesWestinghouse Hanford Co., Richland, WA (United States). 31 Mar 1993. 378p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93011904. Source: OSTI; NTIS; INIS; GPO Dep.

This document, Tank Waste Technical Options Report, assesses technologies that can be applied to treat and dispose of all Hanford Site tank waste including the cesium and strontium capsules. This effort continues the single-shell tank systems engineering work that began at the urging of a National Academy of Science subpanel. The study develops data on specific technologies that are combined to form alternatives for waste treatment and disposal. These alternatives are defined and evaluated in the Tank Waste Decision Analysis Report. Both studies are an integral part of the Tank Waste Remediation System goal of defining a new technical strategy in 1993. The engineering work represented in this document will also serve as data for the environmental impact statement support document.

1522 (WHC-EP-0617-Draft) Tank waste decision analysis report: Draft. Johnson, M.E. (Westinghouse Hanford Co., Richland, WA (United States)); Grygiel, M.L.; Baynes, P.A.; Bekemeier, J.P.; Zimmerman, B.D.; Triplett, M.B. Westinghouse Hanford Co., Richland, WA (United States). 31 Mar 1993. 188p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93011903. Source: OSTI; NTIS; INIS; GPO Dep.

The Assistant Secretary for Environmental Restoration and Waste Management and the director of the Washington State Department of Ecology agreed to the need to re-evaluate treatment and disposal plans for Hanford Site tank waste. Re-evaluation of the tank waste treatment and disposal plans (referred to as rebaselining) was necessary to (1) provide an integrated system approach for achieving safe storage, (2) resolve tank safety issues, and (3) treat

and dispose of all Hanford Site tank waste. Rebaselining evaluated new approaches to remediate Hanford Site tank waste and, thus, reaffirm existing plans or recommend a new technical strategy. To facilitate this integrated system approach for managing the program elements, the US Department of Energy formed the Tank Waste Remediation System (TWRS). While conducting this re-evaluation, the US Department of Energy agreed to continue supporting the existing plan for treatment and disposal of Hanford Site tank waste. The selection of a proposed new technical strategy for the TWRS Program is a complex task involving the evaluation of a large body of data. The data that is available to support the selection of a proposed new technical strategy is based on engineering estimates and preliminary technology development. To accommodate this complex, dynamic situation, a systems engineering approach is being applied to structure and analyze technical strategies and to manage the TWRS Program. Systems engineering is a generalized and systematic methodology for defining problems, evaluating solutions, and implementing the solutions. This report describes the development of the TWRS Program systems engineering analysis, the analytical methodologies that support it, and the results of the analyses that were used to define the proposed new technical strategy.

1523 (WHC-EP-0625) Hanford Site Waste Storage Tank Information Notebook. Husa, E.I.; Raymond, R.E.; Welty, R.K.; Griffith, S.M.; Hanlon, B.M.; Rios, R.R.; Vermeulen, N.J. Westinghouse Hanford Co., Richland, WA (United States). Jul 1993. 499p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93040322. Source: OSTI; NTIS; INIS; GPO Dep.

This report provides summary data on the radioactive waste stored in underground tanks in the 200 East and West Areas at the Hanford Site. The summary data covers each of the existing 161 Series 100 underground waste storage tanks (500,000 gallons and larger). It also contains information on the design and construction of these tanks. The information in this report is derived from existing reports that document the status of the tanks and their materials. This report also contains interior, surface photographs of each of the 54 Watch List tanks, which are those tanks identified as Priority I Hanford Site Tank Farm Safety Issues in accordance with Public Law 101-510, Section 3137*.

1524 (WHC-EP-0627) Tank waste remediation system mission analysis. Baynes, P.A. (Westinghouse Hanford Co., Richland, WA (United States)); Woods, J.W.; Collings, J.L. Westinghouse Hanford Co., Richland, WA (United States). Mar 1993. 57p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93011938. Source: OSTI; NTIS; INIS; GPO Dep.

Mission analysis is an iterative process that expands the mission statement, identifies needed information, and provides sufficient insight to proceed with the necessary, subsequent analyses. The Tank Waste Remediation System (TWRS) mission analysis expands the TWRS Program problem statement: "remediate tank waste." It also and the mission statement: "store, treat, and immobilize highly radioactive Hanford waste in an environmentally sound, safe, and cost effective manner." The mission analysis expands the problem and mission statements to accomplish four primary tasks. First, it defines the mission in enough detail to provide any follow-on work with a consistent foundation. Second, it defines the TWRS boundaries. Third, it identifies

the following for TWRS: (1) current conditions, (2) acceptable final conditions, (3) requirement sources for the final product and the necessary systems, (4) organizations authorized to issue requirements, and (5) the criteria to determine when the problem is solved. Finally, it documents the goals to be achieved. This document concludes that tank safety issues should be resolved quickly and tank waste should be treated and immobilized quickly because of the hazardous nature of the tank waste and the age and condition of the existing tanks. In addition, more information is needed (e.g., waste acceptance criteria, condition of existing waste) to complete the TWRS mission analysis.

1525 (WHC-EP-0628) Tank 101-SY Window E core sample: Interpretation of results. Reynolds, D.A. Westinghouse Hanford Co., Richland, WA (United States). Feb 1993. 90p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93014486. Source: OSTI; NTIS; INIS; GPO Dep.

A full depth core sample was taken for tank 241-SY-101 in December 1991 during a time period called "Window E." This was the second full depth core sample from this tank during the year. The core had two major portions that are known as the convective zone and the nonconvective zone. A crust was on the top of tank but as poorly sampled. The analysis of the Window E core sample stressed segment composite chemical analysis instead of segment by segment as in Window C. Adiabatic calorimetry on samples from both cores showed a slow self heating reaction above 150°C on dried samples. The exothermic events were milder than similar synthetic samples. The chemical and physical properties complemented the information from Window C. The Window E material from the convective zone was more viscous than the Window C convective zone material. The nonconvective zone viscosities were similar for both cores. Heating and dilution tests were made to test mitigation concepts.

1526 (WHC-EP-0638) Ferrocyanide safety program: Heat load and thermal characteristics determination for selected tanks. McLaren, J.M.; Cash, R.J. Westinghouse Hanford Co., Richland, WA (United States). Nov 1993. 68p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94005983. Source: OSTI; NTIS; INIS; GPO Dep.

An analysis was conducted to determine the heat loads, conductivities, and heat distributions of waste tanks 241-BY-105, -106, -108, -110, -111, and 241-C-109 at the Hanford Site. The heat distribution of tank 241-BY-111 was determined to be homogeneously distributed throughout the sludge contained in the tank. All of the other tanks, with the exception of 241-C-109, showed evidence of a heat-producing layer at the bottom of the tanks. No evidence of a heat-producing layer in a position above the bottom was found. The thermal conductivities were determined to be within the ranges found by previous laboratory and computer analysis. The heat loads of the tanks were found to be below 2.81 kW (9,600 Btu/hr).

1527 (WHC-EP-0640) Tank characterization data report: Tank 241-C-112. Simpson, B.C.; Borsheim, G.L.; Jensen, L. Westinghouse Hanford Co., Richland, WA (United States). Apr 1993. 205p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93018062. Source: OSTI; NTIS; INIS; GPO Dep.

Tank 241-C-112 is a Hanford Site Ferrocyanide Watch List tank that was most recently sampled in March 1992.

Analyses of materials obtained from tank 241-C-112 were conducted to support the resolution of the Ferrocyanide Unreviewed Safety Question (USQ) and to support Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement) Milestone M-10-00. Analysis of core samples obtained from tank 241-C-112 strongly indicates that the fuel concentration in the tank waste will not support a propagating exothermic reaction. It is probable that tank 241-C-112 exceeds the 1,000 g-mol inventory criteria established for the Ferrocyanide USQ; however, extensive energetic analysis of the waste has determined a maximum exothermic value of -9 cal/g dry waste. This value is substantially below any levels of concern (-75 cal/g). In addition, an investigation of potential mechanisms to generate concentration levels of radionuclides high enough to be of concern was performed. No credible mechanism was postulated that could initiate the formation of such concentration levels in the tank. Tank 241-C-112 waste is a complex material made up primarily of water and inert salts. The insoluble solids are a mixture of phosphates, sulfates, and hydroxides in combination with aluminum, calcium, iron, nickel, and uranium. Disodium nickel ferrocyanide and sodium cesium nickel ferrocyanide probably exist in the tank; however, there appears to have been significant degradation of this material since the waste was initially settled in the tank.

1528 (WHC-EP-0640-Rev.1) Tank characterization data report: Tank 241-C-112. Simpson, B.C.; Borsheim, G.L.; Jensen, L. Westinghouse Hanford Co., Richland, WA (United States). Sep 1993. 317p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94002358. Source: OSTI; NTIS; INIS; GPO Dep.

Tank 241-C-112 is a Hanford Site Ferrocyanide Watch List tank that was most recently sampled in March 1992. Analyses of materials obtained from tank 241-C-112 were conducted to support the resolution of the Ferrocyanide Unreviewed Safety Question (USQ) and to support Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement) Milestone M-10-00. Analysis of core samples obtained from tank 241-C-112 strongly indicates that the fuel concentration in the tank waste will not support a propagating exothermic reaction. Analysis of the process history of the tank as well as studies of simulants provided valuable information about the physical and chemical condition of the waste. This information, in combination with the analysis of the tank waste, supports the conclusion that an exothermic reaction in tank 241-C-112 is not plausible. Therefore, the contents of tank 241-C-112 present no imminent threat to the workers at the Hanford Site, the public, or the environment from its ferrocyanide inventory. Because an exothermic reaction is not credible, the consequences of this accident scenario, as promulgated by the General Accounting Office, are not applicable.

1529 (WHC-EP-0648) Ferrocyanide safety program: Credibility of drying out ferrocyanide tank waste by hot spots. Dickinson, D.R.; McLaren, J.M.; Borsheim, G.L.; Crippen, M.D. Westinghouse Hanford Co., Richland, WA (United States). Apr 1993. 73p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93014619. Source: OSTI; NTIS; INIS; GPO Dep.

The single-shell waste tanks at the Hanford Site that contain significant quantities of ferrocyanide have been considered a possible hazard, since under certain conditions the ferrocyanide in the waste tanks could undergo an

exothermic chemical reaction with the nitrates and nitrites that are also present in the tanks. The purpose of this report is to assess the credibility of local dryout of ferrocyanide due to a hotspot. This report considers the following: What amount of decay heat generation within what volume would be necessary to raise the temperature of the liquid in the sludge to its boiling point? What mechanisms could produce a significant local concentration of heat sources? Is it credible that a waste tank heat concentration could be as large as that required to reach the dryout temperatures? This report also provides a recommendation as to whether infrared scanning of the ferrocyanide tanks is needed. From the analyses presented in this report it is evident that formation of dry, and thus chemically reactive, regions in the ferrocyanide sludge by local hotspots is not credible. This conclusion is subject to reevaluation if future analyses of tank core samples show much higher ^{137}Cs or ^{90}Sr concentrations than expected. Since hotspots of concern are not credible, infrared scanning to detect such hotspots is not required for safe storage of tank waste.

1530 (WHC-EP-0658) Moisture monitoring of ferrocyanide tanks: An evaluation of methods and tools. Meacham, J.E.; Babad, H.; Toffer, H. Westinghouse Hanford Co., Richland, WA (United States). Apr 1993. 46p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93014634. Source: OSTI; NTIS; INIS; GPO Dep.

This report reviews the strengths and limitations of moisture monitoring technologies that could be used for determining moisture concentration in Hanford Site single-shell ferrocyanide waste tanks. Two technologies (neutron diffusion and near-infrared spectroscopy) are being pursued as part of the ferrocyanide program. A third technology, Raman spectroscopy, is in development as a speciation tool at the Westinghouse Hanford Company 222-S Laboratory. The potential application of Raman spectroscopy to moisture monitoring is discussed.

1531 (WHC-EP-0668) Tank characterization report: Tank 241-C-109. Simpson, B.C.; Borsheim, G.L.; Jensen, L. Westinghouse Hanford Co., Richland, WA (United States). Sep 1993. 294p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94002425. Source: OSTI; NTIS; INIS; GPO Dep.

Single-shell tank 241-C-109 is a Hanford Site Ferrocyanide Watch List tank that was most recently sampled in September 1992. Analyses of materials obtained from tank 241-C-109 were conducted to support the resolution of the ferrocyanide unreviewed safety question (USQ) and to support Hanford Federal Facility Agreement and consent Order (Tri-Party Agreement) Milestone M-10-00. This report describes this analysis.

1532 (WHC-EP-0669) Ferrocyanide safety program: Updated thermal analysis model for ferrocyanide tanks with application to Tank 241-BY-104. McLaren, J.M. Westinghouse Hanford Co., Richland, WA (United States). Dec 1993. 84p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94005975. Source: OSTI; NTIS; INIS; GPO Dep.

During the middle to late 1950's, a program was begun to concentrate the radioactive waste products of the uranium and plutonium recovery processes. This program used sodium nickel ferrocyanide to precipitate radioactive cesium from the waste streams. The precipitate was then stored in large, underground single-shell tanks at the Hanford Site in

south central Washington. Several of the tanks have been stabilized, a process that included removing as much pumpable liquid as possible from the tanks. This liquid contained heat-producing radionuclides. Because of the many transfers involved, the lack of accurate inventory data for the various waste streams, and the absence of a need for an accurate value of the heat load, the heat loads of the ferrocyanide waste storage tanks have only been estimated. As a result of the intense radiation field within these tanks, the chemical content of the waste has changed. This, coupled with the fact that the characteristics of the input waste were not well known, has resulted in uncertainty in the thermal characteristics of the stored sludge. All of these parameters are needed to evaluate the safety of these tanks. The purposes of this report are to document the updated thermal analysis model for ferrocyanide tanks and to use the model to determine the heat load of Tank 241-BY-104. This new model utilizes several new parameters and a new technique, which are described in this report. The new model is considered more accurate than the previous model, and all future thermal analyses of ferrocyanide tanks will use this updated model.

1533 (WHC-EP-0671) Corrective action strategy for single-shell tanks containing organic chemicals. Turner, D.A. Westinghouse Hanford Co., Richland, WA (United States). Aug 1993. 60p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93040335. Source: OSTI; NTIS; INIS; GPO Dep.

A Waste Tank Organic Safety Program (Program) Plan is to be transmitted to the U.S. Department of Energy, Richland Operations Office (RL) for approval by December 31, 1993. In April 1993 an agreement was reached among cognizant U.S. Department of Energy - Headquarters (HQ), RL and Westinghouse Hanford Company (WHC) staff that the Program Plan would be preceded by a "Corrective Action Strategy," which addressed selected planning elements supporting the Program Plan. The "Corrective Action Strategy" would be reviewed and consensus reached regarding the planning elements. A Program Plan reflecting this consensus would then be prepared. A preliminary "corrective action strategy" is presented for resolving the organic tanks safety issue based on the work efforts recommended in the ISB (Interim Safety Basis for Hanford Site tank farm facilities). A "corrective action strategy" logic was prepared for individual SSTs (single-shell tanks), or a group of SSTs having similar characteristics, as appropriate. Four aspects of the organic tanks safety issue are addressed in the ISB: SSTs with the potential for combustion in the tank's headspace; combustion of a floating organic layer as a pool fire; surface fires in tanks that formerly held floating organic layers; SSTs with the potential for organic-nitrate reactions. A preliminary "corrective action strategy" for each aspect of the organic tanks safety issue is presented.

1534 (WHC-EP-0681) Interim criteria for Organic Watch List tanks at the Hanford Site. Babad, S.; Turner, D.A. Westinghouse Hanford Co., Richland, WA (United States). Sep 1993. 53p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94002357. Source: OSTI; NTIS; INIS; GPO Dep.

This document establishes interim criteria for identifying single-shell radioactive waste storage tanks at the Hanford Site that contain organic chemicals mixed with nitrate/nitrite salts in potentially hazardous concentrations. These tanks are designated as "organic Watch List tanks." Watch List tanks are radioactive waste storage tanks that have the

potential for release of high-level waste as a result of uncontrolled increases in temperature or pressure. Organic Watch List tanks are those Watch List tanks that contain relatively high concentrations of organic chemicals. Because of the potential for release of high-level waste resulting from uncontrolled increases in temperature or pressure, the organic Watch List tanks (collectively) constitute a Hanford Site radioactive waste storage tank "safety issue."

1535 (WHC-EP-0691) Ferrocyanide Safety Program: Safety criteria for ferrocyanide watch list tanks. Postma, A.K. (and others); Meacham, J.E.; Barney, G.S. Westinghouse Hanford Co., Richland, WA (United States). Jan 1994. 158p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94006330. Source: OSTI; NTIS; INIS; GPO Dep.

This report provides a technical basis for closing the ferrocyanide Unreviewed Safety Question (USQ) at the Hanford Site. Three work efforts were performed in developing this technical basis. The efforts described herein are: 1. The formulation of criteria for ranking the relative safety of waste in each ferrocyanide tank. 2. The current classification of tanks into safety categories by comparing available information on tank contents with the safety criteria; 3. The identification of additional information required to resolve the ferrocyanide safety issue.

1536 (WHC-EP-0695) Proof of principle report for in-tank moisture monitoring using an active neutron probe. Watson, W.T. Westinghouse Hanford Co., Richland, WA (United States). Dec 1993. 56p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94005985. Source: OSTI; NTIS; GPO Dep.

This document establishes the proof of principle for use of a neutron probe to measure moisture concentrations in ferrocyanide waste tanks at the Hanford Site. Computer modeling and experiments with a modified neutron probe have shown that neutron-based measurements will provide accurate moisture determinations in Hanford Site ferrocyanide waste tanks. Moisture measurement using neutron moderation and diffusion is an established and extensively documented technology for the well logging industry. Sophisticated neutron transport modeling and calibrations with known moisture concentrations have provided the necessary developmental analyses and validations. Proof of principle was accomplished using the existing in-tank neutron surveillance tool and its support equipment. A minor, inexpensive hardware modification permitted extending the use of the existing probe to moisture measurements. A limited moisture calibration was performed using the modified in-tank neutron probe, and the results were used to adjust model parameters. Scan data from three ferrocyanide tanks have been obtained using the modified in-tank neutron probe, and interpretation of these scans is in progress. Modeling analyses and experimental test results have provided information that will be used to develop a prototype neutron device for improved in-tank moisture monitoring at the Hanford Site. Now a prototype device must be assembled, tested, and fully calibrated in known moisture ferrocyanide waste simulants.

1537 (WHC-EP-0701) Laboratory testing of ozone oxidation of Hanford Site waste from Tank 241-SY-101. Delegard, C.H.; Stubbs, A.M.; Bolling, S.D. Westinghouse Hanford Co., Richland, WA (United States). 14 Dec 1993. 119p. Sponsored by USDOE, Washington, DC (United

States). DOE Contract AC06-87RL10930. Order Number DE94005514. Source: OSTI; NTIS; INIS; GPO Dep.

Ozone was investigated as a reagent to oxidize and destroy organic species present in simulated and genuine waste from Hanford Site Tank 241-SY-101 (Tank 101-SY). Two high-shear mixing apparatus were tested to perform the gas-to-solution mass transfer necessary to achieve efficient use of the ozone reagent. Oxidations of nitrite (to form nitrate) and organic species were observed. The organics oxidized to form carbonate and oxalate as well as nitrate and nitrogen gas from nitrogen associated with the organic. Oxidations of metal species also were observed directly or inferred by solubilities. The chemical reaction stoichiometries were consistent with reduction of one oxygen atom per ozone molecule. Acetate, oxalate, and formate were found to comprise about 40% of the genuine waste's total organic carbon (TOC) concentration. Ozonation was found to be chemically feasible for destroying organic species (except oxalate) present in the wastes in Tank 101-SY. The simulated waste formulation used in these studies credibly modelled the ozonation behavior of the genuine waste.

1538 (WHC-EP-0709) Estimation of heat load in waste tanks using average vapor space temperatures. Crowe, R.D.; Kummerer, M.; Postma, A.K. Westinghouse Hanford Co., Richland, WA (United States). Dec 1993. 68p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94005978. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes a method for estimating the total heat load in a high-level waste tank with passive ventilation. This method relates the total heat load in the tank to the vapor space temperature and the depth of waste in the tank. $Q_{total} = C_f (T_{vapor\ space} - T_{air})$ where: C_f = Conversion factor = $(R_o k_{soil} \cdot area) / (z_{tank} - z_{surface})$; R_o = Ratio of total heat load to heat out the top of the tank (function of waste height); Area = cross sectional area of the tank; k_{soil} = thermal conductivity of soil; $(z_{tank} - z_{surface})$ = effective depth of soil covering the top of tank; and $(T_{vapor\ space} - T_{air})$ = mean temperature difference between vapor space and the ambient air at the surface. Three terms - depth, area and ratio - can be developed from geometrical considerations. The temperature difference is measured for each individual tank. The remaining term, the thermal conductivity, is estimated from the time-dependent component of the temperature signals coming from the periodic oscillations in the vapor space temperatures. Finally, using this equation, the total heat load for each of the ferrocyanide Watch List tanks is estimated. This provides a consistent way to rank ferrocyanide tanks according to heat load.

1539 (WHC-EP-0713) Ferrocyanide Safety Program: Waste tank sludge rheology within a hot spot or during draining: Homogeneous flow versus flow through a porous medium. Fauske, H.K. (Fauske and Associates, Inc., Burr Ridge, IL (United States)); Cash, R.J. Westinghouse Hanford Co., Richland, WA (United States). Nov 1993. 44p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94005974. Source: OSTI; NTIS; INIS; GPO Dep.

The conditions under which ferrocyanide waste sludge flows as a homogeneous non-Newtonian two-phase (solid precipitate-liquid) mixture rather than as a liquid through a porous medium (of stationary precipitate) are examined theoretically, based on the notion that the preferred rheological behavior of the sludge is the one which imposes the least resistance to the sludge flow. The homogeneous two-phase

mixture is modeled as a power-law fluid and simple criteria are derived that show that the homogeneous power-law sludge-flow is a much more likely flow situation than the porous medium model of sludge flow. The implication of this finding is that the formation of a hot spot or the drainage of sludge from a waste tank are not likely to result in the uncovering (drying) and subsequent potential overheating of the reactive-solid component of the sludge.

1540 (WHC-EP-0717) Evaluation of 241 AN tank farm flammable gas behavior. Reynolds, D.A. Westinghouse Hanford Co., Richland, WA (United States). Jan 1994. 51p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94012402. Source: OSTI; NTIS; GPO Dep.

The 241 AN Tank Farm tanks 241-AN-103, -104, and 105 are Flammable Gas Watch List tanks. Characteristics exhibited by these tanks (i.e., surface level drops, pressure increases, and temperature profiles) are similar to those exhibited by tank 241-SY-101, which is also a Watch List tank. Although the characteristics exhibited by tank 241-SY-101 are also present in tanks 241-AN-103, -104, and 105, they are exhibited to a lesser degree in the AN Tank Farm tanks. The 241 AN Tank Farm tanks have only small surface level drops, and the pressure changes that occur are not sufficient to release an amount of gas that would cause the dome space to exceed the lower flammability limit (LFL) for hydrogen. Therefore, additional restrictions are probably unnecessary for working within the 241 AN Tank Farm, either within the dome space of the tanks or in the waste.

1541 (WHC-EP-0721) Program plan for evaluation of the Ferrocyanide Waste Tank safety issue at the Hanford Site. Borsheim, G.L.; Meacham, J.E.; Cash, R.J.; Dukelow, G.T. Westinghouse Hanford Co., Richland, WA (United States). Mar 1994. 122p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94010340. Source: OSTI; NTIS; INIS; GPO Dep.

This document describes the background, priorities, strategy and logic, and task descriptions for the Ferrocyanide Waste Tank Safety Program. The Ferrocyanide Safety Program was established in 1990 to provide resolution of a major safety issue identified for 24 high-level radioactive waste tanks at the Hanford Site.

1542 (WHC-EP-0723) Tank 241-C-106 sampling data requirements developed through the data quality objectives (DQO) process. Wang, O.S. (Westinghouse Hanford Co., Richland, WA (United States)); Bell, K.E.; Anderson, C.M.; Peffers, M.S.; Pulsipher, B.A.; Scott, J.L. Westinghouse Hanford Co., Richland, WA (United States). Jan 1994. 50p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94012393. Source: OSTI; NTIS; INIS; GPO Dep.

The rate of heat generation for tank 241-C-106 at the Hanford Site is estimated at more than 100,000 Btu/h. The heat is generated primarily from the radioactive decay of ^{90}Sr waste that was inadvertently transferred into the tank in the late 1960s. If proper tank cooling is not maintained for this tank, heat-induced structural damage to the tank's concrete shell could result in the release of nuclear waste to the environment. Because of high-heat concerns in January 1991, tank 241-C-106 was designated as a Watch List tank and deemed as a Priority 1 safety issue. Waste Tank Safety Program (WTSP) is responsible for the resolution of this safety issue. Although forced cooling is effective for short

term, the long-term resolution for tank cooling is waste retrieval. Single-shell Tank Retrieval Project (Retrieval) is responsible for the safe retrieval and transfer of radioactive waste from tank 241-C-106 to a selected double-shell tank. This data quality objective (DQO) study is an effort to determine engineering and design data needs for WTSP and assist Retrieval in designing contingency action retrieval systems. The 7-step DQO process is a tool developed by the Environmental Protection Agency with a goal of identifying needs and reducing costs. This report discusses the results of two DQO efforts for WTSP and Retrieval. The key data needs to support WTSP are thermal conductivity, permeability, and heat load profile. For the Retrieval support, there are nine and three data needs identified, respectively, for retrieval engineering system design and HVAC system design. The updated schedule to drill two core samples using rotary mode is set for March 1994. The analysis of the sample is expected to be completed by September 1994.

1543 (WHC-EP-0728) Ferrocyanide Safety Program: Data requirements for the ferrocyanide safety issue developed through the data quality objectives (DQO) process. Buck, J.W. (Pacific Northwest Lab., Richland, WA (United States)); Anderson, C.M.; Pulsipher, B.A.; Toth, J.J.; Turner, P.J.; Cash, R.J.; Dukelow, G.T.; Meacham, J.E. Westinghouse Hanford Co., Richland, WA (United States). Dec 1993. 76p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94005976. Source: OSTI; NTIS; INIS; GPO Dep.

This document records the data quality objectives (DQO) process applied to the Ferrocyanide Waste Tank Safety Issue at the Hanford Site by the Pacific Northwest Laboratory and Westinghouse Hanford Company. Specifically, the major recommendations and findings from this Ferrocyanide DQO process are presented so that decision makers can determine the type, quantity, and quality of data required for addressing tank safety issues. The decision logic diagrams and error tolerance equations also are provided. Finally, the document includes the DQO sample-size formulas for determining specific tank sampling requirements.

1544 (WHC-EP-0733) Tank waste processing and disposal technology development data summary. Cruse, J.M. (Westinghouse Hanford Co., Richland, WA (United States)); McGinnis, C.P. Westinghouse Hanford Co., Richland, WA (United States). Jan 1994. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94009753. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy's Waste Management and Technology Development Programs are engaged in a number of projects to develop, demonstrate, test, and evaluate new technologies to support the clean-up and site remediation of more than 300 underground storage tanks containing over 381,000 cubic meters (100 million gallons) of radioactive mixed waste. Significant development is needed within primary processing functions and in determining an overall bounding strategy. This document is a first attempt to summarize the overall strategy and show technology development activities within the strategy. It is intended to serve as an information resource to support understanding, decision making and integration of multiple program technology development activities. Recipients are encouraged to provide comments and input to the authors for incorporation in future revisions.

1545 (WHC-EP-0734) Tank 241-C-103 headspace flammability. Huckaby, J.L. Westinghouse Hanford Co., Richland, WA (United States). Jan 1994. 49p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94009442. Source: OSTI; NTIS; INIS; GPO Dep.

Information regarding flammable vapors, gases, and aerosols is presented for the purpose of resolving the tank 241-C-103 headspace flammability issue. Analyses of recent vapor and liquid samples, as well as visual inspections of the tank headspace, are discussed in the context of tank dynamics. This document is restricted to issues regarding the flammability of gases, vapors, and an aerosol that may exist in the headspace of tank 241-C-103. While discussing certain information about the organic liquid present in tank 241-C-103, this document addresses neither the potential for, nor consequences of, a pool fire involving this organic liquid; they will be discussed in a separate report.

1546 (WHC-EP-0734-Rev.1) Tank 24-C-103 headspace flammability: Revision 1. Huckaby, J.L. Westinghouse Hanford Co., Richland, WA (United States). May 1994. 31p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94011393. Source: OSTI; NTIS; INIS; GPO Dep.

Information regarding flammable vapors, gases, and aerosols is presented and interpreted to help resolve the tank 241-C-103 headspace flammability issue. Analyses of recent vapor and liquid samples, as well as visual inspections of the tank headspace, are discussed in the context of tank dynamics. Concern that the headspace of tank 241-C-103 may contain a flammable mixture of organic vapors and an aerosol of combustible organic liquid droplets arises from the presence of a layer of organic liquid in the tank. This organic liquid is believed to have originated in the plutonium-uranium extraction (PUREX) process, having been stored initially in tank 241-C-102 and apparently transferred to tank 241-C-103 in 1975 (Carothers 1988). Analyses of samples of the organic liquid collected in 1991 and 1993 indicate that the primary constituents are tributyl phosphate (TBP) and several semivolatile hydrocarbons (Prentice 1991, Pool and Bean 1994). This is consistent with the premise that the organic waste came from the PUREX process, because the PUREX process used a solution of TBP in a diluent composed of the $n\text{-C}_{11}\text{H}_{24}$ to $n\text{-C}_{15}\text{H}_{32}$ normal paraffinic hydrocarbons (NPH).

1547 (WHC-EP-0750-Vol.1) High-level waste storage tank farms/242-A evaporator standards/requirements identification document (S/RID), Vol. 1. Westinghouse Hanford Co., Richland, WA (United States). Apr 1994. 212p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94012249. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this Requirements Identification Document (RID) section is to identify, in one location, all of the facility specific requirements and good industry practices which are necessary or important to establish an effective Issues Management Program for the Tank Farm Facility. The Management Systems Functional Area includes the site management commitment to environmental safety and health (ES&H) policies and controls, to compliance management, to development and management of policy and procedures, to occurrence reporting and corrective actions, resource and issue management, and to the self-assessment process.

1548 (WHC-EP-0750-Vol.2) High-level waste storage tank farms/242-A evaporator standards/requirements Identification document (S/RID), Vol. 2. Westinghouse Hanford Co., Richland, WA (United States). Apr 1994. 270p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94012250. Source: OSTI; NTIS; INIS; GPO Dep.

The Quality Assurance Functional Area Requirements Identification Document (RID), addresses the programmatic requirements that ensure risks and environmental impacts are minimized, ensure safety, reliability, and performance are maximized through the application of effective management systems commensurate with the risks posed by the Tank Farm Facility and its operation. This RID incorporates guidance intended to provide Tank Farms management with the necessary requirements information to develop, upgrade, or assess the effectiveness of a Quality Assurance Program in the performance of organizational and functional activities. Quality Assurance is defined as all those planned and systematic actions necessary to provide adequate confidence that a facility, structure, system, or component will perform satisfactorily and safely in service. This document will provide the specific requirements to meet DNFSB recommendations and the guidance provided in DOE Order 5700.6C, utilizing industry codes, standards, regulatory guidelines, and industry good practices that have proven to be essential elements for an effective and efficient Quality Assurance Program as the nuclear industry has matured over the last thirty years.

1549 (WHC-EP-0750-Vol.3) High-level waste storage tank farms/242-A evaporator standards/requirements Identification document (S/RID), Vol. 3. Westinghouse Hanford Co., Richland, WA (United States). Apr 1994. 221p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94012301. Source: OSTI; NTIS; INIS; GPO Dep.

The Safeguards and Security (S&S) Functional Area address the programmatic and technical requirements, controls, and standards which assure compliance with applicable S&S laws and regulations. Numerous S&S responsibilities are performed on behalf of the Tank Farm Facility by site level organizations. Certain other responsibilities are shared, and the remainder are the sole responsibility of the Tank Farm Facility. This Requirements Identification Document describes a complete functional Safeguards and Security Program that is presumed to be the responsibility of the Tank Farm Facility. The following list identifies the programmatic elements in the S&S Functional Area: Program Management, Protection Program Scope and Evaluation, Personnel Security, Physical Security Systems, Protection Program Operations, Material Control and Accountability, Information Security, and Key Program Interfaces.

1550 (WHC-EP-0750-Vol.4) High-level waste storage tank farms/242-A evaporator standards/requirements Identification document (S/RID), Vol. 4. Westinghouse Hanford Co., Richland, WA (United States). Apr 1994. 278p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94012302. Source: OSTI; NTIS; INIS; GPO Dep.

Radiation protection of personnel and the public is accomplished by establishing a well defined Radiation Protection Organization to ensure that appropriate controls on radioactive materials and radiation sources are implemented and documented. This Requirements Identification Document

(RID) applies to the activities, personnel, structures, systems, components, and programs involved in executing the mission of the Tank Farms. The physical boundaries within which the requirements of this RID apply are the Single Shell Tank Farms, Double Shell Tank Farms, 242-A Evaporator-Crystallizer, 242-S, T Evaporators, Liquid Effluent Retention Facility (LERF), Purgewater Storage Facility (PWSF), and all interconnecting piping, valves, instrumentation, and controls. Also included is all piping, valves, instrumentation, and controls up to and including the most remote valve under Tank Farms control at any other Hanford Facility having an interconnection with Tank Farms. The boundary of the structures, systems, components, and programs to which this RID applies, is defined by those that are dedicated to and/or under the control of the Tank Farms Operations Department and are specifically implemented at the Tank Farms.

1551 (WHC-EP-0750-Vol.5) High-level waste storage tank farms/242-A evaporator standards/requirements Identification document (S/RID), Vol. 5. Westinghouse Hanford Co., Richland, WA (United States). Apr 1994. 99p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94012303. Source: OSTI; NTIS; INIS; GPO Dep.

The Fire Protection functional area for the Hanford Site Tank Farm facilities and support structures is based on the application of relevant DOE orders, regulations, and industry codes and standards. The fire protection program defined in this document may be divided into three areas: (1) organizational, (2) administrative programmatic features, and (3) technical features. The information presented in each section is in the form of program elements and orders, regulations, industry codes, and standards that serve as the attributes of a fire protection program for the Tank Farm facilities. Upon completion this document will be utilized as the basis to evaluate compliance of the fire protection program being implemented for the Tank Farm facilities with the requirements of DOE orders and industry codes and standards.

1552 (WHC-EP-0750-Vol.6) High-level waste storage tank farms/242-A evaporator standards/requirements Identification document (S/RID), Vol. 6. Westinghouse Hanford Co., Richland, WA (United States). Apr 1994. 203p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94012304. Source: OSTI; NTIS; INIS; GPO Dep.

The scope of the Environmental Restoration and Waste Management (EM) Functional Area includes the programmatic controls associated with the management and operation of the Hanford Tank Farm Facility. The driving management organization implementing the programmatic controls is the Tank Farms Waste Management (WM) organization whose responsibilities are to ensure that performance objectives are established; and that measurable criteria for attaining objectives are defined and reflected in programs, policies and procedures. Objectives for the WM Program include waste minimization, establishment of effective waste segregation methods, waste treatment technology development, radioactive (low-level, high-level) hazardous and mixed waste transfer, treatment, and storage, applicability of a corrective action program, and management and applicability of a decontamination and decommissioning (D&D) program in future years.

1553 (WHC-EP-0750-Vol.7) High-level waste storage tank farms/242-A evaporator standards/requirements Identification document (S/RID), Vol. 7. Westinghouse

Hanford Co., Richland, WA (United States). Apr 1994. 225p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94012305. Source: OSTI; NTIS; INIS; GPO Dep.

This Requirements Identification Document (RID) describes an Occupational Health and Safety Program as defined through the Relevant DOE Orders, regulations, industry codes/standards, industry guidance documents and, as appropriate, good industry practice. The definition of an Occupational Health and Safety Program as specified by this document is intended to address Defense Nuclear Facilities Safety Board Recommendations 90-2 and 91-1, which call for the strengthening of DOE complex activities through the identification and application of relevant standards which supplement or exceed requirements mandated by DOE Orders. This RID applies to the activities, personnel, structures, systems, components, and programs involved in maintaining the facility and executing the mission of the High-Level Waste Storage Tank Farms.

1554 (WHC-EP-0774) Tank 241-C-103 vapor and gas sampling Data Quality Objectives. Osborne, J.W. (Westinghouse Hanford Co., Richland, WA (United States)); Huckaby, J.L.; Rudolph, T.P.; Hewitt, E.R.; Mahulum, D.D.; Young, J.Y.; Anderson, C.M. Westinghouse Hanford Co., Richland, WA (United States). 28 Feb 1994. 43p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94009387. Source: OSTI; NTIS; GPO Dep.

Two problems are addressed in this report: Potential flammability of gases, vapors, and an aerosol in tank 241-C-103 (hereafter identified as C-103) and potential worker health and safety hazards associated with the toxicity of constituents in C-103. Previous work indicated the potential presence of a fog in the tank, and the fuel content of the tank gases, vapors, and aerosol may be too high to permit work in the tank. Ten reports of adverse health effects associated with vapor exposures near C-103 or in C-Farm have been made by workers. Reported symptoms include headaches, burning sensations in nose and throat, nausea, and impaired pulmonary function. Data are needed to identify and quantify constituents of the C-103 headspace to address potential vapor toxicity. When the compounds of toxicological interest in the tank headspace are identified, industry hygienists can assess "worst-case" worker exposure levels and focus their industrial hygiene monitoring strategy on these target compounds. Final recommendations on the required level of personal protective equipment will be based on the worker breathing zone levels of these chemicals.

1555 (WHC-MR-0213) Single-Shell Tank Phase IA/IB Procedure Compendium. Simiele, C.J. Westinghouse Hanford Co., Richland, WA (United States). Mar 1991. 839p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91018255. Source: OSTI; NTIS; INIS; GPO Dep.

This Single-Shell Tank Phase IA/IB Compendium contains methods used by the Westinghouse Hanford Company (222-S Laboratory) and Pacific Northwest Laboratory (325/329 Laboratories) during Phase IA/IB of the Single-Shell Tank (SST) Characterization Project. Phase IA/IB is defined as the period during which laboratory methods, evaluation, and development occurred, as they applied to the SST Characterization Project. The analysis methods in this compendium describe procedures without modifications or revision utilized during the evaluation and development

stage. The methods used to complete the SST analyses included organic, inorganic, physical, and radiochemical analyses. The scope of Phase IA/IB included the analyses completed on SSTs 241-U-110 (U-110) and 241-B-110 (B-110). Eight cores were taken from SST U-110 that consisted of twenty-three segment samples. These cores were analyzed by the 222-S Laboratory. Eight cores were also taken from SST B-110 that consisted of forty segment samples. These cores were analyzed by the 325/329 Laboratories. Cores from each SST were received by the respective laboratory between August and December 1989, and analyses were completed on the final core in December 1990.

1556 (WHC-MR-0248) 242-A Evaporator crystallizer facility integrated annual safety appraisal: Fiscal year 1991. Westinghouse Hanford Co., Richland, WA (United States). [1991]. 97p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91018154. Source: OSTI; NTIS; INIS; GPO Dep.

This report provides the results of the Fiscal Year (FY) 1991 Annual Integrated Safety Appraisal of the 242-A Evaporator Crystallizer Facility in the Hanford 200 East Area. The appraisal was conducted in December 1990 and January 1991, by the Waste Tank Safety Assurance (WTSA) organizations in conjunction with Radiological Engineering, Criticality Safety, Packaging and Shipping Safety, Emergency Preparedness, Environmental Compliance, and Quality Assurance. Reports of these eight organizations are presented as Sections 2 through 7 of this report. The purpose of the appraisal was to verify that the 242-A Evaporator meets US Department of Energy (DOE) and Westinghouse Hanford Company (WHC) requirements and current industry standards of good practice for the areas being appraised. A further purpose was to identify areas in which program effectiveness could be improved. In accordance with the guidance of WHC Management Requirements and Procedures (MRP) 5.6, previously identified deficiencies which are being resolved by line management were not repeated as Findings or Observations unless progress or intended disposition was considered to be unsatisfactory.

1557 (WHC-MR-0250) Waste Tank 241-A-105 supporting documentation: Miscellaneous reports, letters, memoranda, and data. Neilsen, E.H. Westinghouse Hanford Co., Richland, WA (United States). Jul 1991. 479p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91016736. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents references (mostly internal memoranda and letters) used to support a task team investigation of Waste Tank 241-A-105. These documents are presented in chronological order (cross-referenced by author) and may provide insight with respect to the operation and status of Waste Tank 241-A-105. The following documents contain little technical information. For technical information and data on Waste Tank 241-A-105, the reader is referred to the extensive references cited in WHC-EP-0409, entitled "241-A-105 Waste Tank Program: Summary Report and Plans."

1558 (WHC-MR-0264) Tank 241-A-105 leak assessment. Westinghouse Hanford Co., Richland, WA (United States). Jun 1991. 98p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92002047. Source: OSTI; NTIS; GPO Dep.

Tank 241-A-105 is one of 149 single shell tanks constructed at Hanford to contain and store highly radioactive

wastes originating from the processing of spent nuclear reactor fuel. Radiation detection and temperature monitoring devices installed beneath the tank indicate that several episodes of leakage of waste from the tank have occurred. The aim of this study was to evaluate the previous estimates and reanalyze the data to provide a more accurate estimate of leakage from the tank. The principal conclusions of this study are as follows: Earlier investigators estimated leakage prior to August 1968 at 5,000 to 15,000 gallons. Their estimate appears reasonable. Leakage while the tank was being sluiced (8/68–11/70) probably exceeded 5,000 gallons, but probably did not exceed 30,000 gallons. Insufficient data are available to be more precise. Cooling water added to the tank during the sprinkling phase (11/70 – 12/78) was approximately 610,000 gallons. Sufficient heat was generated in the tank to evaporate most, and perhaps nearly all, of this water. Radionuclides escaping into the soil under the tank cannot be estimated directly because of many uncertainties. Based on a range of leakage from 10,000 to 45,000 gallons, assumed compositions, and decayed to 1/1/91, radioactivity under the tank is expected to be in the range of 85,000–760,000 curies. Measured radiation peaks were nearly all located directly below the perimeter of the tank and, except in rare cases, they showed no tendency to spread horizontally. Moreover, the maximum radiation readings detected are a very small fraction of the radiation reading in the tank. This is the basis for the conclusion that the rate of leakage and, most likely, the quantity leaked, was small. 51 refs., 5 figs., 3 tabs.

1559 (WHC-MR-0300) Tank 241-SX-108 leak assessment. Westinghouse Hanford Co., Richland, WA (United States). May 1992. 63p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92015898. Source: OSTI; NTIS; INIS; GPO Dep.

This report has been prepared by Ebasco Services Incorporated (Ebasco) under WHC Task Order MLW-SVV-037106. The work has performed under Task E-91-10. Environmental/Safety Evaluation of Waste Tank Historical Data, Subtask Tank 241-SX-108 (Tank SX-108) Leak Assessment. The intent of the work was to evaluate previous leak estimates for Tank SX-108 and to determine whether these are accurate based on all available information.

1560 (WHC-MR-0300-Suppl.1) Tank 241-SX-108 supporting documentation: Miscellaneous reports, letters, memoranda, and data: Supplement 1. Neilsen, E.H. Westinghouse Hanford Co., Richland, WA (United States). May 1992. 522p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92015899. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report presents references (primarily internal memoranda and letters) used to support a leak assessment of Waste Tank 241-SX-108. These documents are presented in chronological order (cross-referenced by author) and may provide insight with respect to the operation and status of Waste Tank 241-SX-108. For technical evaluation and conclusions relating to waste volume and radionuclide content of leakages, the reader is referred to WHC-EP-0300. Tank 241-SX-108 Leak Assessment. This report contains 48 miscellaneous reports, letters, memoranda, and data that deal with Waste Tank 241-SX-108, which is located in the 200 West Area on the Hanford Site. These documents range in data from 1957 to 1991. They support an investigation of leakage from Waste Tank 241-SX-108.

1561 (WHC-MR-0302) Tank 241-SX-115 Leak Assessment. Westinghouse Hanford Co., Richland, WA (United States). Nov 1992. 49p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93005012. Source: OSTI; NTIS; INIS; GPO Dep.

Tank 241-SX-115 (SX-115) is one of 149 underground single-shell tanks (SST) used for the storage of radioactive wastes at the Hanford Site near Richland, Washington. The status of Tank SX-115 today is Interim Stabilized/Interim Isolated. It contains approximately 12,000 gal of dry sludge (no interstitial liquid). Tank SX-115 was built in 1953-1954 and was put into service on August 31, 1958. In March 1965 Tank SX-115 was found to have leaked about 50,000 gal of nitrate solution into the sediments beneath the tank. The remaining solution was pumped to another tank, a small air purge was introduced, and the nearly empty tank was allowed to dry through self-heating. In August 1965 10 test wells were drilled around the tank. Data from these wells and from the already existing drywells and materials were used in earlier studies to define and characterize the contaminated area under the tank. About 60% the leaked material was accounted for. It appears possible that part of the 40% not accounted for may have penetrated deeper into the sediments below the tank. Evidence to support this inference is the relatively high level of radioactivity in Lateral 3 that persisted from 1969 through 1987. If it is necessary to confirm this and to fully define the extent of contamination before final plans for remediation are made, core drilling at an angle under the tank will be required. Radionuclides remaining in the leakage plume as of January 1, 1992, are approximately 21,000 Ci, almost all of it ¹³⁷Cs.

1562 (WHC-MR-0302-Suppl.1) Tank 241-SX-115 supporting documentation: Miscellaneous reports, letters, memoranda, and data: Supplement 1. Neilsen, E.H. Westinghouse Hanford Co., Richland, WA (United States). Oct 1991. 267p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93004989. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report presents references (primarily internal memoranda, reports, and letters) used to support a leak assessment of Waste Tank 241-SX-115. These documents are presented in chronological order (cross-referenced by author) and may provide insight with respect to the operation and status of Waste Tank 241-SX-115. For technical evaluation and conclusions relating to waste volume and radionuclide content of leakages, the reader is referred to WHC-MR-0302, Tank 241-SX-115 Leak Assessment.

1563 (WHC-MR-0386) Integrity Assessment Plan for the T-Plant Decontamination Facility Tank Systems: Final report. LaBarge, M.J. (Science Applications International Corp., Richland, WA (United States)). Westinghouse Hanford Co., Richland, WA (United States); Science Applications International Corp., Richland, WA (United States). Dec 1992. 81p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Contract MLW-SVV-518974. Order Number DE93006533. Source: OSTI; NTIS; INIS; GPO Dep.

An Integrity Assessment Plan (IAP) is presented for the T-Plant Decontamination Facility Tank Systems, located in the 200 West Area on the Hanford Site. The T-Plant Facility provides decontamination services (i.e., the removal of radioactive contamination from equipment and vehicles) for the Hanford Site; the systems contained in Buildings 221-T

and 2706-T that handle the liquid wastes resulting from decontamination activities are the subject of the planned Integrity Assessment. The document describes the facility components and the processes that are encompassed in the facility operations. The tasks required to be evaluated whether the waste handling system is in compliance with applicable regulations are listed and discussed. Although the recommendation of facility upgrades is outside the scope of this IAP, where upgrades are obviously needed they are noted. The IAP concludes with a schedule of tasks and an estimate of the budget of time and money needed to complete the Integrity Assessment.

1564 (WHC-MR-0387-1) UST-ID Critical Path: Number 1, October 1991–April 1992. La Barge, F.R. (Westinghouse Hanford Co., Richland, WA (United States)); Cruse, J.M.; Gates, T.E.; Gilchrist, R.L.; Smith, E.H.; Widrig, J.E. Westinghouse Hanford Co., Richland, WA (United States). Jul 1992. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92040482. Source: OSTI; NTIS; GPO Dep.

UST-ID Critical Path is an informational report concerning the US Department of Energy, Office of Technology Development Underground Storage Tank – Integrated Demonstration (UST-ID) Program. The report will cover a wide variety of topics, ranging from a description of activities being conducted by principal investigators to an explanation of how the program planning group, technical support groups, and regulatory steering group are progressing. There will be articles concerning characterization; high-level and low-level waste treatment and disposal; retrieval, transfer, and storage; waste separation; in situ treatment and disposal; and site closure. Each issue should contain information for everyone in the DOE complex interested in the UST-ID Program.

1565 (WHC-MR-0387-2) UST-ID Critical Path, Number 2, May–September 1992. La Barge, F.R. Westinghouse Hanford Co., Richland, WA (United States). Feb 1993. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93009427. Source: OSTI; NTIS; GPO Dep.

Fiscal year 1992 comes to a close with several successes to report: the UST-ID activities were communicated and coordinated with representatives from Tank Waste Remediation System; tests were conducted on several technologies; designs and fabrications were delivered to the Hanford Site (for demonstration); significant findings in leachability were discovered; and lastly, but certainly not least, full-scale retrieval demonstration was conducted, with an additional retrieval demonstration scheduled for November 9–12, 1992.

1566 (WHC-MR-0402) Tank 241-T-111 Core 31 and Core 33 summary results. McKinney, S.G. Westinghouse Hanford Co., Richland, WA (United States). Dec 1992. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93008243. Source: OSTI; NTIS; INIS; GPO Dep.

Tank 241-T-111 (referred to as T-111 in the remainder of this package) is a single shell tank built in 1944 with an operating capacity of 500,000 gallons. T-111 received 488,000 gallons of "2C" and "224" type wastes through February 1976, and is classified as EHW (extremely hazardous waste). During early remediation efforts, ending in 1978, nearly 25,100 gallons of liquid was pumped out of T-111. The "2C" waste was from the second decontamination cycle of the bismuth phosphate process at the B and T plants.

This waste consists of the liquid remaining after precipitation of the plutonium. The "224" waste was from the final decontamination and concentration stage of the bismuth phosphate process. The analyses in this data package were performed by the Westinghouse Hanford 222-S Laboratory or the Battelle Pacific Northwest Laboratory (PNL) under the guidance provided in the "Waste Characterization Plan for the Hanford Site Single Shell Tanks" (WHC-EP-0210) and the "Sampling and Analysis of Ten Single Shell Tanks" (WHC-SOW-91-0006).

1567 (WHC-MR-0406) Final report of the systems engineering technical advisory board for the Tank Waste Remediation Program. Baranowski, F.P.; Goodlett, C.B.; Beard, S.J.; Duckworth, J.P.; Schneider, A.; Zahn, L.L. Westinghouse Hanford Co., Richland, WA (United States). Mar 1993. 70p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93018731. Source: OSTI; NTIS; INIS; GPO Dep.

The Tank Waste Remediation System (TWRS) is one segment of the environmental restoration program at the Hanford site. The scope is to retrieve the contents of both the single shell and double shell tanks and process the wastes into forms acceptable for long term storage and/or permanent disposal. The quantity of radioactive waste in tanks is significantly larger and substantially more complex in composition than the radioactive waste stored in tanks at other DOE sites. The waste is stored in 149 single shell tanks and 28 double shell tanks. The waste was produced over a period from the mid 1940s to the present. The single shell tanks have exceeded their design life and are experiencing failures. The oldest of the double shell tanks are approaching their design life. Spar double shell tank waste volume is limited. The priorities in the Board's view are to manage safely the waste tank farms, accelerate emptying of waste tanks, provide spare tank capacity and assure a high degree of confidence in performance of the TWRS integrated program. At its present design capacity, the glass vitrification plant (HWVP) will require a period of about 15 years to empty the double shell tanks; the addition of the waste in single shell tanks adds another 100 years. There is an urgent need to initiate now a well focused and centralized development and engineering program on both larger glass melters and advanced separations processes that reduce radioactive constituents in the low-level waste (LLW). The Board presents its conclusions and has other suggestions for the management plan. The Board reviews planning schedules for accelerating the TWRS program.

1568 (WHC-MR-0413) Hanford Site Tank Waste Remediation System: Waste management 1993 symposium papers and viewgraphs. Westinghouse Hanford Co., Richland, WA (United States). May 1993. 319p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930205–Pt.1: Waste management '93, Tucson, AZ (United States), 28 Feb - 4 mar 1993). Order Number DE93018065. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy's (DOE) Hanford Site in southeastern Washington State has the most diverse and largest amount of highly radioactive waste of any site in the US. High-level radioactive waste has been stored in large underground tanks since 1944. A Tank Waste Remediation System Program has been established within the DOE to safely manage and immobilize these wastes in anticipation of permanent disposal in a geologic repository. The Hanford Site Tank Waste Remediation System Waste Management

1993 Symposium Papers and Viewgraphs covered the following topics: Hanford Site Tank Waste Remediation System Overview; Tank Waste Retrieval Issues and Options for their Resolution; Tank Waste Pretreatment - Issues, Alternatives and Strategies for Resolution; Low-Level Waste Disposal - Grout Issue and Alternative Waste Form Technology; A Strategy for Resolving High-Priority Hanford Site Radioactive Waste Storage Tank Safety Issues; Tank Waste Chemistry - A New Understanding of Waste Aging; Recent Results from Characterization of Ferrocyanide Wastes at the Hanford Site; Resolving the Safety Issue for Radioactive Waste Tanks with High Organic Content; Technology to Support Hanford Site Tank Waste Remediation System Objectives.

1569 (WHC-MR-0429) Ferrocyanide Safety Program rationale for removing six tanks from the safety watch list. Borsheim, G.L. Westinghouse Hanford Co., Richland, WA (United States). Sep 1993. 250p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94004827. Source: OSTI; NTIS; INIS; GPO Dep.

This report documents an in-depth study of single-shell tanks containing ferrocyanide wastes. Topics include: safety assessments, tank histories, supportive documentation about interim stabilization and planned remedial activities.

1570 (WHC-MR-0433) Type C Investigation report of crane two-blocking event at 241-SY-101 double-shell waste tank. Westinghouse Hanford Co., Richland, WA (United States). Aug 1993. 39p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94002413. Source: OSTI; NTIS; GPO Dep.

This report summarizes the results of a joint Westinghouse Hanford Company (WHC) and Kaiser Engineers Hanford (KEH) investigation into the June 22, 1993 crane event in SY tank farm. The direct cause of the two-block event was operator error; the operator's concentration was distracted from the area of primary responsibility, which was crane operation. Poor work planning and equipment design were contributing factors in the event. Lack of an adequate supply of rope to use as a tag line added increased complexity to the task. This complexity, in the absence of operator aids or designed interlocks to prevent two-blocking the crane, contributed to the event. The timeliness of event reporting issue appears to center on the completeness of event reporting to the line organization responsible for the facility. The causes of this were inadequate training of the designated person-in-charge (PIC) and no formal requirement for external contractors to notify the facility owner of the event.

1571 (WHC-MR-0438) Type B Investigation Report for 241-SY-101 Pump Start and 241-C-106 Pit Cleanout. Ewalt, J.R. Westinghouse Hanford Co., Richland, WA (United States). Sep 1993. 232p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94009438. Source: OSTI; NTIS; GPO Dep.

In accordance with the direction of the Department of Energy (DOE) Manager, Richland Operations Office, a Type "B" investigation in accordance with the DOE Order 5484.1, Environmental Protection, Safety and Health Protection Information Reporting Requirements, has been conducted. The scope of the investigation included two events: The "Inadvertent Mixer Pump Operation at 241-SY-101" (RL-WHC-TANK FARM-1993-069); "Inadequate Work Control Results in Personnel Skin Contamination at 241-C-106, Pit

B" (RL-WHC-TANK FARM-1993-071) events. Additionally, at the request of the President of the WHC, a broader investigation into Waste Tank Farm "safety practices" and "Conduct of Operations" was also conducted. The review was focused on (1) WHC organizations performing operations, maintenance, and radiological safety tasks; and (2) KEH organizations performing major maintenance tasks.

1572 (WHC-SA-0646) Long-term management of Hanford Site single-shell tank waste. Opitz, B.E.; Owens, K.W.; Hall, V.W. Westinghouse Hanford Co., Richland, WA (United States). May 1990. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-9006240-1: American Society for Testing and Materials (ASTM) symposium on water in the 1990's: meeting new challenges, Denver, CO (United States), 11-14 Jun 1990). Order Number DE90014063. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Since the 1940's, defense-related nuclear waste has been stored in single-shell tanks on the Hanford Site. The radioactive components of the waste are regulated in accordance with the Atomic Energy Act of 1954. The hazardous components are regulated in accordance with the Resource Conservation and Recovery Act as implemented by the Washington State Dangerous Waste Regulations. This report provides a background of the single-shell tank waste and a description of the initial studies underway to characterize the material that will provide information to support performance assessment studies and regulatory compliance while minimizing unnecessary radiation doses to workers. 13 refs., 2 figs., 2 tabs.

1573 (WHC-SA-0880) Underground storage tank compliance activities at the Hanford Site. Morton, M.R.; Mihalic, M.A. Westinghouse Hanford Co., Richland, WA (United States). Aug 1990. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-9010186-2: HAZTECH international 1990 conference, Pittsburgh, PA (United States), 2 Oct 1990). Order Number DE90017235. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Hanford Site covers 560 mi² of semi-arid land that is owned by the US Government and managed by the US Department of Energy-Richland Operations Office (DOE-RL). It is located in the Columbia Basin and northwest of the City of Richland, Washington, which lies approximately 5 mi from the southernmost portion of the Hanford Site boundary and is the nearest population center. In early 1943, the US Army Corps of Engineers selected the Hanford Site for the production and purification of plutonium. The purpose of this report is fourfold: it describes the underground storage tanks (UST) at the Hanford Site regulated by title 40 Code of Federal Regulations (CFR) 280 (EPA 1988a); it defines the compliance programs completed, underway, or planned by the affected Hanford Site contractors; it provides costs of program compliance; and it defines long-range planning to comply with 40 CFR 280 after 1998. 5 refs., 1 fig., 2 tabs.

1574 (WHC-SA-0937) Radioactive waste storage tanks at the Hanford Site. Wodrich, D.D. Westinghouse Hanford Co., Richland, WA (United States). Jun 1990. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-9006199-2: United States delegation to the Soviet Union on environmental restoration and waste management conference, Moscow (USSR), 15-29 Jun 1990). Order Number DE90017234. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Hanford Site in south-central Washington State has been a major US Government facility for the production of nuclear materials for nuclear weapons and research and development since the early 1940s. Today, its nuclear material production mission is drawing to a close, and the major mission is waste management and environmental restoration. This paper describes one area of waste management: the storage and disposal of the radioactive waste in underground tanks. Large underground storage tanks have been the central waste management facilities at the Hanford Site. The liquid radioactive wastes resulting from chemically processing nuclear reactor spent fuel to recover the plutonium and uranium have been neutralized and sent to these tanks for the past 46 years. Liquid wastes from other processes, laboratories, and reactor decontamination solutions have also been sent to the tanks. Also, the wastes have been concentrated, selected radioisotopes removed, and the different waste types intermingled. This large volume of multiple waste types, much of it stored in old facilities, presents a challenging waste disposal effort. 18 figs.

1575 (WHC-SA-0999) Innovative technologies and unit operations available for potential in situ and ex situ treatment of waste and residuals for Hanford single-shell tanks. McLaughlin, T.J. (Bovay Northwest Inc., Richland, WA (United States)); Lamar, D.A.; Phillips, S.J. Westinghouse Hanford Co., Richland, WA (United States). [1991]. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-910270-63: Waste management '91, Tucson, AZ (United States), 24 Feb - 1 mar 1991). Order Number DE91016946. Source: OSTI; NTIS; GPO Dep.

In July 1990, the "Third Party Technical Workshop - Hanford Site Single-Shell Tank Waste and Residuals" was held in Spokane, Washington. The objective of the workshop was to identify, discuss, and rate innovative technologies that have not been seriously explored for treatment of single-shell tank waste and residuals. Ten nationally-recognized waste management experts were asked to attend the workshop and to bring their ideas on how to treat this unique waste stream either "in situ" (treat in place) or "ex situ" (remove and treat). The long-term objective of this initiative was to assist the US Department of Energy-Richland Operations Office and Westinghouse Hanford Company in partially fulfilling a milestone to identify an appropriate means of disposing of waste, tanks, contaminated piping and soils by January 1999. A total of 11 ex situ and 11 in situ applied technologies with potential applicability to single-shell tank waste and residuals were identified and discussed in the workshop. An additional 12 nonapplied, innovative (brainstormed) technologies were also identified.

1576 (WHC-SA-1017) Hanford high-activity waste tank safety issues. Babad, H.; Deichman, J.L. Westinghouse Hanford Co., Richland, WA (United States). Feb 1991. 18p. Sponsored by USDOE, Washington, DC (USA). DOE Contract AC06-87RL10930. (CONF-910270-57: Waste management '91, Tucson, AZ (United States), 24 Feb - 1 mar 1991). Order Number DE91012198. Source: OSTI; NTIS; INIS; GPO Dep.

A description of seven primary safety issues associated with continued storage of high-activity wastes in Hanford single- and double-shell storage tanks is presented. Extensive management controls are employed to assure that the tanks continue to be maintained in a safe manner. In addition, comprehensive monitoring, characterization and

applied research efforts have been initiated to support resolution of issues and to prevent creation of future problems associated with potentially incompatible wastes or actions related to the planned disposal of the wastes in these storage tanks. Such efforts will also provide the basis for safe near future remediation of tanks and define the envelope of safety to support the disposal of all high-activity waste in the Hanford tanks. 3 refs., 2 figs., 4 tabs.

1577 (WHC-SA-1071) DOE Hanford Site tank farm interim stabilization during 1990. Boyles, V.C. Westinghouse Hanford Co., Richland, WA (United States). May 1991. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-910603-21: Annual meeting of the American Nuclear Society (ANS), Orlando, FL (United States), 2-6 Jun 1991). Order Number DE91018147. Source: OSTI; NTIS; INIS; GPO Dep.

Three single-shell nuclear waste storage tanks at the US Department of Energy (DOE) Hanford Site were interim stabilized during 1990 using a jet pump system. This paper discusses the pumping system, processes, stabilization criteria, and problems encountered during interim stabilization of these tanks. An upgraded pumping system was used that was developed from a previous jet pumping campaign completed in 1985. 6 figs.

1578 (WHC-SA-1132) The essential linearity of thermal radiation net transport. Barker, J.J. Westinghouse Hanford Co., Richland, WA (United States). Jun 1991. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-911071-2: American Chemical Society (ACS) symposium on emerging technologies for hazardous waste management, Atlanta, GA (United States), 1-3 Oct 1991). Order Number DE91016734. Source: OSTI; NTIS; INIS; GPO Dep.

Thermal radiation net transport is proportional to the difference in the fourth powers of the absolute temperatures of the radiator and the receiver. During a study of heat transfer mechanisms in the underground storage tanks for the radioactive wastes at the Hanford Site in Washington, it was discovered that the fourth power difference is approximated by a linear function of the temperature difference between the radiator and the receiver, with astounding fidelity. This linearity makes satisfying boundary conditions for analytical and numerical calculations much simpler and simplifies comparisons with other modes of heat transfer. The paper derives the relationship and illustrates its use by demonstrating that radiation transports more heat through the air space in the tank than does natural convection. 3 refs., 4 figs., 2 tabs.

1579 (WHC-SA-1133) Thermocouple placement and hot spots in radioactive waste tanks. Barker, J.J. Westinghouse Hanford Co., Richland, WA (United States). Jun 1991. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-911071-3: American Chemical Society (ACS) symposium on emerging technologies for hazardous waste management, Atlanta, GA (United States), 1-3 Oct 1991). Order Number DE91016628. Source: OSTI; NTIS; INIS; GPO Dep.

Analytical solutions available in Carslaw and Jaeger's Conduction of Heat in Solids for continuous point sources and for continuous finite sources are used to demonstrate that placement of thermocouples on a fine enough grid to detect a hot spot is impracticable for existing waste tanks but fortunately not necessary. Graphs covering ranges of

diffusivities, times, temperatures and heat generation rates are included. 2 refs., 8 figs., 5 tabs.

1580 (WHC-SA-1144) Nonlinear analysis techniques for use in the assessment of high-level waste storage tank structures. Moore, C.J. (Westinghouse Hanford Co., Richland, WA (United States)); Julyk, L.J.; Fox, G.L.; Dyrness, A.D. Westinghouse Hanford Co., Richland, WA (United States). Sep 1991. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-9110122-13: Natural phenomena hazards mitigation conference, St. Louis, MO (United States), 15-18 Oct 1991). Order Number DE92002107. Source: OSTI; NTIS; INIS; GPO Dep.

Reinforced concrete in combination with a steel liner has had a wide application to structures containing hazardous material. The buried double-shell waste storage tanks at the US Department of Energy's Hanford Site use this construction method. The generation and potential ignition of combustible gases within the primary tank is postulated to develop beyond-design-basis internal pressure and possible impact loading. The scope of this paper includes the illustration of analysis techniques for the assessment of these beyond-design-basis loadings. The analysis techniques include the coupling of the gas dynamics with the structural response, the treatment of reinforced concrete in regimes of inelastic behavior, and the treatment of geometric nonlinearities. The techniques and software tools presented provide a powerful nonlinear analysis capability for storage tanks. 10 refs., 13 figs., 1 tab.

1581 (WHC-SA-1189) Decommissioning of a grout-and waste-filled storage tank in the 200 East Area of the Hanford Site. Marske, S.G. Westinghouse Hanford Co., Richland, WA (United States). [1991]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-910981-39: Environmental remediation '91 conference, Pasco, WA (United States), 8-11 Sep 1991). Order Number DE92002343. Source: OSTI; NTIS; INIS; GPO Dep.

A self-concentrating waste tank located at the Strontium Semiworks Facility in the 200 East Area of the Hanford Site will be decommissioned following waste removal. During a previous decommissioning phase, the tank, thought to be empty, was filled with grout to prevent it from collapsing over time. Several years later, an agitator rod was pulled from within the tank and found to contain significant amounts of radiation, indicating there was still radioactive waste in the tank. Several alternative waste-removal options have been researched and evaluated. It is concluded that before the waste is to be disposed, the grout must be removed. This paper addresses that effort.

1582 (WHC-SA-1196) Application of a CdTe gamma-ray spectrometer to remote characterization of high-level radioactive waste tanks. Keele, B.D.; Addleman, R.S.; Blewett, G.R.; McClellan, C.S.; Subrahmanyam, V.B.; Troyer, G.L. Westinghouse Hanford Co., Richland, WA (United States). Oct 1991. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-911116-4: ICALEPCS '91: International conference on accelerator and large experimental physics control systems, Tsukuba (Japan), 11-15 Nov 1991). Order Number DE92002714. Source: OSTI; NTIS; INIS; GPO Dep.

Small, shielded cadmium telluride (CdTe) semiconductor gamma-ray detectors have been used for in situ radiological

characterization of underground high-level radioactive waste tanks. Remote measurements up to 700 R/h have been made in gamma radiation fields. Spectral data have been used to generate qualitative and quantitative radionuclide profiles of high-level radioactive waste tanks. Two electronic spectral enhancement techniques (pulse risetime discrimination and pulse risetime compensation) have been used in order to measure trace isotopes in the presence of large amounts of ^{137}Cs . Spectral resolution better than 1.5% FWHM for the ^{137}Cs 662 keV photopeak has been obtained. 4 refs., 7 figs.

1583 (WHC-SA-1215) Hanford waste tank safety issues. Babad, H.; Deichman, J.L.; Wodrich, D.D. Westinghouse Hanford Co., Richland, WA (United States). Aug 1991. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-910981-33: Environmental remediation '91 conference, Pasco, WA (United States), 8-11 Sep 1991). Order Number DE92002114. Source: OSTI; NTIS; INIS; GPO Dep.

This paper presents an overview of the potential high-activity waste safety issues in the 177 underground radioactive waste storage tanks at the Hanford Site. Also, included is a discussion of the strategy and plans to remedy hazardous conditions and remove other deficiencies related to the operation of the tanks. A three-pronged multimillion dollar integrated program has been initiated that (1) assesses and, on an as needed basis, defines remediation and/or mitigation actions to allow interim stabilization of high risk waste tanks; (2) upgrades existing facilities and instrumentation to meet current nuclear facility operations standards; and (3) addresses and upgrades the conduct of operations. For tanks that are considered at risk, extensive management controls presently are employed to ensure that the tanks continue to be maintained in a safe manner. In addition, comprehensive monitoring, characterization and applied research, and engineering efforts have been initiated to support resolution of safety issues. A key element of the Westinghouse Hanford Company effort is preventing future problems associated with creating potentially incompatible wastes as part of waste management activities associated with the planned disposal of the wastes in these storage tanks. Such efforts also will provide the basis for safe near future remediation of tanks and define and maintain the envelope of safety to support the ultimate disposal of all high-activity waste in Hanford Site tanks. 6 refs., 1 fig., 1 tab.

1584 (WHC-SA-1216) Evaluation of tanks that release flammable gases. Babad, H.; Reynolds, D.A.; Stepnewski, D.D.; Johnson, G.D. Westinghouse Hanford Co., Richland, WA (United States). Sep 1991. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-910981-54: Environmental remediation '91 conference, Pasco, WA (United States), 8-11 Sep 1991). Order Number DE92008359. Source: OSTI; NTIS; INIS; GPO Dep.

Scenarios of significant concern associated with waste in these flammable gas tanks include the following. The potential for ignition of flammable gases such as hydrogen-air and/or hydrogen-nitrous oxide, and the potential for secondary ignition of organic-nitrate mixtures by the crust initiated by the burning of flammable gases or mechanical in-tank energy source. Administrative and technical controls are in place to restrict activities that could cause undesirable exothermic reactions. So-called "normal" activities for tanks at issue are limited to surveillance. Special safety analysis documents prepared for all work inside the tank are

extensively peer reviewed and require US Department of Energy (DOE) approval. Although there are 22 other tanks also suspected of potentially containing smaller accumulations of hydrogen or other flammable gases, this paper will focus only on Tank 241-SY-101. There is a significant difference in severity between Tank 241-SY-101 and the other 22 tanks. Evidence of venting, surface level behavior, and knowledge of the other tank contents suggests a much lower likelihood of potentially dangerous gas concentrations in these other tanks. This paper will center on Tank 241-SY-101 because it is currently the focus of efforts to understand and ultimately remediate the problem.

1585 (WHC-SA-1218) High organic containing tanks: Assessing the hazard potential. Hill, R.C.P.; Babad, H. Westinghouse Hanford Co., Richland, WA (United States). Sep 1991. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-910981-31: Environmental remediation '91 conference, Pasco, WA (United States), 8-11 Sep 1991). Order Number DE92002050. Source: OSTI; NTIS; INIS; GPO Dep.

Eight Hanford Site tanks contain organic chemicals at concentrations believed to be greater than 10 mole percent sodium acetate equivalent mixed with the oxidizing salts sodium nitrate/sodium nitrite. Also, three of the hydrogen and ferrocyanide tanks appear on the organic tank list. Concentrations of organics that may be present in some tanks could cause an exothermic reaction given a sufficient driving force, such as high temperatures. However, the difference between ignition temperatures and actual tank temperatures measured is so large that the probability of such a reaction is considered very low. The consequences of the postulated reaction are about the same as the scenarios for an explosion in a "burping" hydrogen tank. Although work on this issue is just beginning, consideration of hazards associated with heating nitrate-nitrite mixtures containing organic materials is an integral part of both the hydrogen and ferrocyanide tank efforts. High concentrations of organic compounds have been inferred (from tank transfer, flow sheet records, and limited analytical data) in eight single-shell tanks. Many organic chemicals, if present in concentrations above 10 dry weight percent (sodium acetate equivalent), have the potential to react with nitrate-nitrites constituents at temperatures above 200°C (392°F) in an exothermic manner. The concentrations of organic materials in the listed single-shell tanks, and their chemical identity, is not accurately known at present. A tank sampling program has been planned to provide more information on the contents of these tanks and to serve as a basis for laboratory testing and safety evaluations. 2 refs., 1 fig., 2 tabs.

1586 (WHC-SA-1219) Operating watch list tanks: A study in control. Ohl, P.C.; Hamrick, D.G.; Marchetti, S. Westinghouse Hanford Co., Richland, WA (United States). Sep 1991. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-910981-50: Environmental remediation '91 conference, Pasco, WA (United States), 8-11 Sep 1991). Order Number DE92006503. Source: OSTI; NTIS; INIS; GPO Dep.

In 1990, Section 3137 of Public Law 101-510 (commonly referred to as the Wyden Bill) identified 23 potential safety issues after reviewing tank farm facilities, operations, anomalies and investigations (Public Law 101-510, 1990). These issues range from episodic flammable gas releases to aging facilities. The 23 potential safety issues were categorized as Priority 1, 2, and 3 issues. The prioritization

process identified four Priority 1 safety issues, thirteen Priority 2 safety issues, and six Priority 3 safety issues. The four Priority 1 safety issues were found to affect 53 Hanford waste tanks (48 SSTs and 5 DSTs) now known as Watch List Tanks. These 53 tanks are undergoing extensive scrutiny through inspection, analysis, and documentation review to identify the full scope of the potential safety issues and the most effective methods for stabilization and mitigation/remediation of the potential threat to safety. The remaining 124 Hanford waste tanks (101 SSTs and 23 DSTs) are affected by one or more of the nineteen Priority 2 and 3 safety issues. These safety issues will be closed by upgrading Tank Farm equipment and documentation, further evaluation and remediation, or simply providing positive verification of current information. As the organizational and cultural changes introduced over the past year become a way of doing business in the Tank Farms and the physical upgrades give the Tank Farms staff the necessary tools to work with, operation of the Hanford waste tanks will be brought under control and the 23 identified safety issues will be resolved. As the safety issues are resolved work can be focused on final remediation of the wastes stored in the Hanford Site waste tanks and eventual closure of the Hanford site.

1587 (WHC-SA-1221) Extended tank use analysis. DeFigh-Price, C.; Green, D.J. Westinghouse Hanford Co., Richland, WA (United States). Sep 1991. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-910981-53: Environmental remediation '91 conference, Pasco, WA (United States), 8-11 Sep 1991). Order Number DE92008358. Source: OSTI; NTIS; INIS; GPO Dep.

The single-shell tanks at the Hanford Site were originally designed for 20 years of use. The newer double-shell tanks were designed for 50 years of use; a number of double-shell tanks failed their original design criteria soon after construction. These single-shell and double-shell tanks now will be required to contain semi-solid high-activity waste well beyond their design lives. It must be determined that the waste contained in these tanks will remain stable for up to an additional 30 years of storage. This paper describes the challenge of demonstrating that the tanks that have exceeded or will exceed their design lifetime can safely store high-level waste until planned disposal actions are taken to empty them. Considerations will include structural and chemical analysis.

1588 (WHC-SA-1222) Development of tank instrumentation: The search for appropriate monitoring. Mech, S.J.; Leggett, W.D.; Defigh-Price, C. Westinghouse Hanford Co., Richland, WA (United States). Sep 1991. 8p. Sponsored by USDOE, Washington, DC (United States). (CONF-910981-52: Environmental remediation '91 conference, Pasco, WA (United States), 8-11 Sep 1991). Order Number DE92008374. Source: OSTI; NTIS; INIS; GPO Dep.

For over 40 years the 177 high-level waste tanks containing Hanford's Site's nuclear processing wastes have operated without significant safety events. The processes being monitored and controlled were seen as slow acting and well understood. Of primary concern were the following: Heat of radioactive decay; Containment; Inventory; Interstitial liquid level. The methods and equipment used for surveillance purposes did not need to be particularly sophisticated, so they remained unchanged for many years. In 1990, in response to unresolved waste tank safety issues, a major effort was focused on providing the methods and equipment necessary to resolve these problems (WHC

1990). The challenge was to devise and provide instrumentation to support a range of functions from detection and surveillance, to identification, characterization, and mitigation (Johnson 1991). To provide adequate monitoring for Hanford Site waste tanks, an initial set of needed measurements have been identified and some candidate methods and equipment have been selected for hardening and feature testing. In general, the supporting data acquisition methods and equipment are being evaluated and enhanced. And finally, the entire instrumentation upgrade program is proceeding with a well defined program plan.

1589 (WHC-SA-1288) Hanford Site waste tank stability assessment: Characterization of headspace vapors by Fourier transform infrared-attenuated total reflectance method. Rebagay, T.V.; Dodd, D.A. Westinghouse Hanford Co., Richland, WA (United States). Feb 1992. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-920302-4: 43. Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy, New Orleans, LA (United States), 9-13 Mar 1992). Order Number DE92008631. Source: OSTI; NTIS; INIS; GPO Dep.

The Hanford Site (Figure 1) near Richland, Washington, operated by the US Department of Energy, Richland Field Office, produced nuclear materials for the nation's defense programs for more than 40 yr. The highly radioactive liquid wastes generated by the chemical processing of the irradiated nuclear fuels are stored temporarily in single- and double-shell steel tanks at the Hanford Site. One of the most important problems arising from the underground storage of waste materials that contain fission products is the high temperature caused by poor dissipation of heat through the surrounding soil. Under abnormal conditions exothermic reactions among the components of the wastes might occur, resulting in runaway organics-nitrate reactions. Laboratory experiments have demonstrated that mixtures of nitrate/nitrites with ferrocyanides decompose spontaneously and rapidly at elevated temperatures following these reactions: Ferrocyanide with nitrate $\text{Na}_2\text{NiFe}(\text{CN})_6 + 6\text{NaNO}_3 = 6\text{N}_2 + 2\text{CO}_2 + 4\text{Na}_2\text{CO}_3 + \text{FeO} + \text{NiO}$ Ferrocyanide with nitrite $\text{Na}_2\text{NiFe}(\text{CN})_6 + 10\text{NaNO}_2 = 8\text{N}_2 + 6\text{Na}_2\text{CO}_3 + \text{FeO} + \text{NiO}$. Recently, tank safety issues at the Hanford Site have been raised, including flammable gases, potentially explosive ferrocyanide-nitrate mixtures, and potential runaway organics-nitrate reactions. Gases such as H_2 , N_2O , N_2 , and water vapor are produced by the breakdown of the radioactive waste by thermolysis, radiolysis, or both. Hydrogen (H_2) is a safety concern because it can be explosive above certain concentrations. These tank safety concerns have created a need for a reliable system to monitor tank waste reactivity.

1590 (WHC-SA-1304) Graphical presentation of ferrocyanide tank compositions. Colby, S.A.; Crippen, M.D. Westinghouse Hanford Co., Richland, WA (United States). Aug 1991. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-910981-34: Environmental remediation '91 conference, Pasco, WA (United States), 8-11 Sep 1991). Order Number DE92002111. Source: OSTI; NTIS; GPO Dep.

This paper illustrates the composition of the Hanford Site ferrocyanide tanks using three-component diagrams. The diagrams show the thermodynamic and physical relationships between reactants and diluents as a function of concentration. They have been especially useful for clarifying safety work and chemistry issues. The three-component diagrams

act as a way to aid in the understanding of both possible and probable tank layer compositions. Most overall tank compositions appear to be nonreactive and indicate that the fraction of material that might react in tank is only a small part of the total. The result has been focus of effort on compositions that can actually propagate and a deemphasis on the many combinations that are endothermic. As sampling data becomes available actual tank compositions will be plotted on the diagrams. 6 figs.

1591 (WHC-SA-1306) Overview of the closure approach for the Hanford Site single-shell tank farm. Smith, E.H. Westinghouse Hanford Co., Richland, WA (United States). Sep 1991. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-910981-43: Environmental remediation '91 conference, Pasco, WA (United States), 8-11 Sep 1991). Order Number DE92003019. Source: OSTI; NTIS; INIS; GPO Dep.

The disposal of chemical and radioactive waste stored within the single-shell tanks (SST) represents one of the most significant waste management problems at the Hanford Site. A comprehensive program has been established to obtain analytical data regarding the chemical and radiological constituents within these tanks. This information will be used to support the development of a supplemental environmental impact statement (SEIS) and ultimately to aid in the selection of a final disposal option. This paper discusses some of the technical options and major regulatory issues associated with SST waste retrieval and in situ waste treatment and disposal. Certain closure options and treatment technologies will require further development before they can be implemented or accepted as being useful. In addition, continued negotiations with the regulatory authorities will be required to determine the preferred closure option and the regulatory pathway to accommodate such closure.

1592 (WHC-SA-1328) Hanford Site radioactive waste storage tank safety issues: The path to resolution. Wodrich, D.D.; Deichman, J.L. Westinghouse Hanford Co., Richland, WA (United States). Jan 1992. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-920307-34: Waste management '92, Tucson, AZ (United States), 1-5 Mar 1992). Order Number DE92008627. Source: OSTI; NTIS; INIS; GPO Dep.

High-level radioactive waste has been stored in large underground storage tanks at the US Department of Energy's (DOE) Hanford Site in Eastern Washington State since 1944. Since then, more than 227,000 m³ (60 Mgal) of waste have been accumulated in 177 tanks. These caustic wastes consist of many different chemicals. The waste forms include liquids, slurries, salt cakes, and sludges. A number of safety issues have been raised about these wastes, and resolution of these issues is a top priority of DOE. A Waste Tank Safety Program has been established and a series of logic charts have been developed that show relationships of the major activities and the steps necessary to resolve the issues. The path to safety issue resolution has been defined, and the effort is well underway.

1593 (WHC-SA-1343) Destruction of ferrocyanide compounds found in the Hanford Site's radioactive waste. Colby, S.A. Westinghouse Hanford Co., Richland, WA (United States). Jan 1992. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-920307-71: Waste management '92, Tucson, AZ (United States), 1-5 Mar 1992). Order Number DE92011334. Source: OSTI; NTIS; INIS; GPO Dep.

This paper reports the test results of candidate waste treatment processes to destroy nickel-ferrocyanide compounds contained in the Hanford Site's radioactive waste storage area. Candidate processes, including ozone oxidation, hydrogen peroxide oxidation, and calcination, were tested in the laboratory using a nonradioactive simulated waste. Ozone oxidation and calcination successfully destroyed the nickel-ferrocyanide. However, tests indicate that nickel-ferrocyanide is not easily destroyed using hydrogen peroxide. To determine the ozone/nickel-ferrocyanide oxidation rate, a laboratory scale prototype ozone reactor was employed. The prototype reactor provides excellent gas-liquid mass transport, which is envisioned to increase the overall nickel-ferrocyanide destruction rate. The analytical results indicate that 250 grams of ozone are required to oxidize 1 gram of nickel-ferrocyanide. At this reaction rate, the process would require excessively large quantities of ozone to process the waste at the Hanford Site. Efforts are currently underway to increase the reaction kinetics for the process. Finally, one processing option successfully demonstrated in the laboratory that encompass calcination not only destroys ferrocyanides, but also separates the transuranics from the bulk nonradioactive waste.

1594 (WHC-SA-1364) Understanding of cyclic venting phenomena in Hanford Site high-level waste tanks: The evaluation of Tank 241-SY-101. Babad, H. (Westinghouse Hanford Co., Richland, WA (United States)); Johnson, G.D.; Reynolds, D.A.; Strachan, D.M. Westinghouse Hanford Co., Richland, WA (United States). Feb 1992. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-920307-74: Waste management '92, Tucson, AZ (United States), 1-5 Mar 1992). Order Number DE92012199. Source: OSTI; NTIS; GPO Dep.

Tank 241-SY-101 is a double-shell, high-level waste tank located in the 200 West Area on the Hanford Site. This tank contains about one million gallons of concentrated neutralized waste. Shortly after the waste was put in the tank, the waste began to expand because of gas generation. In 1990 this tank was declared to have an unreviewed safety question because of the generation of flammable mixtures of hydrogen and nitrous oxide gas that was periodically released to the tank dome space and ventilation system. A safety program was established to characterize the waste and released gases and to determine an effective means to prevent the accumulation of those gases in the tank dome space and ventilation system. Results of the expanded characterization conducted in fiscal year 1991 are presented. Instrumentation placed in the tank helped to provide more detailed information on tank temperatures; gas pressure, gas flow rates, and gas composition.

1595 (WHC-SA-1369) Progress in evaluating the hazards of ferrocyanide waste storage tanks. Babad, H. (Westinghouse Hanford Co., Richland, WA (United States)); Cash, R.; Postma, A. Westinghouse Hanford Co., Richland, WA (United States). Mar 1992. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-920307-21: Waste management '92, Tucson, AZ (United States), 1-5 Mar 1992). Order Number DE92008375. Source: OSTI; NTIS; INIS; GPO Dep.

There are 177 high-level waste tanks on the Hanford site. Twenty-four single-shell tanks are identified as potential safety issues. These tanks contain quantities of ferrocyanide, nitrate, and nitrite salts that potentially could explode under certain conditions. Efforts were initiated in

September 1990 to determine the reactive properties of the ferrocyanide waste and to define the criteria necessary to ensure tank safety until mitigation or remediation actions, if required, could be implemented. This paper describes the results of recent chemical and physical studies on synthetic ferrocyanide waste mixtures. Data obtained from monitoring, tank behavior modeling, and research studies on waste have provided sufficient understanding of the tank behavior. The Waste Tank Safety Program is exploring to determine whether the waste in many of the ferrocyanide tanks actually represents an unreviewed safety question. The General Accounting Office (GAO) in October 1990 (1) suggested that ferrocyanide-tanks accident scenarios exceed the bounds of the Hanford Environmental Impact Statement (2). Using the same assumptions Westinghouse Hanford Company (WHC) staff confirmed the consistency of the GAO report calculations. The hypothetical accident scenario in the GAO report, and in the EIS, are based on several assumptions that may, or may not reflect actual tank conditions. The Ferrocyanide Stabilization Program at Westinghouse Hanford (summarized in this paper) will provide updated and new data using scientific research with synthetic and actual waste tank characterization. This new information will replace the assumptions on tank waste chemical and physical properties allowing an improved recalculation of current safety and future risk associated with these tanks.

1596 (WHC-SA-1405) Ferrocyanide containing tanks: A study in risk evaluation. Cash, R.J. (Westinghouse Hanford Co., Richland, WA (United States)); Babad, H.; Postma, A. Westinghouse Hanford Co., Richland, WA (United States). May 1992. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-920851-30: Spectrum '92: nuclear and hazardous waste management international topical meeting, Boise, ID (United States), 23-27 Aug 1992). Order Number DE92015901. Source: OSTI; NTIS; INIS; GPO Dep.

An accelerated program is underway at the Hanford Site to resolve a possible safety issue with storage of high-level radioactive wastes containing ferrocyanide and nitrate/nitrite compounds in underground storage tanks. In order to resolve this issue, it is necessary to determine (1) if it is possible for a significant exothermic chemical reaction to occur between the ferrocyanide and nitrate/nitrite wastes under existing conditions and (2) if the reaction could reach runaway conditions and result in release of radioactive debris to the environs. This paper describes the current progress and understanding of the safety issue and what actions are being taken to continue in situ safe storage of the waste until either its final disposal or remediation options can be implemented.

1597 (WHC-SA-1406) The Hydrogen Program: The present understanding of cyclic venting tanks. Babad, H. (Westinghouse Hanford Co., Richland, WA (United States)); Johnson, G.D.; Reynolds, D.A.; Strachan, D.M. Westinghouse Hanford Co., Richland, WA (United States). Apr 1992. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-920851-31: Spectrum '92: nuclear and hazardous waste management international topical meeting, Boise, ID (United States), 23-27 Aug 1992). Order Number DE92015900. Source: OSTI; NTIS; INIS; GPO Dep.

On the high-level waste tanks on the Hanford Site, 23 tanks have been identified as having a potential to generate and release hydrogen gases in an episodic manner. Efforts were initiated in 1990 to ensure safe operation of the tanks,

to conduct a characterization of the waste, and to develop approaches for mitigating the release of hydrogen containing gases. The focus of the efforts has been on Tank 241-SY-101 because it has been shown to be the most active tank for the cyclic release of gases. This tank vents gases about every 100 days, and the major components have been determined to be hydrogen (fuel), nitrous oxide (oxidizer) and nitrogen in about equal portions. In some cases, the venting has resulted in mixtures that are above the lower flammability limit. This paper will describe monitoring and characterization data obtained during the most recent gas release events and the results from the analysis of a full core sample taken from Tank 241-SY-101. Summary details of changes in temperature profiles for the tank and other instrument observations during release, gas composition, and volume data are reported. The paper will provide information on the results of synthetic waste studies aimed at defining the mechanisms of flammable gas generation, storage, and release. The new data obtained from characterization, monitoring, tank behavior modeling, and research studies on waste have provided sufficient understanding of the tank behavior that the Waste Tank Safety program is exploring remediation and mitigation alternatives. Finally, the presentation will summarize preliminary steps taken to define mitigation and remediation strategies for Tank 241-SY-101 and to close out the safety issue.

1598 (WHC-SA-1411) A survey of fiber optic sensor technology for nuclear waste tank applications. Greenwell, R.A. (Science & Engineering Associates, Inc. (United States)); Addleman, R.S.; Crawford, B.A.; Mech, S.J.; Troyer, G.L. Westinghouse Hanford Co., Richland, WA (United States). Jan 1992. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-920367-5: Department of Defense (DOD) fiber optics conference, McLean, VA (United States), 25 Mar 1992). Order Number DE92008545. Source: OSTI; NTIS; INIS; GPO Dep.

The need for suitable remote sensors in highly radioactive defense waste storage tanks is discussed. The harsh radiological and chemical tank environment precludes the use of standard sensors because of the need for intrinsically safe systems. Potential sensor systems based on fiber optics technologies suitable for hardening to the tank environment are identified. The need for certification standards for this type of environment is also discussed.

1599 (WHC-SA-1411-Rev.2) Survey of fiber-optic sensor for remote sensing in radiologically and chemically harsh environments: Revision 2. Addleman, R.S. (Westinghouse Hanford Co., Richland, WA (United States)); Crawford, B.A.; Mech, S.J.; Troyer, G.L.; Greenwell, R.A. Westinghouse Hanford Co., Richland, WA (United States). Sep 1992. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-9209184-7-Rev.2: The International Society for Optical Engineering (SPIE) meeting, Boston, MA (United States), 8-11 Sep 1992). Order Number DE93004998. Source: OSTI; NTIS; INIS; GPO Dep.

The need for suitable remote sensors in highly radioactive defense waste storage tanks is discussed. The harsh radiological and chemical tank environment precludes the use of standard sensors because of the need for intrinsically safe systems. Potential sensor systems based on fiber-optics technologies suitable for hardening to the tank environment are identified. The need for certification standards for this type of environment is also discussed.

1600 (WHC-SA-1471) Proposed use of a variable geometry truss manipulator for radioactive waste removal from underground storage tanks. Salerno, R.J. (Virginia Polytechnic Inst. and State Univ., Blacksburg, VA (United States). Dept. of Mechanical Engineering); Robertshaw, H.H.; Millsap, W.J.; Horner, C.G.; Bennett, D.W. Westinghouse Hanford Co., Richland, WA (United States). Jan 1992. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-920307-73: Waste management '92, Tucson, AZ (United States), 1-5 Mar 1992). Order Number DE92012201. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy's Hanford Site's single-shell tank waste problem and some proposed requirements for a waste retrieval manipulator are described. A proposed variable geometry truss (VGT) manipulator is described. The kinematic configuration of the VGT join and the kinematics of the manipulator are discussed. The developmental needs to field a working manipulator are described.

1601 (WHC-SA-1482) Measurement of ferrocyanides and oxyanions in waste sludges by Fourier transform infrared reflection methods. Rebagay, T.V.; Dodd, D.A.; Jeppson, D.W. Westinghouse Hanford Co., Richland, WA (United States). Aug 1993. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930826-1: 9. international conference on Fourier transform spectroscopy, Calgary (Canada), 23-27 Aug 1993). Order Number DE93040316. Source: OSTI; NTIS; INIS; GPO Dep.

Simulated waste sludges with compositions similar to some of the actual waste sludges stored in carbon steel tanks at the Hanford Site were measured for their ferrocyanide and oxyanion contents by Fourier transform infrared (FT-IR) reflection methods. The results indicated the viability of these methods to chemically characterize highly radioactive waste sludges.

1602 (WHC-SA-1492) The Hanford Site high-level tank waste data specification process. Waters, R.D. (Vanderbilt Univ., Nashville, TN (United States)); Babad, H. Westinghouse Hanford Co., Richland, WA (United States). Apr 1992. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-920851-37: Spectrum '92: nuclear and hazardous waste management international topical meeting, Boise, ID (United States), 23-27 Aug 1992). Order Number DE92015833. Source: OSTI; NTIS; INIS; GPO Dep.

Tank 241-SY-101, a double-shell tank in the 200 West Area of the Hanford Site, Richland, Washington, generates hydrogen gas, nitrous oxide, and other gases caused by radiolysis and other unknown chemical reactions, and episodically releases these gases to the tank vapor space approximately every 90 days. Some of these episodic releases have increased the hydrogen concentration in the vapor space to greater than its lower flammability limit in air. When the gases are trapped below the waste surface, the concentration of hydrogen is above its lower flammability limit in nitrous oxide. A full core sample was recovered to assist in characterization of the tank waste and development of mitigation and remediation alternatives. To optimize the sample assay process to meet divergent data user needs, a process for data specification was created. This paper discusses the process developed to obtain formal input of groups requiring data from the core samples and incorporate this input into revisions of the analytical plans. The

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integration of the data requirements is discussed as are methods for prioritizing the data needs.

1603 (WHC-SA-1492-Rev.1) The Hanford Site high-level tank waste data specification: Revision 1. Waters, R.D. (Vanderbilt Univ., Nashville, TN (United States)); Babad, H. Westinghouse Hanford Co., Richland, WA (United States). Apr 1992. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-920851-37-Rev.1: Spectrum '92: nuclear and hazardous waste management international topical meeting, Boise, ID (United States), 23-27 Aug 1992). Order Number DE93004980. Source: OSTI; NTIS; INIS; GPO Dep.

Tank 241-SY-101, a double-shell tank in the 200 West Area of the Hanford Site, Richland, Washington, generates hydrogen gas, nitrous oxide, and other gases caused by radiolysis and other unknown chemical reactions. This tank episodically (every 100 days) releases these gases to the tank vapor space. Some of these episodic releases have increased the hydrogen concentration in the vapor space to greater than its lower flammability limit in air. The initial core analysis plan was written by laboratory personnel based on an informal best engineering judgment assessment of the data needs. To optimize the sample assay process to meet divergent data user needs, a process for data specification was created. This paper discusses the process developed to obtain formal input of groups requiring data from the core samples and to incorporate this input into revisions of the analytical plans. The integration of the data requirements is discussed as are methods for prioritizing the data needs.

1604 (WHC-SA-1501) Biological toxicity evaluation of Hanford Site waste grouts. Rebagay, T.V. Dodd, D.A.; Voogd, J.A. Westinghouse Hanford Co., Richland, WA (United States). Oct 1992. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-921139-1: 13. annual meeting of the Society of Environmental Toxicology and Chemistry, Cincinnati, OH (United States), 8-12 Nov 1992). Order Number DE93004988. Source: OSTI; NTIS; INIS; GPO Dep.

Liquid wastes containing radioactive, hazardous, and regulated chemicals have been generated throughout the 50 years of operation of the Hanford Site of the US Department of Energy near Richland, Washington. These wastes are currently stored onsite in single- and double-shell carbon steel tanks. To effectively handle and treat these wastes, their degree of toxicity must be determined. The disposal of the low-level radioactive liquid portion of the wastes involves mixing the wastes with pozzolanic blends to form grout. Potential environmental hazards posed by grouts are largely unknown. Biological evaluation of grout toxicity is needed to provide information on the potential risks of animal and plant exposure to the grouts. The fish, rat, and Microtox toxicity tests described herein indicate that the grouts formed from Formulations 1 and 2 are nonhazardous and nondangerous. Using the Microtox solid-phase protocol, both soluble and insoluble organic and inorganic toxicants in the grouts can be detected. This protocol may be used for rapid screening of environmental pollutants and toxicants.

1605 (WHC-SA-1513) Underground storage tank-integrated demonstration: Applying tomorrow's technology today. Gilchrist, R.L. Westinghouse Hanford Co., Richland, WA (United States). May 1992. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-920851-29: Spectrum

'92: nuclear and hazardous waste management international topical meeting, Boise, ID (United States), 23-27 Aug 1992). Order Number DE92015555. Source: OSTI; NTIS; INIS; GPO Dep.

The integrated demonstration (ID) process is a critical component in the evolution of technology development and demonstration of its applicability to the mission of environmental restoration and waste management. To efficiently bring the best technologies to bear on the needs of the US Department of Energy (DOE) waste complex, and to successfully commercialize or otherwise implement the results of these proven technologies, integrated demonstration programs have been created to meet the common needs of multiple DOE sites. One such need is resolution of actions required for final closure and disposal of liquid (including sludge and salt cake) radioactive and chemical wastes that have been transferred to underground storage tanks (UST). Hence, the principle objective of the UST-ID Program is the demonstration and continued development of technologies suitable for the remediation of USTs. The eventual objective is the transfer of new technologies as a system to full-scale remediation at the DOE complexes and sites in the private sector. This demonstration is necessary to enable a final decision on disposal of UST wastes and soils, groundwater, and ancillary equipment.

1606 (WHC-SA-1540) An approach to molecular characterization of Hanford Site waste tanks. Crawford, B.A.; Addleman, R.S.; Rebagay, T.V.; Troyer, G.L.; Mech, S.J.; Reich, F.R. Westinghouse Hanford Co., Richland, WA (United States). Aug 1992. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-920815-7: 204. American Chemical Society (ACS) national meeting, Washington, DC (United States), 23-28 Aug 1992). Order Number DE92040798. Source: OSTI; NTIS; INIS; GPO Dep.

Radioactive wastes from defense operations have been stored at the US Department of Energy's Hanford Site in Washington State since the early 1940s. Over the past 5 decades, much of the waste that has accumulated in these tanks has undergone chemical breakdown because of interaction of chemical constituents with high radiation fields and caustic environments. The radiation fields in the tanks can reach 700 rad/h. In these fields, radiolysis is expected to occur with most organic and aqueous solution in the tanks. Radiolysis can best be compared to a fragmentation of chemicals that produces highly reactive species. These species often can form new molecular species. Radiolysis, coupled with the highly caustic environment of the waste tanks, produces even more mechanisms for formation of various degradation products. Typical degradation products are fragmented organics, hydrogen gas, and various nitrogen oxide gases. This report describes the use of molecular spectroscopy to determine the species present in the tanks.

1607 (WHC-SA-1545) Hanford Site Tank Waste Remediation System. Wodrich, D.D. Westinghouse Hanford Co., Richland, WA (United States). Apr 1992. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92015832. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy's (DOE) Hanford Site in southeastern Washington State has the most diverse and largest amount of highly radioactive waste of any site in the United States. High-level radioactive waste has been stored in large underground tanks since 1944. Approximately 227,000 m³ (60 Mgal) of caustic liquids, slurries, saltcakes,

and sludges have accumulated in 177 tanks. In addition, significant amounts of ^{90}Sr and ^{137}Cs were removed from the tank waste, converted to salts, doubly encapsulated in metal containers, and stored in water basins. A Tank Waste Remediation System has been established to safely manage these wastes and then to dispose of them. Implementing this system will require resolving several waste tank safety issues and maintaining safe storage, and then retrieving, treating, and disposing of the waste onsite or packaging it for offsite disposal.

1608 (WHC-SA-1549) Subsurface barrier technologies as potential interim actions for Department of Energy underground storage tanks. McLaughlin, T.J. (Bovay Northwest, Inc., Richland, WA (United States)); Airhart, S.P.; Beattie, K.L.; Rouse, J.K.; Phillips, S.J.; Stewart, W.E. Westinghouse Hanford Co., Richland, WA (United States). Apr 1992. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-920851-32: Spectrum '92: nuclear and hazardous waste management international topical meeting, Boise, ID (United States), 23-27 Aug 1992). Order Number DE92015895. Source: OSTI; NTIS; INIS; GPO Dep.

Westinghouse Hanford Company administers the US Department of Energy (DOE) Underground Storage Tank Integrated Demonstration (UST-ID) Program, which is designed to demonstrate technologies for the retrieval, treatment, and closure to DOE USTs and tank waste at five facilities throughout the US. In February 1992, Bovay Northwest conducted an UST workshop for Westinghouse Hanford. The scope of the workshop included a variety of applied subsurface barrier technologies that could be installed around an UST or series of USTs. This paper summarizes the information presented in the workshop. Once selected, screened technologies will be tested in the field in a full-scale demonstration and development project (also funded by the UST-ID program).

1609 (WHC-SA-1576) Disposal of Hanford site tank wastes. Kupfer, M.J. Westinghouse Hanford Co., Richland, WA (United States). Sep 1993. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-920815-27: 204. American Chemical Society (ACS) national meeting, Washington, DC (United States), 23-28 Aug 1992). Order Number DE94004491. Source: OSTI; NTIS; INIS; GPO Dep.

Between 1943 and 1986, 149 single-shell tanks (SSTs) and 28 double-shell tanks (DSTs) were built and used to store radioactive wastes generated during reprocessing of irradiated uranium metal fuel elements at the U.S. Department of Energy (DOE) Hanford Site in Southeastern Washington state. The 149 SSTs, located in 12 separate areas (tank farms) in the 200 East and 200 West areas, currently contain about $1.4 \times 10^5 \text{ m}^3$ of solid and liquid wastes. Wastes in the SSTs contain about $5.7 \times 10^{18} \text{ Bq}$ (170 MCi) of various radionuclides including ^{90}Sr , ^{99}Tc , ^{137}Cs , and transuranium (TRU) elements. The 28 DSTs also located in the 200 East and West areas contain about $9 \times 10^4 \text{ m}^3$ of liquid (mainly) and solid wastes; approximately $4 \times 10^{18} \text{ Bq}$ (90 MCi) of radionuclides are stored in the DSTs. Important characteristics and features of the various types of SST and DST wastes are described in this paper. However, the principal focus of this paper is on the evolving strategy for final disposal of both the SST and DST wastes. Also provided is a chronology which lists key events and dates in the development of strategies for disposal of Hanford Site tank

wastes. One of these strategies involves pretreatment of retrieved tank wastes to separate them into a small volume of high-level radioactive waste requiring, after vitrification, disposal in a deep geologic repository and a large volume of low-level radioactive waste which can be safely disposed of in near-surface facilities at the Hanford Site. The last section of this paper lists and describes some of the pretreatment procedures and processes being considered for removal of important radionuclides from retrieved tank wastes.

1610 (WHC-SA-1591) Cyclic gas releases in Hanford Site nuclear waste tanks. Reynolds, D.A.; Babad, H. Westinghouse Hanford Co., Richland, WA (United States). Sep 1992. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-9209229-4: Industrial and engineering chemistry (I&EC) special symposium of the American Chemical Society (ACS), Atlanta, GA (United States), 21-23 Sep 1992). Order Number DE93002805. Source: OSTI; NTIS; INIS; GPO Dep.

At the Hanford Site, 177 tanks have been constructed for storing radioactive waste; 53 tanks have been identified as having potential safety issues. This report focuses on tank 241-SY-101, which generates hydrogen gas and releases this gas on a cyclic schedule. The tank is instrumented extensively to monitor the hydrogen, and work restrictions minimize the risk of a hydrogen burn. Mitigation testing centers on two in-tank test assemblies: (1) a large mixer pump, and (2) dilution, heating, and ultrasonic devices. The current understanding of what is happening in the tank is presented in this paper.

1611 (WHC-SA-1600) International cooperation in the pretreatment of Hanford Site high-level liquid waste. Sutherland, D.G. (Westinghouse Hanford Co., Richland, WA (United States)); Grenard, C.E.; McKeon, T.M.; MacKay, S.M.; Snedeker, D.F. Westinghouse Hanford Co., Richland, WA (United States). Jul 1992. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-920808-8: American Institute of Chemical Engineers (AIChE) summer national meeting, Minneapolis, MN (United States), 9-12 Aug 1992). Order Number DE92040416. Source: OSTI; NTIS; INIS; GPO Dep.

The disposal of waste in the Hanford Site storage tanks (227 million L [60 million gal]) requires the pretreatment of this waste to separate the high-level fraction (90% of the radioactivity, 10% of the volume) from the low-level fraction. The high-level fraction will be vitrified, and the low-level fraction will be grouted. As part of the process of developing chemical separations flowsheets and new facility designs, Westinghouse Hanford Company contracted with British Nuclear Fuels for a design concept study based upon United Kingdom design and separations practices. Westinghouse Hanford Company prepared a flowsheet and facility design based on current accepted United States practices. This paper will describe the possible combination of United States/United Kingdom separations technologies. In addition, facility design practices, as related to large separations facilities in the United States and United Kingdom, will be addressed. The overall project intends to allow United States designers to select process and facility features that will benefit the facility design and operation. The objectives of the design and operation are to provide high separation coefficients, as low as reasonably achievable facility design with reduced life-cycle costs, and environmentally sound use of solvents and chemicals.

1612 (WHC-SA-1637) **FT-IR analyses of the oxidative decomposition products of cyanoferrate wastes.** Rebagay, T.V.; Dodd, D.A.; Colby, S.A. Westinghouse Hanford Co., Richland, WA (United States). Mar 1993. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930313-2: 44. Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy, Atlanta, GA (United States), 8-12 Mar 1993). Order Number DE93014589. Source: OSTI; NTIS; INIS; GPO Dep.

The Hanford Site (Fig. 1) near Richland, Washington, operated by the US Department of Energy, Richland Field Office, had produced nuclear materials for the nation's defense programs for more than 50 years. The radioactive liquid waste resulting from the processing of irradiated nuclear materials is stored temporarily in single-shell carbon steel tanks (Fig. 2) at the Site. The tanks are buried underground in tank farms with several feet of soil cover above the tank closure (Fig. 3). As part of a program to conserve tank space in the 1950s, a precipitation process was developed to scavenge radioactive cesium from the waste supernates. Ferrocyanide was added to the radioactive wastes and cesium-depleted supernates were discharged into cribs. Hexacyanoferrates [$\text{Fe}(\text{CN})_6^{3-}$ and $\text{Fe}(\text{CN})_6^{4-}$] are generally considered to be extraordinarily stable and even called-kinetically inert. However, recent 2 safety concerns have focused on the stability of cyanoferrate-bearing tanks containing large quantities of nitrates and nitrites. One strategy to resolve this concern involves oxidative decomposition of the cyanoferrates with common oxidants such as ozone (O_3) and hydrogen peroxide. This paper describes the results of the initial studies on the treatment of simulated cyanoferrate wastes with ozone and ozone-hydrogen peroxide mixtures. The oxidative decomposition products were analyzed by a Fourier transform infrared spectroscopic method.

1613 (WHC-SA-1661) **A strategy for resolving high-priority Hanford Site radioactive waste storage tank safety issues.** Babad, H.; DeFigh-Price, C.; Fulton, J.C. Westinghouse Hanford Co., Richland, WA (United States). Feb 1993. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930205-72: Waste management '93, Tucson, AZ (United States), 28 Feb - 4 mar 1993). Order Number DE93014626. Source: OSTI; NTIS; INIS; GPO Dep.

High-activity radioactive waste has been stored in large underground storage tanks at the US Department of Energy's (DOE) Hanford Site in Eastern Washington State since 1944. Since then, more than 227,000 m^3 (60 Mgal) of waste have been accumulated in 177 tanks. These caustic wastes consist of many different chemicals. The waste forms include liquids, slurries, salt cakes, and sludges. A number of safety issues have been raised about these wastes, and resolution of these issues is a top priority of DOE. A Waste Tank Safety Program has been established to resolve these high-priority safety issues. This paper will deal with three of these issues. The issues described are the release of flammable vapors from single- and double-shell tanks, the existence of organic chemicals, and/or ferrocyanide ion-containing fuel-rich mixtures of nitrate and nitrite salts in single-shell tanks.

1614 (WHC-SA-1668) **Advanced remediation, technology development in the Underground Storage Tank - Integrated Demonstration.** Gates, T.E.; Gilchrist, R.L. Westinghouse Hanford Co., Richland, WA (United States). Sep 1992. 6p. Sponsored by USDOE, Washington, DC

(United States). DOE Contract AC06-87RL10930. (CONF-9209226-3: American Chemical Society (ACS) special symposium on emerging technologies in hazardous waste management, Atlanta, GA (United States), 21-23 Sep 1992). Order Number DE93009419. Source: OSTI; NTIS; INIS; GPO Dep.

The Underground Storage Tank - Integrated Demonstration develops uniquely state-of-the-art and advanced state-of-the-art technologies that can be applied to ongoing and planned remediation of underground storage tanks at sites across the US Department of Energy complex. The Underground Storage Tank - Integrated Demonstration focuses on resolution of the actions required for final closure and waste disposal of liquid (including sludge and salt cake) radioactive and chemical wastes that have been transferred to the underground storage tanks. The demonstration is necessary to enable a final decision on disposal of underground tank wastes, soils, and ancillary equipment. The eventual objective is to transfer new technologies as a system to full-scale remediation at the US Department of Energy complexes and sites in the private sector.

1615 (WHC-SA-1669) **Survey of fiber-optic technology for nuclear waste cleanup applications.** Addleman, R.S. (Westinghouse Hanford Co., Richland, WA (United States)); Crawford, B.A.; Mech, S.J.; Troyer, G.L.; Greenwell, R.A. Westinghouse Hanford Co., Richland, WA (United States). Sep 1992. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-9209184-6: The International Society for Optical Engineering (SPIE) meeting, Boston, MA (United States), 8-11 Sep 1992). Order Number DE93004997. Source: OSTI; NTIS; INIS; GPO Dep.

The need for suitable remote sensors in highly radioactive defense waste storage tanks is discussed. The harsh radiological and chemical tank environment precludes the use of standard sensors because of the need for intrinsically safe systems. Potential sensor systems based on fiber-optics technologies suitable for the nuclear waste environment are identified. The need for certification standards for this type of environment is also discussed.

1616 (WHC-SA-1671) **Resolving the safety issue for radioactive waste tanks with high organic content.** Babad, H. (Westinghouse Hanford Co., Richland, WA (United States)); Crippen, M.D.; Turner, D.A.; Gerber, M.A. Westinghouse Hanford Co., Richland, WA (United States). Feb 1993. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930205-71: Waste management '93, Tucson, AZ (United States), 28 Feb - 4 mar 1993). Order Number DE93014627. Source: OSTI; NTIS; INIS; GPO Dep.

An overview of the Waste Tank Safety Organic Program is provided. The overview discusses the history of the wastes containing high concentrations of organics, existing safety criteria associated with those tanks, and details of thermodynamic studies by Westinghouse Hanford Company bounding potential reactivity. The program to be discussed contains the elements of the collection and analysis of tank historical information; reevaluation of organic tank-listing criteria; the performance of detailed studies on simulated waste; completion of waste characterization for each affected tank; and, as part of issue closure, the preparation of short-term and long-term safety and risk assessments based on results from characterization and the waste simulant studies. This document reports on a number of simplified thermodynamic calculations that were performed

to ascertain combustion limits for simple surrogates of organic materials in a nitrate-nitrite containing alkaline waste. For expected waste species, the results of these calculations indicate that the range of reactivity encompasses energies that vary only by a factor of three over the range of normal paraffin hydrocarbon (NPH) (a fuel rich solvent) to sodium oxalate (a degradation product resulting from in situ organic complexant destruction in Hanford Site wastes).

1617 (WHC-SA-1673) Advancing the US Department of Energy's Technologies through the Underground Storage Tank: Integrated Demonstration Program. Gates, T.E. Westinghouse Hanford Co., Richland, WA (United States). [1993]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930205-28: Waste management '93, Tucson, AZ (United States), 28 Feb - 4 mar 1993). Order Number DE93009421. Source: OSTI; NTIS; INIS; GPO Dep.

The principal objective of the Underground Storage Tank - Integrated Demonstration Program is the demonstration and continued development of technologies suitable for the remediation of waste stored in underground storage tanks. The Underground Storage Tank Integrated Demonstration Program is the most complex of the integrated demonstration programs established under the management of the Office of Technology Development. The Program has the following five participating sites: Oak Ridge, Idaho, Fernald, Savannah River, and Hanford. Activities included within the Underground Storage Tank - Integrated Demonstration are (1) characterizing radioactive and hazardous waste constituents, (2) determining the need and methodology for improving the stability of the waste form, (3) determining the performance requirements, (4) demonstrating barrier performance by instrumented field tests, natural analog studies, and modeling, (5) determining the need and method for destroying and stabilizing hazardous waste constituents, (6) developing and evaluating methods for retrieving, processing (pretreatment and treatment), and storing the waste on an interim basis, and (7) defining and evaluating waste packages, transportation options, and ultimate closure techniques including site restoration. The eventual objective is the transfer of new technologies as a system to full-scale remediation at the US Department of Energy complexes and sites in the private sector.

1618 (WHC-SA-1679) Infrared scanner parametric test using heated simulant tank waste. Efferding, L.E. Westinghouse Hanford Co., Richland, WA (United States). Sep 1992. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930247-1: Waste Management '93, Tucson, FL (United States), 28 Feb - 3 mar 1993). Order Number DE93004496. Source: OSTI; NTIS; INIS; GPO Dep.

An infrared (IR) scanner device has been developed which provides a means of determining the variation in surface temperature throughout the waste surface area in ferrocyanide tanks, or other heat generating high level waste tanks. This report describes an experimental mockup test performed in a pit area of the an experimental building. The mockup duplicated the geometric factors and approximated the tank gas space conditions which are anticipated in the heat generating waste tanks. The waste surface temperature magnitudes in these tanks are estimated to range from 70 to 120 °F. The experiments described in this report addressed a lower range of anticipated waste surface temperature below 100 °F by employing test tables of heated simulant. The experiments were conservative in that the IR instrument was

evaluated in a lower temperature range that is more challenging to the IR detector sensitivity. The IR scanner temperature indications were compared with simulant waste temperatures measured by emplaced thermocouples.

1619 (WHC-SA-1687) Integrated instrument platform for in situ characterization of tank wastes. Eberlein, S.J. Westinghouse Hanford Co., Richland, WA (United States). Jan 1993. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93009423. Source: OSTI; NTIS; INIS; GPO Dep.

An integrated instrument platform will support robotic characterization of radioactive chemical waste materials in the underground storage tanks at the Department of Energy's Hanford Site in Richland, Washington. The support platform supplies the basic support infrastructure needed to perform remotely controlled robotic deployment of sensors. A trailer serves as a field operations center, providing power and utilities, data acquisition and control equipment, common instrumentation, and test equipment. As part of the platform development effort, information on operational requirements and interface specifications is being compiled and distributed to potential suppliers of instrumentation. An overall characterization strategy has been developed, incorporating the currently identified characterization missions. This strategy will evolve over time and should provide a baseline to assist in planning for future deployment of characterization technology.

1620 (WHC-SA-1694) Tank waste chemistry: A new understanding of waste aging. Babad, H. (Westinghouse Hanford Co., Richland, WA (United States)); Camaioni, D.M.; Lilga, M.A.; Samuels, W.D.; Strachan, D.M. Westinghouse Hanford Co., Richland, WA (United States). Feb 1993. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930205-70: Waste management '93, Tucson, AZ (United States), 28 Feb - 4 mar 1993). Order Number DE93014625. Source: OSTI; NTIS; INIS; GPO Dep.

There is concern about the risk of uncontrolled exothermic reaction(s) in Hanford Site waste tanks containing NO_3^- / NO_2 based salts and/or metal hydroxide sludges in combination with organics or ferrocyanides. However, gradual oxidation of the waste in the tanks to less reactive species appears to have reduced the risk. In addition, wastes sampled to date contain sufficiently large quantities of water so that propagation reactions are highly unlikely. This paper investigates various aspects of the aging of Hanford tank wastes.

1621 (WHC-SA-1697) Tank waste retrieval issues and options for their resolution. Miller, W.C. (Westinghouse Savannah River Co., Aiken, SC (United States)); Henderson, J.M.; Shen, E.J.; Stegen, L.C.; Wrzesinski, W.R. Westinghouse Savannah River Co., Aiken, SC (United States). Feb 1993. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930205-68: Waste management '93, Tucson, AZ (United States), 28 Feb - 4 mar 1993). Order Number DE93014488. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy has undertaken the significant challenge of remediating the high-level wastes currently being stored underground in tanks located at the Hanford Site in Washington State. A key element of the remediation process is the recovery of these defense production wastes in preparation for downstream processing and disposal. A number of technical and programmatic issues have been

identified with the waste recovery process, referred to as retrieval. In response to these issues, a retrieval strategy has been developed that addresses the need to meet legal obligations and balances the technology development needs. This strategy has been embodied into a retrieval plan, which has looked at numerous retrieval system approaches and establishes a basis for development of the selected systems. The strategy and plan are evolutionary in approach, with the ability to change when waste properties are better understood, key decisions are negotiated, and lessons learned are available from initial retrieval efforts.

1622 (WHC-SA-1701) Recent results from characterization of ferrocyanide wastes at the Hanford Site. Simpson, B.C.; Babad, H.; Cash, R.J. Westinghouse Hanford Co., Richland, WA (United States). Feb 1993. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930205-67: Waste management '93, Tucson, AZ (United States), 28 Feb - 4 mar 1993). Order Number DE93014491. Source: OSTI; NTIS; INIS; GPO Dep.

Public Law 101-510, Section 3137, "Safety Measures for Waste Tanks at Hanford Nuclear Reservation," (1) requires that Westinghouse Hanford Company develop plans to resolve safety issues for tanks that could experience excessive temperature changes or pressure increases, resulting in a release of radioactive material from any high-level waste tank at the Hanford Site. Fifty-three tanks have been identified and categorized by tank contents. These include tanks that (a) contain ferrocyanide compounds, (b) have the potential for flammable gas generation, (c) contain organics, or (d) have high-heat loads. The ferrocyanide and hydrogen gas safety issues have been declared unreviewed safety questions (USQs) because postulated accident scenarios may fall outside safety envelopes defined by existing safety analysis documentation (2). Both USQ issues were reported at Waste Management '92 (3, 4). Detailed research has been conducted to provide insight into the severity of the ferrocyanide tank safety issue. Work included waste characterization and investigation of the energetic behavior of ferrocyanide waste material. The data presented will focus on "In-Farm" simulant studies and information from tank 241-C-112, core samples 34 and 36.

1623 (WHC-SA-1723) Computer simulation of the thermal history of a Hanford Site high heat load waste tank. Bander, T.J. (Westinghouse Hanford Co., Richland, WA (United States)); McCall, T.B. Westinghouse Hanford Co., Richland, WA (United States). Jan 1993. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930395-4: Computer simulation in waste management and environmental sciences, Washington, DC (United States), 29 Mar - 1 apr 1993). Order Number DE93011354. Source: OSTI; NTIS; INIS; GPO Dep.

This paper presents the results of a transient thermal analysis based on historical records of a high heat load single-shell tank of radioactive waste from United States weapons material processes. The thermally related information includes the following: waste material additions and extractions, recorded levels of both liquid and sludge layers, total heat load for the tank, based upon: water additions, psychrometric measurements, and isotopic chemical makeup of sampled wastes thermocouple data in the air space, liquid layer, and sludge layers. This information was analyzed and evaluated to construct an approximate heat source in the tank as a function of time. A thermal model was developed for each consistent geometric configuration

of the waste with boundary conditions and thermal input. Reasonably conservative assumptions were used in all aspects of the modeling. The boundary conditions were always selected to cause higher-than-expected temperatures in the transient analyses. The temperature distribution is shown for the time when maximum temperatures occur in the models. Also, temperature histories are shown for selected nodes in the models.

1624 (WHC-SA-1748) Waste separations and pretreatment technology development in the Underground Storage Tank-Integrated Demonstration Program. Cruse, J.M. Westinghouse Hanford Co., Richland, WA (United States). Apr 1993. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930702-25: 1993 ASME pressure vessel and piping conference, Denver, CO (United States), 25-29 Jul 1993). Order Number DE93014189. Source: OSTI; NTIS; INIS; GPO Dep.

The principal objective of the Underground Storage Tank Integrated Demonstration (UST-ID) Program is the demonstration and continued development of technologies suitable for the remediation of USTs. The most promising new technologies are selected for demonstration, testing, and evaluation. The objective is the eventual transfer of new technologies as a system to full-scale remediation at US Department of Energy (DOE) complexes and sites in the private sector. Technologies under development in the UST-ID Program are targeted toward use in remediation actions at the following five DOE participant sites: Hanford, Fernald, Idaho, Oak Ridge, and Savannah River. Combined, these participant sites have more than 300 USTs containing more than 100 m gal of high-level and low-level radioactive liquid waste. This paper focuses on the Waste Separations and Pretreatment area of the UST-ID, summarizing the currently funded technology development projects. In this area, several "compact processing units" (CPUs) are being developed to effect near-term demonstration and deployment of promising processes in actual tank environments. The CPU design and development approach is summarized. A number of programmatic issues are discussed, including onsite and off-site transportation of potentially contaminated processing systems, containment design criteria, including applicable codes and standards, and operation and maintenance of such systems in a developmental testing environment.

1625 (WHC-SA-1770) Hanford Site Tank Waste Remediation System: A program overview. Tseng, J.C. (USDOE, Washington, DC (United States)); Anttonen, J.H.; Wodrich, D.D.; Herbst, R. Westinghouse Hanford Co., Richland, WA (United States). Jan 1993. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930205-59: Waste management '93, Tucson, AZ (United States), 28 Feb - 4 mar 1993). Order Number DE93011276. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy's (DOE) Hanford Site in southeastern Washington State has the most diverse and largest amount of highly radioactive waste of any site in the United States. High-level radioactive waste has been stored in large underground tanks since 1944. Approximately 227,000 m³ (60 Mgal) of caustic liquids, slurries, salt cakes, and sludges have accumulated in 177 tanks. In addition, significant amounts of ⁹⁰Sr and ¹³⁷Cs were removed from the tank waste, converted to salts, doubly encapsulated in metal containers, and stored in water basins. A Tank Waste Remediation System Program has been established within the

DOE to safely manage and immobilize these wastes in anticipation of permanent disposal of the high-level radioactive waste fraction in a geologic repository. Implementing this program will require resolving several waste tank safety issues to maintain safe storage, and then retrieving, treating, and immobilizing the waste for disposal.

1626 (WHC-SA-1825) Three candidate treatment technologies for remediating Hanford Site watch-list tanks. Colby, S.A. Westinghouse Hanford Co., Richland, WA (United States). Feb 1993. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930205-30: Waste management '93, Tucson, AZ (United States), 28 Feb - 4 mar 1993). Order Number DE93009426. Source: OSTI; NTIS; INIS; GPO Dep.

A major Hanford Site tank pretreatment objective is to resolve the tank safety issues regarding organic compounds (and accompanied hydrogen generation), which can all potentially react to evolve heat and gases. This paper reports scoping test results of three candidate waste pretreatment processes to oxidize organic compounds contained in the Hanford Site's radioactive waste storage tanks. Ozone oxidation, electrochemical oxidation, and calcination/dissolution were tested for their ability to destroy tank waste organics using a nonradioactive simulated tank waste.

1627 (WHC-SA-1835) Tank 241-CX-70 waste removal and packaging. DuVon, D.K. Westinghouse Hanford Co., Richland, WA (United States). [1993]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-9304128-10: Department of Energy (DOE) radiation protection conference, Las Vegas, NV (United States), 13-15 Apr 1993). Order Number DE93014624. Source: OSTI; NTIS; INIS; GPO Dep.

Tank 241-CX-70, located on the Hanford Site in Washington State, is a 30,000 gal single-shell storage tank built in 1952 to hold high-level process waste from pilot tests of the reduction-oxidation process. In 1979 decommissioning operations were begun by pumping liquid waste from the tank to the double-shell tank (DST) 101-AY. Not all the waste was removed at that time. Approximately 10,300 gal of sludge remained. On September 25, 1987, operations were resumed to remove the remaining waste using a sluicing and pumping method. This report documents the final removal of waste from Tank 241-CX-70.

1628 (WHC-SA-1837) Tank waste pretreatment issues, alternatives and strategies for resolution. Miller, W.C. (Westinghouse Hanford Co., Richland, WA (United States)); Appel, J.; Barton, W.B.; Orme, R.M.; Holton, L.K. Jr. Westinghouse Hanford Co., Richland, WA (United States). Feb 1993. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930205-66: Waste management '93, Tucson, AZ (United States), 28 Feb - 4 mar 1993). Order Number DE93014490. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy (DOE) has established the Tank Waste Remediation System (TWRS) to safely manage and dispose of the Hanford Site tank waste. The overall strategy for disposing of tank waste is evolving and initial recommendations on a course of action are expected in March, 1993. Pretreatment of these wastes may be required for one or both of the following reasons: (1) resolution of tank safety issues, and (2) preparation of low level and high level waste fractions for disposal. Pretreatment is faced with several issues that must be addressed by the deployment

strategies that are being formulated. These issues are identified. There is also a discussion of several pretreatment deployment strategies and how these strategies address the issues. Finally, the technology alternatives that are being considered for the pretreatment function are briefly discussed.

1629 (WHC-SA-1878) Establishing in situ conditions of Hanford waste tanks subjected to the aging effects of thermal degradation and creep of concrete. Julyk, L.J. (Westinghouse Hanford Co., Richland, WA (United States)); Weis, M.P.; Dyrness, A.D. Westinghouse Hanford Co., Richland, WA (United States). Oct 1993. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-9310102-11: 4. energy natural phenomena hazards mitigation conference, Atlanta, GA (United States), 19-22 Oct 1993). Order Number DE93040407. Source: OSTI; NTIS; INIS; GPO Dep.

Some of the underground reinforced-concrete waste-storage tanks at the US Department of Energy's Hanford Site have been exposed to high temperatures (greater than 200°F) generated by radioactive liquid wastes. Establishment of the in situ conditions of these tanks is the first step toward their remediation. In this environment concrete damage can result in the form of mechanical property degradation, increased creep response, and cracking from thermal expansion and load redistribution. Regression analyses of data from tests on Hanford-concrete mix designs conducted in the mid-1970's provided mechanical property correlations that are a function of time at temperature. Creep compliance functions were developed on the bases of literature reviews and limited Hanford Site test data. The property-degradation correlations are thermal-history dependent because of the irreversible nature of the degradation processes. In addition, tests were conducted to determine the thermal expansion coefficient of the Hanford concrete. This paper discusses the implementation of these correlations into a nonlinear concrete constitutive subroutine that is linked to a general-purpose finite-element computer code. The methodology used to treat variable temperature histories is illustrated. A case study of the Hanford Site's buried, high-heat, single-shell, waste storage tank 241-C-106 illustrates the degradation history predicted over its service life. In addition, this paper provides a statistically based discussion of the effects of potential batch-to-batch variation of concrete strength. It addresses material property uncertainties, including the thermal-expansion coefficient.

1630 (WHC-SA-1881) Structural analysis of Hanford's single-shell 241-C-106 tank: A first step toward waste-tank remediation. Harris, J.P. (Westinghouse Hanford Co., Richland, WA (United States)); Julyk, L.J.; Marlow, R.S.; Moore, C.J.; Day, J.P.; Dyrness, A.D.; Jagadish, P.; Shulman, J.S. Westinghouse Hanford Co., Richland, WA (United States). Oct 1993. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-9310102-12: 4. energy natural phenomena hazards mitigation conference, Atlanta, GA (United States), 19-22 Oct 1993). Order Number DE93040405. Source: OSTI; NTIS; INIS; GPO Dep.

The buried single-shell waste tank 241-C-106, located at the US Department of Energy's Hanford Site, has been a repository for various liquid radioactive waste materials since its construction in 1943. A first step toward waste tank remediation is demonstrating that remediation activities can be performed safely. Determination of the current structural capacity of this high-heat tank is an important element in

this assessment. A structural finite-element model of tank 241-C-106 has been developed to assess the tank's structural integrity with respect to in situ conditions and additional remediation surface loads. To predict structural integrity realistically, the model appropriately addresses two complex issues: (1) surrounding soil-tank interaction associated with thermal expansion cycling and surcharge load distribution and (2) concrete-property degradation and creep resulting from exposure to high temperatures generated by the waste. This paper describes the development of the 241-C-106 structural model, analysis methodology, and tank-specific structural acceptance criteria.

1631 (WHC-SA-1899) Structural analysis and evaluation of a mixer pump in a double-shell tank at the Hanford Site. Rezvani, M.A. (Westinghouse Hanford Co., Richland, WA (United States)); Strehlow, J.P.; Baliga, R. Westinghouse Hanford Co., Richland, WA (United States). Aug 1993. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-9310102-6: 4. energy natural phenomena hazards mitigation conference, Atlanta, GA (United States), 19-22 Oct 1993). Order Number DE93019318. Source: OSTI; NTIS; INIS; GPO Dep.

The double-shell waste tank 241-SY-101 is a 1,000,000 gallon tank used to store radioactive waste at the Hanford Site near Richland, Washington. With time the waste has formed two layers of sludge, a convective and a nonconvective layer. In addition, a crust has formed over the surface of the waste, isolating the convective layer from the vapor space. Ongoing reactions in the waste cause a buildup of hydrogen molecules that become trapped within the nonconvective layer and under the crust. Over time, this hydrogen buildup increases pressure on the crust from beneath. Every 100 to 140 days, the pressure is released when the crust lifts upward in what is called a waste rollover. To prevent the release of a large volume of hydrogen to the vapor space, a mixer pump has been designed to be installed in the tank to circulate the waste and reduce or prevent the hydrogen buildup. The structural analysis and evaluation designed as part of the hydrogen mitigation test process and presented herein addresses the response of the mixer pump and the tank dome resulting from expected operational and design loads. The loads include deadweight, waste rollover, asymmetric thrust, and pump vibration, as well as seismic loads. The seismically induced loads take into consideration both the convective and the impulsive effects of the waste-filled tank. The structural evaluations were performed in accordance with applicable national codes and standards. The qualification of the mixer pump required the design of a unique mounting assembly to transfer the loads from the pump to the surrounding soil without overstressing the structural components such as the dome penetration riser. Also, special consideration was given to minimize the additional stresses in the already stressed concrete tank dome.

1632 (WHC-SA-1911) Seismically induced loads on internal components submerged in waste storage tanks. Rezvani, M.A.; Julyk, J.L.; Weiner, E.O. Westinghouse Hanford Co., Richland, WA (United States). Oct 1993. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-9310102-9: 4. energy natural phenomena hazards mitigation conference, Atlanta, GA (United States), 19-22 Oct 1993). Order Number DE93019317. Source: OSTI; NTIS; INIS; GPO Dep.

As new equipment is designed and analyzed to be installed in the double-shell waste storage tanks at the Hanford Site near Richland, Washington, the equipment and the tank integrity must be evaluated. These evaluations must consider the seismically induced loads, combined with other loadings. This paper addresses the hydrodynamic behavior and response of structural components submerged in the fluid waste. The hydrodynamic effects induced by the horizontal component of ground shaking is expressed as the sum of the impulsive and convective (sloshing) components. The impulsive component represents the effects of the fluid that may be considered to move in synchronism with the tank wall as a rigidly attached mass. The convective component represents the action of the fluid near the surface that experiences sloshing or rocking motion. The added-mass concept deals with the vibration of the structural component in a viscous fluid. The presence of the fluid gives rise to a fluid reaction force that can be interpreted as an added-mass effect and a damping contribution to the dynamic response of the submerged components. The distribution of the hydrodynamic forces on the internal components is not linear. To obtain the reactions and the stresses at the critical points, the force distribution is integrated along the length of the equipment submerged in the fluid.

1633 (WHC-SA-1920) Developing waste separations technologies in the Underground Storage Tank - Integrated Demonstration Program. Cruse, J.M. Westinghouse Hanford Co., Richland, WA (United States). Apr 1993. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930873-15: 2. international mixed waste symposium, Baltimore, MD (United States), 17-20 Aug 1993). Order Number DE93014164. Source: OSTI; NTIS; INIS; GPO Dep.

The principal objective of the Underground Storage Tank - Integrated Demonstration (UST-ID) Program is the demonstration and continued development of technologies suitable for the remediation of USTs. This paper focuses on the Waste Separations and Pretreatment area of the UST-ID, summarizing the currently funded technology development projects. In this area, several "compact processing units" are being developed to effect near-term demonstration and deployment of promising processes in actual tank environments. The compact processing units design and development approach is summarized. A number of programmatic issues are discussed, including onsite and offsite transportation of potentially contaminated processing systems, containment design criteria, including applicable codes and standards, and operation and maintenance of such systems in a developmental testing environment.

1634 (WHC-SA-1976) Hanford Site Tank 241-SY-101, damaged equipment removal. Titzler, P.A.; Legare, D.E.; Barrus, H.G. Westinghouse Hanford Co., Richland, WA (United States). Nov 1993. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-931160-35: American Nuclear Society (ANS) winter meeting, San Francisco, CA (United States), 14-18 Nov 1993). Order Number DE94004490. Source: OSTI; NTIS; INIS; GPO Dep.

Hanford Site Tank 241-SY-101 has a history of generating hydrogen-nitrous oxide gases. The gases are generated and trapped in the non-convective waste layer near the bottom of the 23-m- (75-ft-) diameter underground tank. Approximately every three months the pressure in the tank is relieved as the trapped gases are released through or around the surface crust into the tank dome. This process moves large

amounts of liquid waste and crust material around in the tank. The moving waste displaced air lances and thermocouple assemblies (2-in. schedule-40 pipe) installed in four tank risers and permanently bent them to a maximum angle of 40 degrees. The bends were so severe that assemblies could not be removed from the tank using the originally designed hardware. Just after the tank releases the trapped gas, a 20-to-30-day work "window" opens.

1635 (WHC-SA-1982) Corrosion considerations for life management of Hanford high-level waste tanks. Ohi, P.C.; Vollert, F.R.; Thomson, J.D. Westinghouse Hanford Co., Richland, WA (United States). Oct 1993. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-940222-15: Corrosion 94: National Association of Corrosion Engineers (NACE) international annual conference, Baltimore, MD (United States), 28 Feb - 4 mar 1994). Order Number DE94011388. Source: OSTI; NTIS; INIS; GPO Dep.

The potential for corrosion-related aging mechanisms to be active in the Hanford Site waste tanks is frequently questioned and there are related uncertainties. This paper considers surveillance and analyses for evaluating the potential influence of corrosion processes such as stress corrosion cracking, pitting, crevice corrosion of the reinforced concrete steel on the useful life of Hanford radioactive waste tanks. There are two types of Hanford Site underground reinforced concrete, carbon steel lined waste tank structures. They primarily store caustic nitrate wastes, some at elevated temperatures, from defense reprocessing of spent nuclear fuels. Some of the Hanford waste tanks have leaked radioactive liquid waste to the soil. These leaks are possibly due to nitrate-induced stress corrosion cracking. Major efforts prescribed to avoid nitrate-induced stress corrosion cracking in newer tank designs appear successful. A potential for pitting and crevice corrosion cracking in the carbon steel liners exists. There has been no evidence of significant uniform corrosion of the carbon steel liners and there has been no evidence of waste tank degradation caused by corrosion of the concrete reinforcing steel. A waste tank life management program is being developed to qualify the Hanford waste tanks for continued safe storage of these wastes. Corrosion evaluations, structural analyses, and surveillance are required to qualify the tanks and to promptly detect evidence of possible distress.

1636 (WHC-SA-1983) Hanford high-level waste evaporator/crystallizer corrosion evaluation. Ohi, P.C.; Carlos, W.C. Westinghouse Hanford Co., Richland, WA (United States). Oct 1993. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-940222-16: Corrosion 94: National Association of Corrosion Engineers (NACE) international annual conference, Baltimore, MD (United States), 28 Feb - 4 mar 1994). Order Number DE94011389. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy, Hanford Site nuclear reservation, located in Southeastern Washington State, is currently home to 61 Mgal of radioactive waste stored in 177 large underground storage tanks. As an intermediate waste volume reduction, the 242-A Evaporator/Crystallizer processes waste solutions from most of the operating laboratories and plants on the Hanford Site. The waste solutions are concentrated in the Evaporator/Crystallizer to a slurry of liquid and crystallized salts. This concentrated slurry is returned to Hanford Site waste tanks at a significantly reduced

volume. The Washington State Department of Ecology Dangerous Waste Regulations, WAC 173-393 require that a tank system integrity assessment be completed and maintained on file at the facility for all dangerous waste tank systems. This corrosion evaluation was performed in support of the 242-A Evaporator/Crystallizer Tank System Integrity Assessment Report. This corrosion evaluation provided a comprehensive compatibility study of the component materials and corrosive environments. Materials used for the Evaporator components and piping include austenitic stainless steels (SS) (primarily ASTM A240, Type 304L) and low alloy carbon steels (CS) (primarily ASTM A53 and A106) with polymeric or asbestos gaskets at flanged connections. Building structure and secondary containment is made from ACI 301-72 Structural Concrete for Buildings and coated with a chemically resistant acrylic coating system.

1637 (WHC-SA-1985) Corrosion monitoring of high-level waste tanks. Anantamula, R.P. (Westinghouse Hanford Co., Richland, WA (United States)); Divine, J.R. Westinghouse Hanford Co., Richland, WA (United States). Nov 1993. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-940222-8: Corrosion 94: National Association of Corrosion Engineers (NACE) international annual conference, Baltimore, MD (United States), 28 Feb - 4 mar 1994). Order Number DE94004822. Source: OSTI; NTIS; INIS; GPO Dep.

High-level nuclear wastes are currently being stored in carbon steel tanks at the Hanford Site. The wastes are stored in both single-shell tanks (SSTs) and double-shell tanks (DSTs). The SSTs have already exceeded their design life and some of these tanks have already leaked waste into the surrounding soil. The DSTs, on the other hand, were fabricated and put into operation more recently and have not been observed to show any leakage of wastes. One of the objectives at the Hanford Site is to monitor the degradation of the DSTs with the aid of in-tank corrosion probes. Outside the nuclear industry, electrochemical and resistance corrosion probes are in common use. The application of these probes to nuclear waste storage is generally complicated by the high radiation and complexed caustic environment. This paper deals with the details of a proposed development of commercial probes to monitor corrosion of the DSTs at the Hanford Site. Once the corrosion probes are successfully developed, the technology can be applied to SSTs and also transferred to other US Department of Energy (DOE) Sites.

1638 (WHC-SA-2021) Underground storage tanks soft waste dislodging and conveyance. Wellner, A.F. Westinghouse Hanford Co., Richland, WA (United States). Oct 1993. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-931160-27: American Nuclear Society (ANS) winter meeting, San Francisco, CA (United States), 14-18 Nov 1993). Order Number DE94001681. Source: OSTI; NTIS; INIS; GPO Dep.

Currently 140 million liters (37 million gallons) of waste are stored in the single shell underground storage tanks (SSTs) at Hanford. The wastes contain both hazardous and radioactive constituents. This paper focuses on the Westinghouse Hanford Company's testing program for soft waste dislodging and conveyance technology. This program was initialized to investigate methods of dislodging and conveying soft waste. The main focus was on using air jets, water jets, and/or mechanical blades to dislodge the waste and air conveyance to convey the dislodged waste. These waste

dislodging and conveyance technologies would be used in conjunction with a manipulator based retrieval system.

1639 (WHC-SA-2065) Structural design and analysis of a mixer pump for beyond-design-basis load. Rezvani, M.A. (Westinghouse Hanford Co., Richland, WA (United States)); Strehlow, J.P.; Baliga, R.; Kok, S.B. Westinghouse Hanford Co., Richland, WA (United States). Mar 1994. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-940613-4: 1994 pressure vessels and piping conference, Minneapolis, MN (United States), 19-23 Jun 1994). Order Number DE94009609. Source: OSTI; NTIS; GPO Dep.

This paper presents the results of the structural evaluation of a mixer pump for a postulated drop accident. The mixer pump will be installed in a double-shell tank at the Hanford Site, near Richland, Washington. This tank has a 1,000,000-gallon (3,785,000 liter) capacity and is used to store radioactive waste before final disposal. The beyond-design-basis load case presented here is a postulated drop of the pump during installation or removal. It is assumed that the pump assembly might be dropped approximately 140 ft (15 m) from a height at which the bottom of the pump assembly is slightly above the top of the access riser to the bottom of the tank. The acceptance criterion for this load case is that the pump assembly shall not penetrate the primary tank liner. To ensure the integrity of the liner, the kinetic energy (developed in the pump drop) must be absorbed by some means to limit the impact force on the tank dome and thereby keep the pump from contacting the bottom of the tank. The limited clearance near the mounting assembly warranted an innovative two-step design of the energy absorbing system to limit the impact force on the tank dome to an acceptable value. This innovative design incorporates two energy absorbers in a unique series arrangement, one with the pump assembly and the other in the pump pit.

1640 (WHC-SA-2074) Gas monitoring systems in support of Waste tank 241-SY-101 hydrogen mitigation task. Philipp, B.L.; Schneider, T.C.; Straalsund, E.K. Westinghouse Hanford Co., Richland, WA (United States). Jan 1994. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-940149-1: 8. international forum on process analytical chemistry, Houston, TX (United States), 24-26 Jan 1994). Order Number DE94005489. Source: OSTI; NTIS; GPO Dep.

Twenty-four hazardous waste storage tanks at the Hanford Site in Richland Washington, are identified as having the potential to build up gases, including hydrogen, nitrous oxide and ammonia, to a flammable level. Because this behavior was not addressed adequately by the facility Safety Analyses, the US Department of Energy (DOE) declared an Unreviewed Safety Question, placing the tanks on a Flammable Gas Watch List. Westinghouse Hanford Company (WHC) identified Waste tank 241-SY-101 (SY-101) as presenting the most serious safety concern. Generated gases collect in the sludge layer near the bottom of the tank. The accumulation creates a buoyancy that eventually overcomes the density and bonding strength of the bottom layer. When this happens, the gases detach and travel upward through a liquid layer to the vapor space above the tank crust. This event typically occurs at 90-day intervals and is completed within a couple hours. This allows a rapid buildup of hydrogen to potentially flammable levels in the tank vapor space.

1641 (WHC-SA-2100) Remote infrared imaging system for scanning hazardous waste tanks. Morris, K.L.H. Westinghouse Hanford Co., Richland, WA (United States). Jan 1994. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-940553-29: International high-level radioactive waste management conference, Las Vegas, NV (United States), 22-26 May 1994). Order Number DE94009386. Source: OSTI; NTIS; GPO Dep.

This paper provides a description of the deployment of an infrared imaging system in an underground radioactive waste storage tank. The system was made for surface scanning to detect regions of high heat if present. The deployment described was for testing the system's capabilities as well as the logistics of deployment and the system's functionality in the field. The system was deployed and removed successfully providing a surface scan of the tank. Some improvements are recommended.

1642 (WHC-SA-2102) Progress toward resolution of vapor problems associated with tank 241-C-103. Huckaby, J.L. (Westinghouse Hanford Co., Richland, WA (United States)); Babad, H.; Story, M.S. Westinghouse Hanford Co., Richland, WA (United States). Feb 1994. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-940225-102: Waste management '94, Tucson, AZ (United States), 27 Feb - 3 mar 1994). Order Number DE94010348. Source: OSTI; NTIS; INIS; GPO Dep.

Noxious and flammable gases and vapors associated with high-level radioactive waste storage tank 241-C-103 at the Hanford Site are discussed. Focus is on the Westinghouse Hanford Company strategy to characterize the tank headspace. The sampling and analysis methodology is described. Sampling limitations, devices, and equipment are discussed. Results to date are given.

1643 (WHC-SA-2118) Hydrodynamically Induced loads on components submerged in high-level waste-storage tanks. Weiner, E.O.; Julyk, J.L.; Rezvani, M.A. Westinghouse Hanford Co., Richland, WA (United States). Jun 1994. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-940613-5: 1994 pressure vessels and piping conference, Minneapolis, MN (United States), 19-23 Jun 1994). Order Number DE94009663. Source: OSTI; NTIS; INIS; GPO Dep.

This paper addresses the effects of added mass on components submerged in fluids. In particular, as new equipment is designed for installation in the double-shell waste-storage tanks at the Hanford Site near Richland, Washington, the equipment and the tank must be evaluated for the anticipated loads. Seismically induced loads combined with loadings from other sources must be considered during this evaluation. A literature review shows that, for components in fluids confined to a narrow annulus or without a free surface, drastic reductions in response to seismic excitation are predicted by two-dimensional analysis. This phenomenon has been supported by testing. The reductions are explained in terms of mass coupling and buoyancy effects. For equipment submerged in fluids having a free surface and large annulus, practice suggest that it is appropriate to lump the added-mass terms with the component to address the hydrodynamic effects adequately. As in the case of a narrow annulus, this practice will reduce the natural frequency of the submerged component, but generally will increase the loads. This paper presents the structural evaluations of submerged components using computer

models that employ mock fluid elements that determine the appropriateness of considering fluid added-mass and buoyancy effects. The results indicate that if a free surface exists and the submerged component has a wide fluid annulus about it, then the added mass should be lumped with the model, and buoyancy effects are not significant. The component then may be considered to be in an air environment, and the stresses are calculated from the application of standard response spectrum procedures.

1644 (WHC-SA-2123) The use of ultra high pressure water for installation of instrumentation in "assumed" leaker tanks. Dukelow, G.T.; Hertelendy, N.A. Westinghouse Hanford Co., Richland, WA (United States). Feb 1994. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-940225-86: Waste management '94, Tucson, AZ (United States), 27 Feb - 3 mar 1994). Order Number DE94009437. Source: OSTI; NTIS; GPO Dep.

A technique using ultra high pressure water, using pressures up to 259,000 kPa (gage) (37,500 psig), was developed to install thermocouple trees. The technique will enable the use of water to be decreased by up to a factor of 30, thereby reducing the potential for leaks. Although the final design is specifically to install thermocouple trees, this concept also can be used for installation of many other types of equipment into waste storage tanks.

1645 (WHC-SA-2124) The Hanford Site Tank Waste Remediation System: An update. Alumkal, W.T.; Babad, H.; Harmon, H.D.; Wodrich, D.D. Westinghouse Hanford Co., Richland, WA (United States). 27 Jan 1994. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-940225-103: Waste management '94, Tucson, AZ (United States), 27 Feb - 3 mar 1994). Order Number DE94010343. Source: OSTI; NTIS; INIS; GPO Dep.

The U.S. Department of Energy's Hanford Site, located in southeastern Washington State, has the most diverse and largest amount of highly radioactive waste in the United States. High-level radioactive waste has been stored in large underground tanks since 1944. Approximately 230,000 m³ (61 Mgal) of caustic liquids, slurries, saltcakes, and sludges have ¹³⁷Cs accumulated in 177 tanks. In addition, significant amounts of ⁹⁰Sr and were removed from the tank waste, converted to salts, doubly encapsulated in metal containers, and stored in water basins. A Tank Waste Remediation System Program was established by the U.S. Department of Energy in 1991 to safely manage and immobilize these wastes in anticipation of permanent disposal of the high-level waste fraction in a geologic repository. Since 1991, progress has been made resolving waste tank safety issues, upgrading Tank Farm facilities and operations, and developing a new strategy for retrieving, treating, and immobilizing the waste for disposal.

1646 (WHC-SA-2129) Flammable gas generation, retention, and release in high-level waste tanks - physical and chemical models. McDuffie, N.G. Westinghouse Hanford Co., Richland, WA (United States). Mar 1994. 10p. Sponsored by USDOE, Washington, DC (United States); Los Alamos National Lab., NM (United States); Argonne National Lab., IL (United States); Georgia Inst. of Tech., Atlanta, GA (United States); Department of the Interior, Washington, DC (United States); Texas DOE Contract AC06-87RL10930. (CONF-940225-100: Waste management '94, Tucson, AZ

(United States), 27 Feb - 3 mar 1994). Order Number DE94010347. Source: OSTI; NTIS; INIS; GPO Dep.

The most evident dangers from flammable gas release in ventilated high-level waste tanks at Hanford are those caused by periodic release of gases generated and retained in depths of the tanks. In Hanford Tank 101-SY the flammable gases and hydrogen, ammonia and methane are accumulated along with oxidizer nitrous oxide in bubbles while the ammonia and nitrous oxide are also deposited in solution. Accumulation of both the free and dissolved gases is enhanced by hydrostatic pressure. The free gases are apparently held by several mechanisms - viscous trapping of bubbles, stabilization in three-phase foams at hydrophobic surfaces, capillary channel gas accumulation, mechanical trapping in crystal clusters, and tight engulfment in armored bubbles. Episodic release is brought about by the ascension from the bottom of large conglomerates which release gases by bubble detachment and by slower diffusion-controlled mass-transfer processes. Density of the conglomerates increases in this process, whereupon they settle to repeat the cycle again. The flammable gases are produced by a combination of radiolytic and non-radiolytic chemical processes in breakdown of water and organic and inorganic constituents. Hydrogen production is enhanced by organic destruction while radiolytic hydrogen production is depressed by nitrite ion. Most of the nitrous oxide and ammonia appear to be derived from reduction of nitrite by organics, with smaller amounts coming from amine nitrogen in chelators. Methane is produced in only small amounts. Formate, oxalate, and carbonate are refractory end-products from degradation of organic constituents such as the chelators ethylenediaminetetraacetate (EDTA) and N-(2-hydroxyethyl)ethylenediaminetriacetate (HEDTA).

1647 (WHC-SA-2130) Resolving the Ferrocyanide Safety Issue at the Hanford Site. Meacham, J.E.; Cash, R.J.; Babad, H. Westinghouse Hanford Co., Richland, WA (United States). Feb 1994. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-940225-101: Waste management '94, Tucson, AZ (United States), 27 Feb - 3 mar 1994). Order Number DE94010349. Source: OSTI; NTIS; INIS; GPO Dep.

Considerable data have been obtained on the chemical and physical properties of ferrocyanide waste stored in Hanford Site single-shell tanks (SSTs). Theoretical analyses and ferrocyanide waste simulant studies have led to the development of fuel, moisture, and temperature criteria that define continued safe storage. Developing the criteria provides the technical basis for closing the Ferrocyanide Unreviewed Safety Question (USQ). Using the safety criteria, the ferrocyanide tanks have been ranked into one of three safety categories: Safe, Conditionally Safe, and Unsafe. All the ferrocyanide tanks are currently ranked in either the Safe or Conditionally Safe categories. Analyses of core samples taken from three ferrocyanide tanks have shown cyanide concentrations about a factor of ten lower than predicted by the original flowsheets. Hydrolytic and radiolytic destruction (aging) of the ferrocyanide matrix has occurred during the 35 plus years the waste has been stored at the Hanford Site. Because of waste aging, it is possible that all of the ferrocyanide tanks may now contain less than the 8 wt % sodium nickel ferrocyanide specified in the fuel criterion for the Safe category. Ferrocyanide tanks that remain in the Conditionally Safe category may require monitoring and surveillance to verify that the waste remains in an unreactive state. Further characterization of the tanks by core sampling

and analyses should lead to resolution of the Ferrocyanide Safety Issue by September 1997.

1648 (WHC-SA-2140) Hanford Tank Waste Remediation Systems (TWRS) Waste Pretreatment Program strategy and Issues. Gasper, K.A. Westinghouse Hanford Co., Richland, WA (United States). Feb 1994. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-940225-95: Waste management '94, Tucson, AZ (United States), 27 Feb - 3 mar 1994). Order Number DE94009762. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy (DOE) has established the Tank Waste Remediation System (TWRS) to safely manage and dispose of the Hanford Site tank waste. Pretreatment is one of the major program elements of the TWRS. The scope of the TWRS Tank Waste Pretreatment Program is to treat tank waste to separate it into high- and low-level waste fractions and to provide additional treatment as required to feed low-level waste fractions and to provide additional treatment as required to feed low-level and high-level waste immobilization processes. The Pretreatment Program activities include technology development, design, fabrication, construction, and operation of facilities to support the pretreatment of radioactive mixed waste retrieved from 28 large underground double-shell tanks and 149 single-shell tanks.

1649 (WHC-SA-2152) Progress toward mitigation of flammable gas Tank 241-SY-101. Lentsch, J.W.; Babad, H.; Hanson, C.E.; Kirch, N.W. Westinghouse Hanford Co., Richland, WA (United States). Jan 1994. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-940225-104: Waste management '94, Tucson, AZ (United States), 27 Feb - 3 mar 1994). Order Number DE94010342. Source: OSTI; NTIS; INIS; GPO Dep.

The mixing pump installed in Hanford Site tank 241-SY-101 has been shown to be effective in releasing flammable gases in a controlled manner. This controlled release of gas prevents the accumulation and episodic release above flammable limits. More work needs to be done to optimize the pumping operation, and to evaluate the long-term effects of mixing so as to assure that no undesirable changes have occurred to the waste. Other alternative mitigation concepts are still being evaluated as a backup to mixing.

1650 (WHC-SA-2159) Neutron pulse simulation in nuclear waste for waste characterization. Toffer, H.; Watson, W.T.; Roetman, V.E. Westinghouse Hanford Co., Richland, WA (United States). Dec 1993. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-940456-17: 1994 Society for Computer Simulation multiconference, San Diego, CA (United States), 11-15 Apr 1994). Order Number DE94009765. Source: OSTI; NTIS; INIS; GPO Dep.

The numerical simulations discussed in this paper show how analysis with computer-generated illustrations can be used to explain the concepts and advantages of pulsed neutron systems for tank waste evaluations. Furthermore, the analysis-illustration approach lends itself to parametric studies evaluating design features of hardware before it is fabricated. Nuclear material characteristics of hazardous or toxic simulants can be evaluated before preparing them or finding nontoxic or nonhazardous substitutes that will exhibit similar nuclear properties. Pulsed neutron systems hold significant promise for partial characterization of tank waste.

The device could operate in a high background gamma radiation field and provide important information on moisture concentrations, fissionable material contents, and material interfaces quickly and at considerably less cost than obtainable from sample analyses.

1651 (WHC-SA-2172) Application of intrinsic germanium spectral gamma-ray logging for characterization of high-level nuclear waste tank leaks. Brodeur, J.R.; Kiesler, J.P.; Kos, S.E.; Koizumi, C.J.; Nicaise, W.F.; Price, R.K. Westinghouse Hanford Co., Richland, WA (United States). Nov 1993. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94004480. Source: OSTI; NTIS; INIS; GPO Dep.

Spectral gamma-ray logging with a high-resolution, intrinsic germanium logging system was completed in boreholes surrounding two high-level nuclear waste tanks at the US Department of Energy's Hanford Site. The purpose was to characterize the concentrations of man-made radionuclides in the unsaturated zone sediments and identify any new leaks from the tanks. An intrinsic germanium detection system was used for this work because it was important to positively identify the specific radionuclides and to precisely assay those radionuclides. The spectral gamma log data were processed and displayed as log plots for each individual borehole and as three-dimensional plots of ¹³⁷Cs radionuclide concentrations. These data were reviewed to identify the sources of the contamination. The investigation did not uncover a new or active leak from either of the tanks. Most of the contamination found could be related to known pipeline leaks, to surface contamination from above-ground liquid spills, or to leaks from other tanks. The current spectral gamma ray data now provide a new baseline from which to compare future log data and identify any changes in the radioelement concentration.

1652 (WHC-SA-2185) AIRSOURC code aerosol model in radioactive waste tanks. Roblyer, S.P. Westinghouse Hanford Co., Richland, WA (United States). Jan 1994. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-940456-15: 1994 Society for Computer Simulation multiconference, San Diego, CA (United States), 11-15 Apr 1994). Order Number DE94009764. Source: OSTI; NTIS; INIS; GPO Dep.

An aerosol model was developed for a radioactive waste tank vapor space and ventilation system. The source of aerosol formation was modeled from gas bubble bursts at the liquid surface. The gases contained in these bubbles are formed by radiolytic breakdown of liquid and organic materials in the radioactive tank contents. The model accounts for the rate of radiolytic gas formation and the rate of tank liquids that are released as aerosols. The concentration of particles in the tank vapor are modeled as a function of the deposition rate of dry particles and the vapor removal rate by ventilation. The ventilation rate in tanks without an active ventilation system has a threshold level that is driven by atmospheric pressure variation. The model predictions are compared to measurements in several typical waste tank vapors of the Hanford Site waste storage tanks.

1653 (WHC-SA-2190) Characterization and reaction behavior of ferrocyanide simulants and Hanford Site high-level ferrocyanide waste. Jeppson, D.W.; Simpson, B.C. Westinghouse Hanford Co., Richland, WA (United States). Feb 1994. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-940225-97: Waste management '94, Tucson, AZ

(United States), 27 Feb - 3 mar 1994). Order Number DE94009787. Source: OSTI; NTIS; INIS; GPO Dep.

Nonradioactive waste simulants and initial ferrocyanide tank waste samples were characterized to assess potential safety concerns associated with ferrocyanide high-level radioactive waste stored at the Hanford Site in underground single-shell tanks (SSTs). Chemical, physical, thermodynamic, and reaction properties of the waste simulants were determined and compared to properties of initial samples of actual ferrocyanide wastes presently in the tanks. The simulants were shown to not support propagating reactions when subjected to a strong ignition source. The simulant with the greatest ferrocyanide concentration was shown to not support a propagating reaction that would involve surrounding waste because of its high water content. Evaluation of dried simulants indicated a concentration limit of about 14 wt% disodium mononickel ferrocyanide, below which propagating reactions could not occur in the ambient temperature bulk tank waste. For postulated localized hot spots where dried waste is postulated to be at an initial temperature of 130 C, a concentration limit of about 13 wt% disodium mononickel ferrocyanide was determined, below which propagating reactions could not occur. Analyses of initial samples of the presently stored ferrocyanide waste indicate that the waste tank ferrocyanide concentrations are considerably lower than the limit for propagation for dry waste and that the water content is near that of the as-prepared simulants. If the initial trend continues, it will be possible to show that runaway ferrocyanide reactions are not possible under present tank conditions. The lower ferrocyanide concentrations in actual tank waste may be due to tank waste mixing and/or degradation from radiolysis and/or hydrolysis, which may have occurred over approximately 35 years of storage.

1654 (WHC-SA-2341) Issues and design concepts for high-activity liquid packaging. Meinert, N.M. (Westinghouse Hanford Co., Richland, WA (United States)); Riley, D.; Wells, A.H. Westinghouse Hanford Co., Richland, WA (United States). Feb 1994. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-940225-87: Waste management '94, Tucson, AZ (United States), 27 Feb - 3 mar 1994). Order Number DE94009439. Source: OSTI; NTIS; INIS; GPO Dep.

The tank waste pretreatment process involves the separation of low-level and high-level constituents. The liquid high-level defense production waste will be vitrified into thousands of glass logs at the US DOE sites and then transported to a high-level repository for final disposal. Pretreatment and vitrification technology will need to be developed and tested to assess cost-effectiveness. The appropriate pretreatment strategy for complex high-activity liquid will depend on proving a competent process. As technology development matures, actual liquid will be substituted for simulants, and pilot scale plants will replace laboratory scale process demonstrations. Development of this strategy depends on tank waste sample analyses and a high-activity liquid supply for process testing. However, high-activity liquid transportation beyond DOE site boundaries is limited to Type B quantities in volumes less than 50 mL; no licensed packaging exists for greater than 50 mL quantities. The following paper summarizes the need for a high-activity liquid packaging, and identifies the agencies effecting packaging design and transportation. The high-activity liquid packaging concept retrofits licensed spent fuel casks by replacing the spent fuel basket with a sturdy containment vessel appropriate for the chemical nature of the liquid. A Nuclear Packaging (Pacific Nuclear's NuPat™ 125-B) spent

fuel cask was hypothetically retrofitted with a containment vessel filled with liquid source term, the radionuclide inventory contained in the liquid. The structural, thermal, dose rate, and criticality consequences of retrofitting the cask body were evaluated based on data in the 125-B Cask Safety Analysis Report for Packaging. In addition, future packaging development work is discussed.

1655 (WHC-SD-WM-ER-288) CPAC moisture study: Phase 1 report on the study of optical spectra calibration for moisture. Veltkamp, D. (Washington Univ., Seattle, WA (United States). Center for Process Analytical Chemistry). Westinghouse Hanford Co., Richland, WA (United States). 16 Dec 1993. 94p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94005424. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses work done to investigate the feasibility of using optical spectroscopic methods, combined with multivariate Partial Least Squares (PLS) calibration modeling, to quantitatively predict the moisture content of the crust material in Hanford's waste tank materials. Experiments were conducted with BY-104 simulant material for the 400-1100 nm (VIS), 1100-2500 (NIR), and 400-4000 cm^{-1} (IR) optical regions. The test data indicated that the NIR optical region, with a single PLS calibration factor, provided the highest accuracy response (better than 0.5 wt %) over a 0-25 wt % moisture range. Issues relating to the preparation of moisture samples with the BY-104 materials and the potential implementation within hot cell and waste tanks are also discussed. The investigation of potential material interferences, including physical and chemical properties, and the scaled demonstration of fiber optic and camera types of applications with simulated waste tanks are outlined as future work tasks.

1656 (WHC-SD-WM-ES-218-Rev.1) Engineering study of tank leaks related to hydraulic retrieval of sludge from tank 241-C-106: Revision 1. Lowe, S.S.; Carlos, W.C.; Irwin, J.J.; Khaleel, R.; Kline, N.W.; Ludowise, J.D.; Marusich, R.M.; Rittman, P.D. Westinghouse Hanford Co., Richland, WA (United States). 9 Jun 1993. 155p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93016767. Source: OSTI; NTIS; INIS; GPO Dep.

This study evaluates hydraulic retrieval (sluicing) of the waste in single-shell tank 241-C-106 with respect to the likelihood of tank leaks, gross volumes of potential leaks, and their consequences. A description of hydraulic retrieval is developed to establish a baseline for the study. Leak models are developed based on postulated leak mechanisms to estimate the amount of waste that could potentially leak while sluicing. Transport models describe the movement of the waste constituents in the surrounding soil and groundwater after a leak occurs. Environmental impact and risk associated with tank leaks are evaluated. Transport of leaked material to the groundwater is found to be dependent on the rate of recharge of moisture in the soil for moderate-sized leaks. Providing a cover over the tank and surrounding area would eliminate the recharge. The bulk of any leaked material would remain in the vicinity of the tank for remedial action.

1657 (WHC-SD-WM-ES-219) Laboratory flammability studies of mixtures of hydrogen, nitrous oxide, and air: Final report. Cashdollar, K.L. (Bureau of Mines, Pittsburgh, PA (United States). Pittsburgh Research Center);

Hertzberg, M.; Zlochower, I.A.; Lucci, C.E.; Green, G.M.; Thomas, R.A. Westinghouse Hanford Co., Richland, WA (United States); Bureau of Mines, Pittsburgh, PA (United States). Pittsburgh Research Center. 26 Jun 1992. 71p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AI06-91RL12253; AC06-87RL10930. Order Number DE93005134. Source: OSTI; NTIS; INIS; GPO Dep.

At the request of the Department of Energy and the Westinghouse Hanford Company, the Bureau of Mines has investigated the flammability of mixtures of hydrogen, nitrous oxide, and air. This work is relevant to the possible hazards of flammable gas generation from nuclear waste tanks at Hanford, WA. The tests were performed in a 120-L spherical chamber under both quiescent and turbulent conditions using both electric spark and pyrotechnic ignition sources. The data reported here for binary mixtures of hydrogen in air generally confirm the data of previous investigators, but they are more comprehensive than those reported previously. The results clarify to a greater extent the complications associated with buoyancy, turbulence, and selective diffusion. The data reported here for ternary mixtures of hydrogen and nitrous oxide in air indicate that small additions of nitrous oxide (relative to the amount of air) have little effect, but that higher concentrations of nitrous oxide (relative to air) significantly increase the explosion hazard.

1658 (WHC-SD-WM-FRD-011) Functions and requirements for subsurface barriers used in support of single-shell tank waste retrieval. Lowe, S.S. Westinghouse Hanford Co., Richland, WA (United States). 16 Nov 1993. 54p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94004257. Source: OSTI; NTIS; INIS; GPO Dep.

The mission of the Tank Waste Remediation System (TWRS) Program is to store, treat, and immobilize highly radioactive Hanford waste in an environmentally sound, safe, and cost-effective manner. The scope of the TWRS Program includes project and program activities for receiving, storing, maintaining, treating, and disposing onsite, or packaging for offsite disposal, all Hanford tank waste. Hanford tank waste includes the contents of 149 single-shell tanks (SSTs) and 28 double-shell tanks (DSTs), plus any new waste added to these facilities, and all encapsulated cesium and strontium stored onsite and returned from offsite users. A key element of the TWRS Program is retrieval of the waste in the SSTs. The waste stored in these underground tanks must be removed in order to minimize environmental, safety, and health risks associated with continuing waste storage. Subsurface barriers are being considered as a means to mitigate the effects of tank leaks including those occurring during SST waste retrieval. The functions to be performed by subsurface barriers based on their role in retrieving waste from the SSTs are described, and the requirements which constrain their application are identified. These functions and requirements together define the functional baseline for subsurface barriers.

1659 (WHC-SD-WM-PRS-012) Pretreatment status report on the identification and evaluation of alternative processes: Milestone Report No. C064. Sutherland, D.G. (Westinghouse Hanford Co., Richland, WA (United States)); Brothers, A.J.; Beary, M.M.; Nicholson, G.A. Westinghouse Hanford Co., Richland, WA (United States). Sep 1993. 265p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94003528. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this report is to support the development and demonstration of a pretreatment system that will (1) destroy organic materials and ferrocyanide in tank wastes so that the wastes can be stored safely, (2) separate the high-activity and low-activity fractions, (3) remove radionuclides and remove or destroy hazardous chemicals in LLW as necessary to meet waste form feed requirements, (4) support development and demonstration of vitrification technology by providing representative feeds to the bench-scale glass melter, (5) support full-scale HLW vitrification operations, including near-term operation, by providing feed that meets specifications, and (6) design and develop pretreatment processes that accomplish the above objectives and ensure compliance with environmental regulations. This report is a presentation of candidate technologies for pretreatment of Hanford Site tank waste. Included are descriptions of studies by the Pacific Northwest Laboratory of Battelle Memorial Institute; Science Applications International Corporation, an independent consultant; BNFL, Inc. representing British technologies; Numatec, representing French technologies; and brief accounts of other relevant activities.

1660 (WHC-SD-WM-SARR-001) Safety analysis of exothermic reaction hazards associated with the organic liquid layer in tank 241-C-103. Postma, A.K. (Westinghouse Hanford Co., Richland, WA (United States)); Bechtold, D.B.; Borsheim, G.L.; Grisby, J.M.; Guthrie, R.L.; Kummerer, M.; Turner, D.A.; Plys, M.G. Westinghouse Hanford Co., Richland, WA (United States). Mar 1994. 192p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94011592. Source: OSTI; NTIS; INIS; GPO Dep.

Safety hazards associated with the interim storage of a potentially flammable organic liquid in waste Tank C-103 are identified and evaluated. The technical basis for closing the unreviewed safety question (USQ) associated with the floating liquid organic layer in this tank is presented.

1661 (WHC-SD-WM-TRP-150) Sintered Stainless Steel pre-filter test report. Austin, D.A. Westinghouse Hanford Co., Richland, WA (United States). 24 Aug 1993. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94005488. Source: OSTI; NTIS; GPO Dep.

Rotary mode core sampling of waste tanks uses a nitrogen purge gas to remove cuttings from the drill bit. The use of the nitrogen purge gas requires an exhaustor to remove the purge gas and maintain a negative pressure inside the tank. The exhaustor will experience a high HEPA (High Efficiency Particulate Air) filter loading rate due to the cuttings from the rotary mode core sampling operation. This prompted the investigation of a re-useable pre-filter media that would lower the frequency of HEPA filter change out and reduce personnel exposure. The candidate media for the pre-filter was selected to be Bekipor ST-AL multi-layered metal fiber filter media (Sintered Stainless Steel). This sintered stainless steel media produces a fine mesh filter rated 99% efficient on 5 micron particulate. This media is commonly used in fluid and gas filtration systems. This media was tested to determine its ability to be cleaned and reused. Results of testing as well as a description of the test environment and conclusions are provided in this report.

1662 (WHC-SP-0850) Maintenance Implementation Plan for the Waste Tank maintenance and production management. Kerwick, D.P. Westinghouse Hanford Co., Richland, WA (United States). Jun 1992. 67p. Sponsored by

USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93001677. Source: OSTI; NTIS; INIS; GPO Dep.

The objective of the Maintenance Implementation Plan (MIP) is to describe how the Waste Tank facility will implement the requirements established by DOE Order 4330.4A, Maintenance Management Program, Chapter 2.0 Nuclear Facilities (DOE 1990). The plan provides a blueprint for a disciplined approach to implementation and compliance. In addition to the elements described in Chapter 2.0 of the order, the MIP also addresses how the Graded Approach to Maintenance will be used. Section 3.0 of the plan separates facility structures, systems, and components into four separate categories; safety, process, facility systems not related to safety or the process, and other parts of the facility infrastructure. It describes the level of detail that must be applied to each of the categories, the priority that must be assigned to preventive and corrective maintenance related to these categories. It also describes the process used to determine the category assigned to structures, systems and components.

1663 (WHC-SP-0850-Rev.1) Maintenance Implementation Plan for waste tank maintenance and production management: Revision 1. Kerwick, D.P. Westinghouse Hanford Co., Richland, WA (United States). Dec 1992. 66p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93008159. Source: OSTI; NTIS; GPO Dep.

The objective of the Maintenance Implementation Plan (MIP) is to describe how the Waste Tank facility will implement the requirements established by DOE Order 4330.4A, Maintenance Management Program, Chapter 2.0 Nuclear Facilities (DOE 1990). The plan provides a blueprint for a disciplined approach to implementation and compliance. Each element of the order is prioritized, categorized, and then placed into one of three phases for implementation.

1664 (WHC-SP-1689) Infrared imaging systems for the ferrocyanide waste tanks at the US Department of Energy's Hanford Site. Mailhot, R.B.; Morris, K.L. Westinghouse Hanford Co., Richland, WA (United States). Feb 1993. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930204-3: '93 meeting on waste management, Tucson, AZ (United States), 28 Feb - 4 mar 1993). Order Number DE93011285. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy's Hanford Site in Washington State has 24 radioactive storage tanks containing ferrocyanide. There is a concern that these tanks could become explosive. Infrared imaging was investigated as a method to determine if high-heat areas (i.e., "hot spots") exist in the tanks. A hot spot is defined as a volumetric region within a waste tank with an excessively warm [220°C (428°F)] temperature that is generated by radioactive isotopes. The thermal image of a hot spot was modeled by computer. This model determined the temperature variation an infrared system must detect. Laboratory and field tests of the imaging system are described and conclusions based on the laboratory data are presented. The report describes the system's capabilities and limitations. The infrared imaging system is able to detect the surface image of the modeled hot spot in most of the ferrocyanide tanks.

1665 (WINCO-1183) Analysis of ICPP tank farm infiltration. Richards, B.T. Westinghouse Idaho Nuclear Co.,

Inc., Idaho Falls, ID (United States). Oct 1993. 174p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-84ID12435. Order Number DE94008921. Source: OSTI; NTIS; INIS; GPO Dep.

This report addresses water seeping into underground vaults which contain high-level liquid waste (HLLW) storage tanks at the Idaho Chemical Processing Plant (ICPP). Each of the vaults contains from one to three sumps. The original purpose of the sumps was to serve as a backup leak detection system for release of HLLW from the storage tanks. However, water seeps into most of the vaults, filling the sumps, and defeating their purpose as a leak detection system. Leak detection for the HLLW storage tanks is based on measuring the level of liquid inside the tank. The source of water leaking into the vaults was raised as a concern by the State of Idaho INEL Oversight Group because this source could also be leaching contaminants released to soil in the vicinity of the tank farm and transporting contaminants to the aquifer. This report evaluates information concerning patterns of seepage into vault sumps, the chemistry of water in sumps, and water balances for the tank farm to determine the sources of water seeping into the vaults.

1666 (WINCO-1184) ICPP water inventory study progress report. Richards, B.T. Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (United States). May 1993. 34p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-84ID12435. Order Number DE94008922. Source: OSTI; NTIS; INIS; GPO Dep.

Recent data from the Idaho Chemical Processing Plant (ICPP) indicate that water is entering the sumps located in the bottom of Tank Farm Vaults in quantities that exceed expected levels. In addition, perched water body(s) exist beneath the northern portion of the ICPP. Questions have been raised concerning the origin of water entering the Tank Farm sumps and the recharge sources for the perched water bodies. Therefore, in an effort to determine the source of water, a project has been initiated to identify the source of water for Tank Farm sumps and the perched water bodies. In addition, an accurate water balance for the ICPP will be developed. The purpose of this report is to present the specific results and conclusions for the ICPP water balance portion of the study. In addition, the status of the other activities being conducted as part of study, along with the associated action plans, is provided.

1667 (WINCO-1192) ICPP Tank Farm systems analysis. Palmer, W.B.; Beer, M.J.; Cukars, M.; Law, J.P.; Millet, C.B.; Murphy, J.A.; Nenni, J.A.; Park, C.V.; Pruitt, J.I.; Thiel, E.C.; Ward, F.S.; Woodard, J. Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (United States). Jan 1994. 289p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-84ID12435. Order Number DE94008926. Source: OSTI; NTIS; INIS; GPO Dep.

During the early years (1950-1965) of Idaho Chemical Processing Plant (ICPP) operations, eleven, 300,000-gallon waste storage tanks were constructed. A project was in progress to replace these aging tanks; however, since fuel reprocessing has been curtailed at ICPP, it is not clear that the new tanks are required. The Department of Energy (DOE) requested a systems engineering evaluation to determine the need for the new tanks. Over 100 alternatives were identified during a facilitated team meeting using Value Engineering techniques. After eliminating any ideas which clearly could not meet the requirements, the remaining ideas were combined into nine basic cases with five sub cases. These

fourteen cases were then carefully defined using two methods. First, each case was drawn graphically to show waste processing equipment interfaces and time constraints where they existed or were imposed. Second, each case was analyzed using a time-dependent computer simulation of ICPP waste management activities to determine schedule interactions, liquid storage requirements, and solid waste quantities. Based on the evaluation data, the team developed the following recommendations: Install and operate the high-level liquid waste evaporator; minimize liquid waste generation as much as possible within the constraints of required ICPP operational, safety, and environmental commitments; bring a Waste Immobilization Facility on line by 2008 or earlier; operate NWCF as required to alleviate the need for new tank farm capacity; maximize the concentration of Na and K in the calcine to minimize the final amount of waste requiring immobilization; avoid using Bin Set 7 for calcine storage, if possible, to reduce future calcine retrieval and D&D costs; and use WM-190 for liquid waste storage and one of the pillar and panel vaulted tanks as the spare.

1668 (WINCO-11926) Technology development program for Idaho Chemical Processing Plant spent fuel and waste management. Ermold, L.F.; Knecht, D.A.; Hogg, G.W.; Olson, A.L. Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (United States). [1993]. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-84ID12435. (CONF-930906-11: '93 international conference on nuclear waste management and environmental remediation, Prague (Czech Republic), 5-11 Sep 1993). Order Number DE93015567. Source: OSTI; NTIS; INIS; GPO Dep.

Irradiated nuclear fuel has been reprocessed at the Idaho Chemical Processing Plant (ICPP) since 1953 to recover uranium-235 and krypton-85 for the US Department of Energy (DOE). The resulting acidic high-level liquid radioactive waste (HLLW) has been solidified to a high-level waste (HLW) calcine since 1963 and stored in stainless-steel bins enclosed in concrete vaults. Residual HLW and radioactive sodium-bearing waste are stored in stainless-steel underground tanks contained in concrete vaults. Several different types of unprocessed irradiated DOE-owned fuels are also stored at INEL. In April, 1992, DOE announced that spent fuel would no longer be reprocessed to recover enriched uranium. As a result of the decision to curtail reprocessing the ICPP Spent Fuel and Waste Management Technology Development plan has been implemented to identify acceptable options for disposing of the (1) sodium-bearing liquid radioactive waste, (2) radioactive calcine, and (3) irradiated spent fuel stored at the INEL. The plan was developed jointly by DOE and Westinghouse Idaho Nuclear Company, Inc., (WINCO) and with the concurrence of the State of Idaho.

1669 (WINCO-11935) Development of radionuclide separation technologies for processing of Idaho Chemical Processing Plant spent fuel and HLW calcine. Olson, A.L.; Todd, T.A.; Ermold, L.F.; Knecht, D.A.; Hogg, G.W. Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (United States). [1993]. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-84ID12435. (CONF-940417-1: 4. international conference on nuclear fuel reprocessing and waste management, London (United Kingdom), 24-28 Apr 1994). Order Number DE94000933. Source: OSTI; NTIS; INIS; GPO Dep.

Irradiated nuclear fuel has been reprocessed at the Idaho Chemical Processing Plant (ICPP), which is a part of the Idaho National Engineering Laboratory (INEL), since 1953 to

recover uranium-235 and krypton-85 for the US Department of Energy (DOE). The resulting acidic high-level liquid radioactive waste (HLLW) has been solidified to a high-level waste (HLW) calcine since 1963 and stored in stainless-steel bins enclosed in concrete vaults. Residual HLW and radioactive sodium-bearing waste are stored in stainless-steel underground tanks contained in concrete vaults. Several different types of unprocessed irradiated DOE-owned fuels are also stored at INEL. In April 1992, DOE announced that spent fuel would no longer be reprocessed to recover enriched uranium. As a result of the decision to curtail reprocessing the ICPP Spent Fuel and Waste Management Technology Development plan has been implemented to identify acceptable options for disposing of the (1) sodium-bearing liquid radioactive waste, (2) radioactive calcine, and (3) irradiated spent fuel stored at the INEL. The plan was developed jointly by DOE and Westinghouse Idaho Nuclear Company, Inc. (WINCO).

LANDFILL STABILIZATION

Refer also to citation(s) 296, 297, 654, 2536

1670 (CONF-900525-4) Field demonstration of in situ grouting of radioactive solid waste burial trenches with polyacrylamide. Spalding, B.P.; Fontaine, T.A. Oak Ridge National Lab., TN (United States). [1990]. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 2. international symposium on stabilization/solidification of hazardous, radioactive and mixed waste; Williamsburg, VA (United States); 29 May - 1 Jun 1990. Order Number DE91007281. Source: OSTI; NTIS; INIS; GPO Dep.

Demonstrations of in situ grouting with polyacrylamide were carried out on two undisturbed burial trenches and one dynamically compacted burial trench in Solid Waste Storage Area (SWSA) 6 at Oak Ridge National Laboratory (ORNL). The injection of polyacrylamide was achieved quite easily for the two undisturbed burial trenches which were filled with grout, at typical pumping rates of 95 L/min, in several batches injected over several days. The compacted burial trench, however, failed to accept grout at more than 1.9 L/min even when pressure was applied. Thus, it appears that burial trenches, stabilized by dynamic compaction, have a permeability too low to be considered groutable. The water table beneath the burial trenches did not respond to grout injections indicating a lack of hydrologic connection between fluid grout and the water table which would have been observed if the grout failed to set. Because grout set times were adjusted to less than 60 min, the lack of hydrologic connection was not surprising. Postgrouting penetration testing revealed that the stability of the burial trenches was increased from 26% to 79% that measured in the undisturbed soil surrounding the trenches. In situ permeation tests on the grouted trenches indicated a significant reduction in hydraulic conductivity of the trench contents from a mean of 2.1×10^{-3} to 1.85×10^{-5} cm/s. Preliminary observations indicated that grouting with polyacrylamide is an excellent method for both improved stability and hydrologic isolation of radioactive waste and its incidental hazardous constituents.

1671 (CONF-930160-2) Stabilization of contaminated soils by in situ vitrification. Jacobs, G.K. (Oak Ridge National Lab., TN (United States)); Spalding, B.P.; Tixier, J.S.; Powell, T.D. Oak Ridge National Lab., TN (United States); Pacific Northwest Lab., Richland, WA

(United States). [1992]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400 ; AC06-76RL01830. From 2. semi-annual Office of Technology Development (OTD) information meeting; Houston, TX (United States); 26-28 Jan 1993. Order Number DE93005152. Source: OSTI; NTIS; INIS; GPO Dep.

In situ methods are preferred for the stabilization or restoration of soil sites contaminated with elevated levels of hazardous materials (e.g., radionuclides, metals, organics) to minimize potential risks to personnel and the environment associated with removal and treatment. In situ methods available include polymer and silicate grouting, compaction, chemical treatment, groundwater diversion, and vitrification. Of these, in situ vitrification (ISV) is most desirable because it is more a permanent solution and produces a final waste form with the most preferred characteristics. The ISV product, generally a mixture of glass and crystals, has high strength, is resistant to leaching, and has low porosity and permeability. Results are presented on an ISV test at an Oak Ridge Laboratory Site.

1672 (CONF-940225-77) Evaluation of the cover cracking potential due to ground subsidence at UMTRA Project disposal cells. Claire, R.F.; Kuo, J.C.; Wanket, D.R. Morrison-Knudsen Co., Inc., Boise, ID (United States). [1994]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. From Waste management '94; Tucson, AZ (United States); 27 Feb - 3 mar 1994. Order Number DE94008607. Source: OSTI; NTIS; GPO Dep.

The US Department of Energy's Uranium Mill Tailings Remedial Action (UMTRA) Project requires that mill tailings, containing low-level radioactive uranium mill tailings and other waste, be stabilized and controlled by placement in an encapsulated disposal cell. The cover of the cell is a multi-layer system which includes a low-permeability earthen radon/infiltration barrier, a bedding layer, and a erosion protection layer. The radon/infiltration barrier is designed to limit the radon flux and reduce water infiltration. The performance criteria established by the US Environmental Protection Agency in 40 CFR 192 require the cover to be effective for up to 1000 years to the extent reasonably achievable, and in any case, for at least 200 years. One concern that would affect the integrity of the radon/infiltration barrier is the potential for cracking due to the post-construction settlement of underlying compressible materials. To investigate the potential of cover cracking for UMTRA disposal cells, a simplified beam analysis is used to determine the horizontal movements and strains due to the differential settlements at the top surface of a relatively incompressible layer (e.g. radon/infiltration barrier and compacted tailings). The potential of cover cracking is then evaluated by comparing the calculated horizontal tensile strains with the strains that will cause cracking of the cover for a given material.

1673 (CONF-940225-79) Design of UMTRA covers to mitigate the effect of frost penetration. Banani, A.M.; Claire, R.F. Morrison-Knudsen Co., Inc., Boise, ID (United States). [1994]. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. From Waste management '94; Tucson, AZ (United States); 27 Feb - 3 mar 1994. Order Number DE94008604. Source: OSTI; NTIS; GPO Dep.

The Uranium Mill Tailings Remedial Action (UMTRA) Project, contracted by the US Department of Energy (DOE), requires construction of disposal cells for residual radioactive materials from abandoned uranium mill tailings. A

disposal cell consists of contaminated material placed within a stabilized embankment with a top cover. The embankment and cover should be effective for up to 1000 years, to the extent reasonably achievable, and in any case for at least 200 years. The embankment cover usually consists of a radon/infiltration barrier, a frost barrier and erosion protection layer consisting of bedding and riprap layers. The radon/infiltration barrier and frost barrier are two important elements of the cover systems. A radon/infiltration barrier is designed to reduce the radon emissions from the contaminated materials and to limit the surface water infiltration into the contaminated material. However, a radon/infiltration barrier has to be protected from repeated freeze-thaw cycles to prevent an increase in permeability. Frost penetration depth is site specific and depends on local climatic conditions and soil properties of the cover system. However, placing a frost barrier is not only very costly but also reduces the disposal capacity of the embankment. Recent laboratory test results indicate that freeze-thaw cycles do not significantly effect the permeability of compacted sand-bentonite mixtures. Therefore, radon/infiltration barriers using sand-bentonite mixtures may not require frost barriers for protection against the effects of freeze-thaw. In this paper the design of UMTRA covers is briefly explained; the criteria to determine a 200 year freeze event, and the frost penetration depth are discussed. The results of freeze-thaw permeability tests on compacted clay and sand-bentonite mixtures are also presented.

1674 (DOE/AL/62350-9F) Licensing plan for UMTRA project disposal sites: Final [report]. Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Sep 1993. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94001477. Source: OSTI; NTIS; INIS; GPO Dep.

The Uranium Mill Tailings Remedial Action (UMTRA) Project Office developed a plan to define UMTRA Project licensing program objectives and establish a process enabling the DOE to document completion of remedial actions in compliance with 40 CFR 192 and the requirements of the NRC general license. This document supersedes the January 1987 Project Licensing Plan (DOE, 1987). The plan summarizes the legislative and regulatory basis for licensing, identifies participating agencies and their roles and responsibilities, defines key activities and milestones in the licensing process, and details the coordination of these activities. This plan provides an overview of the UMTRA Project from the end of remedial actions through the NRC's acceptance of a disposal site under the general license. The licensing process integrates large phases of the UMTRA Project. Other programmatic UMTRA Project documents listed in Section 6.0 provide supporting information.

1675 (DOE/AL/62350-21D-Attach.2) Remedial action and site design for stabilization of the inactive uranium mill tailings sites at Slick Rock, Colorado: Attachment 2, Geology report. USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office; Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Jul 1993. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350 ; FC04-82AL16257. Order Number DE93041031. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents geologic considerations that are pertinent to the Remedial Action Plan for Slick Rock mill tailings. Topics covered include regional geology, site geology, geologic stability, and geologic suitability.

1676 (DOE/AL/62350-21D-Attach.3) **Remedial action and site design for stabilization of the inactive uranium mill tailings sites at Slick Rock, Colorado: Attachment 3, Groundwater hydrology report.** USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office; Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Jul 1993. 60p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350 ; FC04-82AL16257. Order Number DE93041032. Source: OSTI; NTIS; INIS; GPO Dep.

The US Environmental Protection Agency (EPA) has established health and environmental protection regulations to correct and prevent groundwater contamination resulting from processing activities at inactive uranium milling sites (EPA, 1987). According to the Uranium Mill Tailings Radiation Control Act (UMTRCA) of 1978 Public Law (PL) 95-604 (PL 95-604), the US Department of Energy (DOE) is responsible for assessing the inactive uranium processing sites. The DOE has determined that for Slick Rock, this assessment shall include hydrogeologic site characterization for two separate uranium processing sites, the Union Carbide (UC) site and the North Continent (NC) site, and for the proposed Burro Canyon disposal site.

1677 (DOE/AL/62350-21D-Attach.3-App.A) **Remedial action plan and site design for stabilization of the inactive uranium mill tailings sites at Slick Rock, Colorado: Appendix A to Attachment 3, Tables.** USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office; Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Jul 1993. 463p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350 ; FC04-82AL16257. Order Number DE93041033. Source: OSTI; NTIS; GPO Dep.

This report is a compilation of chemical and radionuclide measurements made in the environment as part of the Remedial Action Plan and Site Design for Stabilization program.

1678 (DOE/AL/62350-21D-Attach.3-App.B) **Remedial action plan and site design for stabilization of the inactive uranium mill tailings sites at Slick Rock, Colorado: Appendix B to Attachment 3, Lithologic logs.** USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office; Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Jul 1993. 257p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350 ; FC04-82AL16257. Order Number DE93041034. Source: OSTI; NTIS; GPO Dep.

This report consists of well logging information gathered during work on the Remedial Action Plan and Site Design for Stabilization program.

1679 (DOE/AL/62350-21D-Attach.3-App.C) **Remedial action plan and site design for stabilization of the inactive uranium mill tailings sites at Slick Rock, Colorado: Appendix C to Attachment 3, Calculations.** USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office; Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Jul 1993. 520p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350 ; FC04-82AL16257. Order Number DE93041035. Source: OSTI; NTIS; GPO Dep.

This report is a compilation of data taken in the ground water hydrology section of the Remedial Action Plan for Slick Rock mill tailings.

1680 (DOE/AL/62350-21D-Attach.4) **Remedial action and site design for stabilization of the inactive uranium mill tailings sites at Slick Rock, Colorado: Attachment 4, Water resources protection strategy.** USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office; Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Jul 1993. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350 ; FC04-82AL16257. Order Number DE93041036. Source: OSTI; NTIS; INIS; GPO Dep.

To achieve compliance with the proposed US Environmental Protection Agency (EPA) groundwater protection standards (Subpart A of 40 CFR 192), the US Department of Energy (DOE) proposes to apply supplemental standards for Class III (limited use) groundwater because of low yield [less than 150 gallons per day (gpd) (7×10^{-3} liters per second (L/s))] in the uppermost aquifer (upper sandstone unit of the Burro Canyon Formation). Groundwater in the uppermost aquifer is not a current or potential source of drinking water because of the aquifer's low yield. As a result, the proposed remedial action will ensure protection of human health and the environment.

1681 (DOE/AL/62350-21PF) **Remedial action plan and site design for stabilization of the inactive uranium mill tailings sites at Slick Rock, Colorado: Remedial Action Selection Report: Preliminary final.** Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Mar 1994. 96p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94008596. Source: OSTI; NTIS; GPO Dep.

This proposed remedial action plan incorporates the results of detailed investigation of geologic, geomorphic, and seismic conditions at the proposed disposal site. The proposed remedial action will consist of relocating the uranium mill tailings, contaminated vicinity property materials, demolition debris, and windblown/waterborne materials to a permanent repository at the proposed Burro Canyon disposal cell. The proposed disposal site will be geomorphically stable. Seismic design parameters were developed for the geotechnical analyses of the proposed cell. Cell stability was analyzed to ensure long-term performance of the disposal cell in meeting design standards, including slope stability, settlement, and liquefaction potential. The proposed cell cover and erosion protection features were also analyzed and designed to protect the RRM (residual radioactive materials) against surface water and wind erosion. The location of the proposed cell precludes the need for permanent drainage or interceptor ditches. Rock to be used on the cell top-, side-, and toeslopes was sized to withstand probable maximum precipitation events.

1682 (DOE/AL/62350-21PF-Attach.2) **Remedial action and site design for stabilization of the inactive uranium mill tailings sites at Slick Rock, Colorado: Attachment 2, Geology report: Appendix B, Preliminary final.** USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office; Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Mar 1994. 124p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94008597. Source: OSTI; NTIS; GPO Dep.

Detailed investigations of geologic, geomorphic, and seismic conditions at the Burro Canyon site were conducted by the US Department of Energy (DOE) as a disposal site for the tailings at two processing sites near the Slick Rock, Colorado, post office. The purposes of these studies are basic site characterization and identification of potential geologic hazards that could affect long-term site stability. Subsequent engineering studies (e.g., analyses of hydrologic and liquefaction hazards) used the data developed in these studies. The geomorphic analysis was employed in the design of effective erosion protection. Studies of the regional and local seismotectonic setting, which included a detailed search for possible capable faults within a 65-km radius of the site, provided the basis for seismic design parameters.

1683 (DOE/AL/62350-21PF-Attach.3) Remedial action plan and site design for stabilization of the inactive uranium mill tailings sites at Slick Rock, Colorado: Attachment 3, Ground water hydrology report: Preliminary final. Jacobs Engineering Group, Inc., Albuquerque, NM (United States). 4 Mar 1994. 67p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94008598. Source: OSTI; NTIS; GPO Dep.

The US Environmental Protection Agency (EPA) has established health and environmental protection regulations to correct and prevent ground water contamination resulting from processing activities at inactive uranium milling sites (52 FR 36000 (1987)). According to the Uranium Mill Tailings Radiation Control Act (UMTRCA) of 1978, 42 USC §7901 et seq., the US Department of Energy (DOE) is responsible for assessing the inactive uranium processing sites. The DOE has determined that for Slick Rock, this assessment shall include hydrogeologic site characterization for two separate uranium processing sites, the Union Carbide (UC) site and the North Continent (NC) site, and for the proposed Burro Canyon disposal site. The water resources protection strategy that describes how the proposed action will comply with the EPA ground water protection standards is presented in Attachment 4. The following site characterization activities are discussed in this attachment: Characterization of the hydrogeologic environment, including hydrostratigraphy, ground water occurrence, aquifer parameters, and areas of recharge and discharge. Characterization of existing ground water quality by comparison with background water quality and the maximum concentration limits (MCL) of the proposed EPA ground water protection standards. Definition of physical and chemical characteristics of the potential contaminant source, including concentration and leachability of the source in relation to migration in ground water and hydraulically connected surface water. Description of local water resources, including current and future use, availability, and alternative supplies.

1684 (DOE/AL/62350-21PF-Attach.3-App.A) Remedial action plan and site design for stabilization of the inactive uranium mill tailings sites at Slick Rock, Colorado: Appendix A to Attachment 3, tables: Preliminary final. Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Mar 1994. 463p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94008599. Source: OSTI; NTIS; INIS; GPO Dep.

This appendix contains the supporting tables for the remedial action plan for uranium mill tailings sites at Slick Rock, CO. The tables contain monitoring well information, background groundwater quality data, regulated constituent

summaries, tailings pore fluid sample analyses, and other data for each of the sites studied.

1685 (DOE/AL/62350-21PF-Attach.3-App.B) Remedial action plan and site design for stabilization of the inactive uranium mill tailings sites at Slick Rock, Colorado: Appendix B to Attachment 3, lithologic logs: Preliminary final. Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Mar 1994. 205p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94008600. Source: OSTI; NTIS; INIS; GPO Dep.

This appendix contains the lithologic logs and monitor well construction information for the remedial action plan for uranium mill tailings sites at Slick Rock, CO. Data from each borehole is presented graphically and a stratigraphic description is given.

1686 (DOE/AL/62350-21PF-Attach.3-App.C) Remedial action plan and site design for stabilization of the inactive uranium mill tailings sites at Slick Rock, Colorado: Appendix C to Attachment 3, calculations: Preliminary final. Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Mar 1994. 566p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94008601. Source: OSTI; NTIS; INIS; GPO Dep.

This appendix contains the calculations for the remedial action plan for the uranium mill tailings sites at Slick Rock, CO. Included are calculations and charts for background ground water quality, lysimeter water quality, on-site and downgradient ground water quality at the Slick Rock processing and disposal sites. Also included are calculations for the average hydraulic gradients, average linear ground water velocities in the upper, middle and lower sandstone units at the Burro Canyon Disposal Site, and canyon pumping and slug tests and seepage reports.

1687 (DOE/AL/62350-21PF-Attach.4) Remedial action plan and site design for stabilization of the inactive uranium mill tailings sites at Slick Rock, Colorado: Attachment 4, water resources protection strategy: Preliminary final. Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Mar 1994. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94008603. Source: OSTI; NTIS; GPO Dep.

This attachment contains a summary of the proposed water resources protection strategy developed to achieve compliance with US EPA ground water protection standards for the remedial action plan at the Slick Rock, CO uranium mill tailings sites. Included are the conceptual design considerations such as climate and infiltration, surface and subsurface drainage, and features for water resources protection such as disposal cell cover components, transient drainage and control of construction water, subsidence and disposal cell longevity. The disposal and control of radioactive materials and nonradioactive contaminants as it relates to ground water protection standards is discussed, and the plan for cleanup and control of existing contamination is outlined.

1688 (DOE/AL/62350-33D) UMTRA Project Office Records Management Plan. USDOE Albuquerque Field Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Jun 1993. 18p. Sponsored by USDOE,

Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE93040745. Source: OSTI; NTIS; GPO Dep.

The Uranium Mill Tailings Remedial Action (UMTRA) Project Office maintains two distinct records handling areas. One of the areas is maintained by a Technical Assistance Contractor (TAC), and is referred to as the UMTRA Project Document Control Center (UPDCC). The UPDCC manages all UMTRA records except those dealing with contracts, personnel, budgeting, finance, and any other documents which are of a purely administrative nature. The second area, the UMTRA Project Administrative Files Collection (UPAFC), contains all those records listed above that are not managed by the UPDCC. This Records Management Plan (RMP) for the UPAFC will be the framework for identifying the elements and activities that relate to the management and operational aspects involved in the handling of UPAFC. Guidelines for the program will be obtained from US Department of Energy (DOE) Orders. DOE Orders implement the guidelines issued by the National Archives and Records Administration (NARA), the final authority for records management. The RMP will address the life cycle of records, including their creation, maintenance, use, and disposition.

1689 (DOE/AL/62350-35F-Rev.1) **Uranium Mill Tailings Remedial Action (UMTRA) Surface Project: Project plan: Revision 1.** USDOE Albuquerque Field Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. 11 Aug 1993. 65p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE93040747. Source: OSTI; NTIS; INIS; GPO Dep.

The Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA) [Public Law (PL) 95-604, 42 United States Code (USC) 7901], hereinafter referred to as the "Act," authorizes the US Department of Energy (DOE) to stabilize and control surface tailings and ground water contamination. To fulfill this mission, the DOE has established two projects under the Uranium Mill Tailings Remedial Action (UMTRA) Project Office. The Ground Water Project was established in April 1991 as a major project and a separate project plan will be prepared for that portion of the mission. This project plan covers the UMTRA Surface Project, a major system acquisition (MSA).

1690 (DOE/AL/62350-40F-Attach.2) **Remedial action plan and site design for stabilization of the inactive uranium processing site at Naturita, Colorado: Remedial Action Selection Report, Appendix B of Attachment 2: Geology report, Final.** Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Mar 1994. 225p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350 ; FC04-82AL16257. Order Number DE94011048. Source: OSTI; NTIS; INIS; GPO Dep.

The uranium processing site near Naturita, Colorado, is one of 24 inactive uranium mill sites designated to be cleaned up by the US Department of Energy (DOE) under the Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA), 42 USC § 7901 et seq. Part of the UMTRCA requires that the US Nuclear Regulatory Commission (NRC) concur with the DOE's remedial action plan (RAP) and certify that the remedial action conducted at the site complies with the standards promulgated by the US Environmental Protection Agency (EPA). Included in the RAP is this Remedial Action Selection Report (RAS), which describes the proposed remedial action for the Naturita site. An extensive

amount of data and supporting information has been generated and evaluated for this remedial action. These data and supporting information are not incorporated into this single document but are included or referenced in the supporting documents. The RAP consists of this RAS and four supporting documents or attachments. This Attachment 2, Geology Report describes the details of geologic, geomorphic, and seismic conditions at the Dry Flats disposal site.

1691 (DOE/AL/62350-40F-Attach.3-4) **Remedial action plan and site design for stabilization of the inactive uranium processing site at Naturita, Colorado: Appendix B of Attachment 3: Groundwater hydrology report, Attachment 4: Water resources protection strategy, Final.** Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Mar 1994. 329p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350 ; FC04-82AL16257. Order Number DE94011041. Source: OSTI; NTIS; INIS; GPO Dep.

Attachment 3 Groundwater Hydrology Report describes the hydrogeology, water quality, and water resources at the processing site and Dry Flats disposal site. The Hydrological Services calculations contained in Appendix A of Attachment 3, are presented in a separate report. Attachment 4 Water Resources Protection Strategy describes how the remedial action will be in compliance with the proposed EPA groundwater standards.

1692 (DOE/AL/62350-40F-Attach.3-App.A) **Remedial action plan and site design for stabilization of the inactive uranium processing site at Naturita, Colorado: Appendix A of Attachment 3: Calculations, Final.** Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Mar 1994. 325p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350 ; FC04-82AL16257. Order Number DE94011049. Source: OSTI; NTIS; INIS; GPO Dep.

This report contains calculations for: hydraulic gradients for Alluvial Aquifer and Salt Wash Aquifer; slug test analysis to determine hydraulic conductivity for Alluvial Aquifer and Salt Wash Aquifer; average linear groundwater velocity for Alluvial Aquifer and Salt Wash Aquifer; statistical analysis of the extent of existing groundwater contamination; hydraulic gradients for Dakota/Burro Canyon Formation and Salt Wash Aquifer; slug test analysis to determine hydraulic conductivity for Dakota/Burro Canyon Formation and Perched Salt Wash Aquifer; determination of hydraulic conductivity of the Dakota/Burro Canyon Formation from Packer Tests; average linear groundwater velocity for Dakota/Burro Canyon and Salt Wash Aquifer; chemical and mineralogical characterization of core samples from the Dry Flats Disposal Site; and demonstration of low groundwater yield from Uppermost Aquifer.

1693 (DOE/AL/62350-40PF-Attach.2) **Remedial action plan and site design for stabilization of the inactive uranium processing site at Naturita, Colorado: Remedial action selection report, Attachment 2, Geology report: Preliminary final.** USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office; Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Aug 1993. 179p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE93041027. Source: OSTI; NTIS; INIS; GPO Dep.

The uranium processing site near Naturita, Colorado, is one of 24 inactive uranium mill sites designated to be

cleaned up by the US Department of Energy (DOE) under the Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA), Public Law 95-604. Part of the UMTRCA requires that the US Nuclear Regulatory Commission (NRC) concur with the DOE's remedial action plan (RAP) and certify that the remedial action conducted at the site complies with the standards promulgated by the US Environmental Protection Agency (EPA). Included in the RAP is this Remedial Action Selection Report (RAS), which serves two purposes. First, it describes the activities that are proposed by the DOE to accomplish remediation and long-term stabilization and control of the radioactive materials at the inactive uranium processing site near Naturita, Colorado. Second, this document and the rest of the RAP, upon concurrence and execution by the DOE, the state of Colorado, and the NRC, become Appendix B of the cooperative agreement between the DOE and the State of Colorado.

1694 (DOE/AL/62350-40PF-Attach.3-4) Remedial action plan and site design for stabilization of the inactive uranium processing site at Naturita, Colorado: Attachment 3, Groundwater hydrology report, Attachment 4, Water resources protection strategy: Preliminary final. USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office; Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Aug 1993. 356p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE93041028. Source: OSTI; NTIS; INIS; GPO Dep.

The US Environmental Protection Agency (EPA) has established health and environmental protection regulations to correct and prevent groundwater contamination resulting from processing activities at inactive uranium milling sites (40 CFR 192). The Uranium Mill Tailings Radiation Control Act (UMTRCA) of 1978 designated responsibility to the US Department of Energy (DOE) for assessing the inactive uranium milling sites. The DOE has determined that each assessment shall include information on site characterization, a description of the proposed action, and a summary of the water resources protection strategy that describes how the proposed action will comply with the EPA groundwater protection standards. To achieve compliance with the proposed US Environmental Protection Agency (EPA) groundwater protection standards, the US Department of Energy (DOE) proposes that supplemental standards be applied at the Dry Flats disposal site because of Class III (limited use) groundwater in the uppermost aquifer (the basal sandstone of the Cretaceous Burro Canyon Formation) based on low yield. The proposed remedial action will ensure protection of human health and the environment.

1695 (DOE/AL/62350-40PF-Attach.3-App.A) Remedial action plan and site design for stabilization of the inactive uranium processing site at Naturita, Colorado: Appendix A of Attachment 3, Calculations: Preliminary final. USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office; Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Aug 1993. 302p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE93041029. Source: OSTI; NTIS; INIS; GPO Dep.

This report consists primarily of calculations for ground water flow and hydraulic conductivity as part of the Remedial Action Plan and Site Design for Stabilization program.

1696 (DOE/AL/62350-44) Environment, safety, and health regulatory implementation plan. Jacobs Engineering Group, Inc., Albuquerque, NM (United States). 21 Oct 1993. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94003070. Source: OSTI; NTIS; INIS; GPO Dep.

To identify, document, and maintain the Uranium Mill Tailings Remedial Action (UMTRA) Project's environment, safety, and health (ES&H) regulatory requirements, the US Department of Energy (DOE) UMTRA Project Office tasked the Technical Assistance Contractor (TAC) to develop a regulatory operating envelope for the UMTRA Project. The system selected for managing the UMTRA regulatory operating envelope data base is based on the Integrated Project Control/Regulatory Compliance System (IPC/RCS) developed by WASTREN, Inc. (WASTREN, 1993). The IPC/RCS is a tool used for identifying regulatory and institutional requirements and indexing them to hardware, personnel, and program systems on a project. The IPC/RCS will be customized for the UMTRA Project surface remedial action and groundwater restoration programs. The purpose of this plan is to establish the process for implementing and maintaining the UMTRA Project's regulatory operating envelope, which involves identifying all applicable regulatory and institutional requirements and determining compliance status. The plan describes how the Project will identify ES&H regulatory requirements, analyze applicability to the UMTRA Project, and evaluate UMTRA Project compliance status.

1697 (DOE/AL/62350-100) In situ testing to determine field-saturated hydraulic conductivity of UMTRA Project disposal cell covers, liners, and foundation areas: Special study. Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Feb 1994. 85p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94007199. Source: OSTI; NTIS; INIS; GPO Dep.

This special study was conducted to prepare a guidance document for selecting in situ hydraulic conductivity (K) tests, comparing in situ testing methods, and evaluating the results of such tests. This report may be used as a practical decision-making tool by the Uranium Mill Tailings Remedial Action (UMTRA) Project staff to determine which testing method will most efficiently achieve the field-saturated K results needed for long-term planning. A detailed section on near-surface test methods discusses each method which may be applicable to characterization of UMTRA disposal cell covers, liners and foundation materials. These potentially applicable test methods include the sealed double-ring infiltrometer (SDRI), the air-entry permeameter (AEP), the guelph permeameter, the two-stage borehole technique (TSB), the pressure infiltrometer, and the disk permeameter. Analytical solutions for these methods are provided, and limitations of these solutions are discussed, and a description of testing equipment design and installation are provided.

1698 (DOE/AL/62350-108) UMTRA Project Office Federal Employee Occupational Safety and Health Program Plan: Final draft. Young, B.H. Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Feb 1994. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94008245. Source: OSTI; NTIS; GPO Dep.

This document establishes the Federal Employee Occupational Safety and Health (FEOSH) Program for the US Department of Energy (DOE) Uranium Mill Tailings Remedial Action (UMTRA) Project Office. This program will

ensure compliance with the applicable requirements of DOE Order 3790.1 B and DOE Albuquerque Operations Office (AL) Order 3790.1A. FEOSH Program responsibilities delegated by the DOE-AL to the UMTRA Project Office by AL Order 3790.1A also are assigned. The UMTRA Project Office has developed the UMTRA Project Environmental, Safety, and Health (ES&H) Plan (DOE, 1992), which establishes the basic programmatic ES&H requirements for all participants on the UMTRA Project. The ES&H plan is designed primarily to cover remedial action activities at UMTRA sites, and defines the ES&H responsibilities of both the UMTRA Project Office and its contractors. The UMTRA FEOSH Program described herein is a subset of the overall UMTRA ES&H program and covers only the federal employees working on the UMTRA Project.

1699 (DOE/AL-62350-111D) UMTRA project list of reportable occurrences. Jacobs Engineering Group, Inc., Albuquerque, NM (United States); MK-Ferguson Co., Albuquerque, NM (United States). Apr 1994. 63p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94011034. Source: OSTI; NTIS; INIS; GPO Dep.

This UMTRA Project List of Reportable occurrences is provided to facilitate efficient categorization of reportable occurrences. These guidelines have been established in compliance with DOE minimum reporting requirements under DOE Order 5000.3B. Occurrences are arranged into nine groups relating to US Department of Energy (DOE) Uranium Mill Tailings Remedial Action (UMTRA) Project operations for active sites. These nine groupings are provided for reference to determine whether an occurrence meets reporting requirement criteria in accordance with the minimum reporting requirements. Event groups and significance categories that cannot or will not occur, and that do not apply to UMTRA Project operations, are omitted. Occurrence categorization shall be as follows: Group 1. Facility Condition; Group 2. Environmental; Group 3. Personnel Safety; Group 4. Personnel Radiation Protection; Group 5. Safeguards and Security; Group 6. Transportation; Group 7. Value Basis Reporting; Group 8. Facility Status; and Group 9. Cross-Category Items.

1700 (DOE/AL-150329.0001) Scoping session of the programmatic environmental impact statement for the uranium mill tailings remedial action project. USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Project Office. 8 Dec 1992. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE93005693. Source: OSTI; NTIS; GPO Dep.

This report contains documentation of the scoping session of the environmental impact statement for the Uranium Mill Tailings Remedial Action Project. The purpose of the meeting was to talk about the Programmatic Environmental Impact Statement on the groundwater.

1701 (DOE/AL-150329.0002) Department of Energy Programmatic Environmental Impact Statement (PEIS) scoping session. USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. [1992]. 75p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE93005694. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this programmatic environmental impact statement (PEIS) scoping meeting was: to present the

ground water program so as to build some familiarity and understanding about the issue involved; and to get the Durango community's input. This report contains the presentations made by the project manager for the uranium mill tailings program, site manager for the Durango UMTRA site, manager of ground water hydrology, and includes comments made by local residents.

1702 (DOE/EA-0464-Rev.1) Environmental assessment of remedial action at the Naturita Uranium processing site near Naturita, Colorado: Revision 1. USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office; Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Aug 1993. 131p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE93041037. Source: OSTI; NTIS; INIS; GPO Dep.

The proposed remedial action for the Naturita processing site is relocation of the contaminated materials and debris to the Dry Flats disposal site, 6 road miles (mi) [10 kilometers (km)] to the southeast. At the disposal site, the contaminated materials would be stabilized and covered with layers of earth and rock. The proposed disposal site is on land administered by the Bureau of Land Management (BLM) and used primarily for livestock grazing. The final disposal site would cover approximately 57 ac (23 ha), which would be permanently transferred from the BLM to the DOE and restricted from future uses. The remedial action activities would be conducted by the DOE's Uranium Mill Tailings Remedial Action (UMTRA) Project. The remedial action would result in the loss of approximately 164 ac (66 ha) of soils, but 132 ac (53 ha) of these soils are contaminated and cannot be used for other purposes. Another 154 ac (62 ha) of soils would be temporarily disturbed. Approximately 57 ac (23 ha) of open range land would be permanently removed from livestock grazing and wildlife use. The removal of the contaminated materials would affect the 100-year floodplain of the San Miguel River and would result in the loss of riparian habitat along the river. The southwestern willow flycatcher, a Federal candidate species, may be affected by the remedial action, and the use of water from the San Miguel River "may affect" the Colorado squawfish, humpback chub, bonytail chub, and razorback sucker. Traffic levels on State Highways 90 and 141 would be increased during the remedial action, as would the noise levels along these transportation routes. Measures for mitigating the adverse environmental impacts of the proposed remedial action are discussed in Section 6.0 of this environmental assessment (EA).

1703 (DOE/EA-0464-Rev.2) Environmental assessment of remedial action at the Naturita Uranium processing site near Naturita, Colorado: Revision 2. Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Jan 1994. 163p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94006201. Source: OSTI; NTIS; INIS; GPO Dep.

The proposed remedial action for the Naturita processing site is relocation of the contaminated materials and debris to the Dry Flats disposal site, 6 road miles (mi) [10 kilometers (km)] to the southeast. At the disposal site, the contaminated materials would be stabilized and covered with layers of earth and rock. The proposed disposal site is on land administered by the Bureau of Land Management (BLM) and used primarily for livestock grazing. The final disposal site would cover approximately 57 ac (23 ha), which would be

permanently transferred from the BLM to the DOE and restricted from future uses. The remedial action activities would be conducted by the DOE's Uranium Mill Tailings Remedial Action (UMTRA) Project. The proposed remedial action would result in the loss of approximately 162 ac (66 ha) of soils at the processing and disposal sites; however, 133 ac (55 ha) of these soils at and adjacent to the processing site are contaminated and cannot be used for other purposes. If supplemental standards are approved by the NRC and state of Colorado, approximately 112 ac (45 ha) of contaminated soils adjacent to the processing site would not be cleaned up. This area is steeply sloped. The cleanup of this contamination would have adverse environmental consequences and would be potentially hazardous to remedial action workers. Another 220 ac (89 ha) of soils would be temporarily disturbed during the remedial action. The final disposal site would result in approximately 57 ac (23 ha) being removed from livestock grazing and wildlife use.

1704 (DOE/EA-0464-Rev.3) **Environmental assessment of remedial action at the Naturita uranium processing site near Naturita, Colorado: Revision 3.** Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Feb 1994. 144p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94007202. Source: OSTI; NTIS; INIS; GPO Dep.

The proposed remedial action for the Naturita processing site is relocation of the contaminated materials and debris to the Dry Flats disposal site, 6 road miles (mi) [10 kilometers (km)] to the southeast. At the disposal site, the contaminated materials would be stabilized and covered with layers of earth and rock. The proposed disposal site is on land administered by the Bureau of Land Management (BLM) and used primarily for livestock grazing. The final disposal site would cover approximately 57 ac (23 ha), which would be permanently transferred from the BLM to the DOE and restricted from future uses. The remedial action activities would be conducted by the DOE's Uranium Mill Tailings Remedial Action (UMTRA) Project. The proposed remedial action would result in the loss of approximately 162 ac (66 ha) of soils at the processing and disposal sites; however, 133 ac (55 ha) of these soils at and adjacent to the processing site are contaminated and cannot be used for other purposes. If supplemental standards are approved by the NRC and state of Colorado, approximately 112 ac (45 ha) of contaminated soils adjacent to the processing site would not be cleaned up. This area is steeply sloped. The cleanup of this contamination would have adverse environmental consequences and would be potentially hazardous to remedial action workers. Another 220 ac (89 ha) of soils would be temporarily disturbed during the remedial action. The final disposal site would result in approximately 57 ac (23 ha) being removed from livestock grazing and wildlife use.

1705 (DOE/ID-12123) **Managing soil moisture on waste burial sites.** Anderson, J.E. (Idaho State Univ., Pocatello, ID (United States). Dept. of Biological Sciences); Ratzlaff, T.D.; Nowak, R.S.; Markham, O.D. USDOE Idaho Field Office, Idaho Falls, ID (United States). Nov 1991. 22p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92012364. Source: OSTI; NTIS; INIS; GPO Dep.

Shallow land burial is a common method of disposing of industrial, municipal, and low-level radioactive waste. The exclusion of water from buried wastes is a primary objective in designing and managing waste disposal sites. If wastes

are not adequately isolated, water from precipitation may move through the landfill cover and into the wastes. The presence of water in the waste zone may promote the growth of plant roots to that depth and result in the transport of toxic materials to above-ground foliage. Furthermore, percolation of water through the waste zone may transport contaminants into ground water. This report presents results from a field study designed to assess the the potential for using vegetation to deplete soil moisture and prevent water from reaching buried wastes at the Idaho National Engineering Laboratory (INEL). Our results show that this approach may provide an economical means of limiting the intrusion of water on waste sites.

1706 (DOE/LLW-152) **1991 State-by-state assessment of low-level radioactive wastes received at commercial disposal sites: National Low-Level Waste Management Program.** Fuchs, R.L.; Culbertson-Arendts, K. EG and G Idaho, Inc., Idaho Falls, ID (United States). National Low-Level Waste Management Program. Sep 1992. 139p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. (INEL/MISC-92070). Order Number DE93005068. Source: OSTI; NTIS; INIS; GPO Dep.

Each year the National Low-Level Waste Management Program publishes a state-by-state assessment report. This report provides both national and state-specific disposal data on low-level radioactive waste commercially disposed of in the United States. Data in this report are categorized according to disposal site, generator category, waste class, volumes, and radionuclide activity. Included in this report are tables showing the distribution of waste by state for 1991 and a comparison of waste volumes and radioactivity by state for 1987 through 1991; also included is a list of all commercial nuclear power reactors in the United States as of December 31, 1991. This report distinguishes between low-level radioactive waste shipped directly for disposal by generators and that which was handled by an intermediary, a reporting change introduced in the 1988 state-by-state report.

1707 (DOE/UMTRA-050503-0000) **Remedial Action Plan and site design for stabilization of the inactive uranium mill tailings site at Durango, Colorado: Remedial action selection report: Revised final report.** USDOE Albuquerque Field Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Dec 1991. 56p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350 ; FC04-82AL16257. Order Number DE93010352. Source: OSTI; NTIS; INIS; GPO Dep.

The uranium mill tailings site near Durango, Colorado, was one of 24 inactive uranium mill sites designated to be remediated by the US Department of Energy (DOE) under the Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA). Part of the UMTRCA requires that the US Nuclear Regulatory Commission (NRC) concur with the DOE's Remedial Action Plan (RAP) and certify that the remedial action conducted at the site complies with the standards promulgated by the US Environmental Protection Agency (EPA). Included in the RAP is this Remedial Action Selection Report (RAS), which has been developed to serve a two-fold purpose. First, it describes the activities that have been conducted by the DOE to accomplish remediation and long-term stabilization and control of the radioactive materials at the inactive uranium mill processing site near Durango, Colorado. Secondly, this document and the rest of the RAP, upon concurrence and execution by the DOE, the State of Colorado,

and the NRC, become Appendix B of the Cooperative Agreement between the DOE and the State of Colorado.

1708 (DOE/UMTRA-050503-0000-Attach.4) Remedial Action Plan and site design for stabilization of the inactive uranium mill tailings site at Durango, Colorado: Attachment 4, Water resources protection strategy: Revised final report. USDOE Albuquerque Field Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Dec 1991. 31p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350 ; FC04-82AL16257. Order Number DE93010386. Source: OSTI; NTIS; INIS; GPO Dep.

To achieve compliance with the proposed US Environmental Protection Agency (EPA) groundwater protection standards (Subpart A of 40 CFR 192), the US Department of Energy (DOE) proposes to meet background concentrations or the EPA maximum concentration limits (MCLs) for hazardous constituents in groundwater in the uppermost aquifer (Cliff House/Menefee aquifer) at the point of compliance (POC) at the Uranium Mill Tailings Remedial Action (UMTRA) Project disposal site in Bodo Canyon near Durango, Colorado (DOE, 1989). Details of hydrologic site characterization at the disposal site are provided in Attachment 3, Groundwater Hydrology Report. The principal features of the water resources protection strategy for the Bodo Canyon disposal site are presented in this document.

1709 (DOE/UMTRA-050503-Attach.2) Remedial Action Plan and site design for stabilization of the inactive uranium mill tailings site at Durango, Colorado: Attachment 2, Geology report: Revised final report. USDOE Albuquerque Field Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Dec 1991. 77p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350 ; FC04-82AL16257. Order Number DE93010384. Source: OSTI; NTIS; INIS; GPO Dep.

Detailed investigations of geologic, geomorphic, and seismic conditions at the Bodo Canyon disposal site were conducted. The purpose of these investigations was basic site characterization and identification of potential geologic hazards that could affect long-term site stability. Subsequent engineering studies, such as analyses of hydrologic and liquefaction hazards, used the data developed in these studies. The geomorphic analysis was employed in the design of effective erosion protection. Studies of the regional and local seismotectonic setting, which included a detailed search for possible capable faults within a 65 kilometer radius of the site, provided the basis for seismic design parameters. The scope of work performed included the following: Compilation and analysis of previous published and unpublished geologic literature and maps; Review of historical and instrumental earthquake data; Review of site-specific subsurface geologic data, including lithologic and geophysical logs of exploratory boreholes advanced in the site area; Photogeologic interpretations of existing conventional aerial photographs; and, Ground reconnaissance and mapping of the site region.

1710 (DOE/UMTRA-050503-Attach.3) Remedial Action Plan and site design for stabilization of the inactive uranium mill tailings site at Durango, Colorado: Attachment 3, Groundwater hydrology report: Revised final report. USDOE Albuquerque Field Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Dec 1991. 411p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350 ;

FC04-82AL16257. Order Number DE93010385. Source: OSTI; NTIS; INIS; GPO Dep.

The US Environmental Protection Agency (EPA) has established health and environmental protection regulations to correct and prevent groundwater contamination resulting from processing activities at inactive uranium milling sites. According to the Uranium Mill Tailings Radiation Control Act of 1978, (UMTRCA) the US Department of Energy (DOE) is responsible for assessing the inactive uranium processing sites. The DOE has determined this assessment shall include information on hydrogeologic site characterization. The water resources protection strategy that describes how the proposed action will comply with the EPA groundwater protection standards is presented in Attachment 4. Site characterization activities discussed in this section include: Characterization of the hydrogeologic environment; characterization of existing groundwater quality; definition of physical and chemical characteristics of the potential contaminant source; and description of local water resources.

1711 (DOE/UMTRA-050503-Attach.5) Remedial Action Plan and site design for stabilization of the inactive uranium mill tailings site at Durango, Colorado: Attachment 5, Dewatering report: Revised final report. USDOE Albuquerque Field Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Dec 1991. 36p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350 ; FC04-82AL16257. Order Number DE93010387. Source: OSTI; NTIS; INIS; GPO Dep.

This report provides an update on dewatering activities at the Durango disposal embankment and presents recommendations for the work required to complete the closure of the cell in 1990 (Section 2). In October 1989, test pit investigations were performed and a toe trench was excavated at the eastern slope of the disposal embankment. A description and results of the test pit investigations along with the implications of the results relative to the overall dewatering effort are discussed in Sections 3 through 5. Installation and performance of the 17-well dewatering system were previously described in the "Status Report on Dewatering of Disposal Embankment" issued in September, 1989. Additional studies are still on-going and are described in Section 6. Laboratory analysis continues on samples taken from the test pits. TAC's characterization of the hydrogeological conditions at the Durango site is also proceeding. Results of these studies will be presented in subsequent reports. Appendices A and B present construction details of the well point system, toe trench and holding pond. Appendix C summarizes the performance of the 17 pumping wells prior to winter shutdown and provides information on pumping rates, drawdowns, and disposition of the wells. Appendix D outlines the chronology of the dewatering effort to date.

1712 (DOE/UMTRA-050503-Attach.6) Remedial Action Plan and site design for stabilization of the inactive uranium mill tailings site at Durango, Colorado: Attachment 6, Supplemental standard for Durango processing site: Revised final report. USDOE Albuquerque Field Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Dec 1991. 123p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350 ; FC04-82AL16257. Order Number DE93010388. Source: OSTI; NTIS; INIS; GPO Dep.

Excavation control to the 15 pCi/g radium-226 (Ra-226) standard at certain areas along the Animas River on the Durango Site would require extensive engineering and construction support. Elevated Ra-226 concentrations have

been encountered immediately adjacent to the river at depths in excess of 7 feet below the present river stage. Decontamination to such depths to ensure compliance with the EPA standards will, in our opinion, become unreasonable. This work does not appear to be in keeping with the intent of the standards. Because the principal reason for radium removal is reduction of radon daughter concentrations (RDC) in homes to be built onsite, and because radon produced at depth will be attenuated in clean fill cover before entering such homes, it is appropriate to calculate the depth of excavation needed under a home to reduce RDC to acceptable levels. Potential impact was assessed through radon emanation estimation, using the RAECOM computer model. Elevated Ra-226 concentrations were encountered during final radium excavation of the flood plain below the large tailings pile, adjacent to the slag area. Data from 7 test pits excavated across the area were analyzed to provide an estimate of the Ra-226 concentration profile. Results are given in this report.

1713 (DOE/UMTRA-050506-0000-Vol.1) Remedial Action Plan and site design for stabilization of the inactive uranium mill tailings site at Rifle, Colorado: Volume 1, Text: Appendices A, B, and C: Final report. USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Feb 1990. 182p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-82AL14086 ; FC04-85AL20533. Order Number DE93010203. Source: OSTI; NTIS; INIS; GPO Dep.

This document has been structured to provide a comprehensive understanding of the remedial action proposed for the Rifle sites. That remedial action consists of removing approximately 4,185,000 cubic yards (cy) of tailings and contaminated materials from their current locations, transporting, and stabilizing the tailings material at the Estes Gulch disposal site, approximately six miles north of Rifle. The tailings and contaminated materials are comprised of approximately 597,000 cy from Old Rifle, 3,232,000 cy from New Rifle, and 322,000 cy from vicinity properties and about 34,000 cy from demolition. The remedial action plan includes specific design requirements for the detailed design and construction of the remedial action. An extensive amount of data and supporting information have been generated for this remedial action and cannot all be incorporated into this document. Pertinent information and data are included with reference given to the supporting documents.

1714 (DOE/UMTRA-050506-0000-Vol.2) Remedial action plan and site design for stabilization of the inactive uranium mill tailings sites at Rifle, Colorado: Volume 2, Appendices D and E: Final report. USDOE Albuquerque Field Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Feb 1992. 636p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC04-82AL16257. Order Number DE93010763. Source: OSTI; NTIS; INIS; GPO Dep.

This appendix assesses the present conditions and data gathered about the two inactive uranium mill tailings sites near Rifle, Colorado, and the designated disposal site six miles north of Rifle in the area of Estes Gulch. It consolidates available engineering, radiologic, geotechnical, hydrological, meteorological, and other information pertinent to the design of the Remedial Action Plan (RAP). The data characterize conditions at the mill, tailings, and disposal site so that the Remedial Action Contractor (RAC) may complete final designs for the remedial actions.

1715 (DOE/UMTRA-050506-Vol.3-App.F) Remedial action plan and site design for stabilization of the inactive uranium mill tailings sites at Rifle, Colorado: Final report: Volume 3, Appendix F, Final design, specifications, and drawings. USDOE Albuquerque Field Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office; Colorado State Government, Denver, CO (United States). Feb 1992. 312p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC04-82AL16257. Order Number DE93012928. Source: OSTI; NTIS; GPO Dep.

Engineering drawings for this project are identified as CAPE-3054. Inquiries may be directed to: Office of Scientific and Technical Information, P.O. Box 62, Oak Ridge, TN 37831.

This volume contains Appendix F, bid schedule and specifications for remedial action on three sites: Old Rifle processing site; New Rifle processing site and Estes Gulch disposal site.

1716 (DOE/UMTRA-050506-Vol.4) Remedial action plan and site design for stabilization of the inactive uranium mill tailings sites at Rifle, Colorado: Final report: Volume 4, Addenda D1-D5 to Appendix D. USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office; New Mexico State Government, Santa Fe, NM (United States); Bendix Field Engineering Corp., Grand Junction, CO (United States). Feb 1990. 569p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC04-85AL20533 ; AC07-76GJ01664. Order Number DE93012929. Source: OSTI; NTIS; INIS; GPO Dep.

This radiologic characterization of the two inactive uranium millsites at Rifle, Colorado, was conducted by Bendix Field Engineering Corporation (Bendix) for the US Department of Energy (DOE), Grand Junction Projects Office, in accord with a Statement of Work prepared by the DOE Uranium Mill Tailings Remedial Action (UMTRA) Project Technical Assistance Contractor, Jacobs Engineering Group, Inc. (Jacobs). The purpose of this project is to define the extent of radioactive contamination at the Rifle sites that exceeds US Environmental Protection Agency, (EPA) standards for UMTRA sites. The data presented in this report are required for characterization of the areas adjacent to the tailings piles and for the subsequent design of cleanup activities. An orientation visit to the study area was conducted on 31 July-1 August 1984, in conjunction with Jacobs, to determine the approximate extent of contaminated area surrounding the piles. During that visit, survey control points were located and baselines were defined from which survey grids would later be established; drilling requirements were assessed; and radiologic and geochemical data were collected for use in planning the radiologic fieldwork. The information gained from this visit was used by Jacobs, with cooperation by Bendix, to determine the scope of work required for the radiologic characterization of the Rifle sites. Fieldwork at Rifle was conducted from 1 October through 16 November 1984.

1717 (DOE/UMTRA-050506-Vol.5) Remedial action plan and site design for stabilization of the inactive uranium mill tailings sites at Rifle, Colorado: Volume 5, Addenda D6-D8 to Appendix D: Final report. USDOE Albuquerque Field Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Feb 1990. 436p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC04-85AL20533. Order Number DE93012927. Source: OSTI; NTIS; INIS; GPO Dep.

LANDFILL STABILIZATION

This volume contains appendices D6 through D8 containing laboratory test data: from MK-F investigation, 1987, Old Rifle and New Rifle sites; on bentonite amended radon barrier material; and from MK-F investigation, 1987, riprap tests.

1718 (DOE/UMTRA-050508-0000) Remedial Action Plan and site design for stabilization of the inactive uranium mill tailings site at Gunnison, Colorado: Remedial action selection report: Final report. USDOE Albuquerque Field Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Oct 1992. 97p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE93010473. Source: OSTI; NTIS; INIS; GPO Dep.

The Gunnison uranium mill tailings site is just south of the city limits of Gunnison, Colorado, in the south-central part of the state. The entire site covers 61 acres in the valley of the Gunnison River and Tomichi Creek. Contaminated materials at the Gunnison processing site include the tailings pile, covering about 35 acres to an average depth of nine feet and containing 459,000 cubic yards. Ore storage areas and the former mill processing area cover about 20 acres on the south side of the site. The volume of contaminated materials to be disposed of as part of the remedial action is estimated to be 718,900 cubic yards. An interim action was approved by the US Department of Energy to eliminate existing safety hazards to the Gunnison community. These actions, started in September 1991, included demolition of mill buildings and related processing facilities, excavation of two underground storage tanks, removal of asbestos and other hazardous materials from buildings, storage of those materials in a secured area on the site, and improvements of site security.

1719 (DOE/UMTRA-050508-0000-Attach.2) Remedial Action Plan and site design for stabilization of the inactive uranium mill tailings site at Gunnison, Colorado: Attachment 2, Geology report: Final report. USDOE Albuquerque Field Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Oct 1992. 72p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE93010474. Source: OSTI; NTIS; INIS; GPO Dep.

Detailed investigations of geologic, geomorphic, and seismic conditions at the Landfill disposal site were conducted. The purpose of these studies was basic site characterization and identification of potential geologic hazards that could affect long-term site stability. Subsequent engineering studies, such as analyses of hydrologic and liquefaction hazards, used the data developed in these studies. The geomorphic analysis was employed in the design of effective erosion protection. Studies of the regional and local seismotectonic setting, which included a detailed search for possible capable faults within a 65-kilometer (km) (40-mile) radius of the site, provided the basis for seismic design parameters. The scope of work performed included the following: Compilation and analysis of previous published and unpublished geologic literature and maps. Review of historical and instrumental earthquake data. Review of site-specific subsurface geologic data, including lithologic and geophysical logs of exploratory boreholes advanced in the site area. Photogeologic interpretations of existing conventional aerial photographs. Ground reconnaissance and mapping of the site region.

1720 (DOE/UMTRA-050508-0000-Attach.3) Remedial Action Plan and site design for stabilization of the inactive uranium mill tailings site at Gunnison, Colorado:

Attachment 3, Groundwater hydrology report: Final report. USDOE Albuquerque Field Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Oct 1992. 66p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE93010475. Source: OSTI; NTIS; INIS; GPO Dep.

The US Environmental Protection Agency (EPA) has established health and environmental protection regulations to correct and prevent groundwater contamination resulting from processing activities at inactive uranium milling sites (40 CFR Part 192). According to the Uranium Mill Tailings Radiation Control Act of 1978, (UMTRCA) (48 CFR 590), the US Department of Energy (DOE) is responsible for assessing the inactive uranium processing sites. The DOE has determined that this assessment shall include information on hydrogeologic site characterization. The water resources protection strategy that describes how the proposed action will comply with the EPA groundwater protection standards is presented in Attachment 4. Site characterization activities discussed in this attachment include the following: Characterization of the hydrogeologic environment, including hydro-stratigraphy, groundwater occurrence, aquifer parameters, and areas of recharge and discharge. Characterization of existing groundwater quality by comparison with background water quality and the maximum concentration limits (MCLs) of the proposed EPA groundwater protection standards. Definition of physical and chemical characteristics of the potential contaminant source, including concentration and leachability of the source in relation to migration in groundwater and hydraulically connected surface water. Description of local water resources, including current and future use and value, availability, and alternative supplies.

1721 (DOE/UMTRA-050508-0000-Attach.3-App.A) Remedial Action Plan and site design for stabilization of the inactive uranium mill tailings site at Gunnison, Colorado: Appendix A to Attachment 3, Tables: Final report. USDOE Albuquerque Field Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Oct 1992. 494p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE93010476. Source: OSTI; NTIS; INIS; GPO Dep.

This volume contains the following tables: monitoring well information; static ground water levels; background ground water quality data by parameter; 1984 lysimeter tailings pore water quality by parameter; lysimeter tailings pore fluid quality data by parameter; and on site/downgradient ground water quality data by parameter.

1722 (DOE/UMTRA-050508-0000-Attach.3-App.B) Remedial Action Plan and site design for stabilization of the inactive uranium mill tailings site at Gunnison, Colorado: Appendix B to Attachment 3, Lithologic logs: Final report. USDOE Albuquerque Field Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Oct 1992. 410p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE93010484. Source: OSTI; NTIS; INIS; GPO Dep.

This volume contains lithologic logs for processing site and for disposal site.

1723 (DOE/UMTRA-050508-0000-Attach.3-App.C) Remedial Action Plan and site design for stabilization of the inactive uranium mill tailings site at Gunnison, Colorado: Appendix C to Attachment 3, Calculations: Final report. USDOE Albuquerque Field Office, NM (United

States). Uranium Mill Tailings Remedial Action Project Office. Oct 1992. 1033p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE93010485. Source: OSTI; NTIS; INIS; GPO Dep.

The US Environmental Protection Agency (EPA) has established health and environmental protection regulations to correct and prevent groundwater contamination resulting from processing activities at inactive uranium milling sites (40 CFR 192). The US Department of Energy (DOE) is responsible for assessing the inactive uranium processing sites. The DOE has determined this assessment shall include information on hydrogeologic site characterization. This document contains appendices to Attachment 3, Groundwater Hydrology Report included are calculations.

1724 (DOE/UMTRA-050508-0000-Attach.4) **Remedial Action Plan and site design for stabilization of the inactive uranium mill tailings site at Gunnison, Colorado: Attachment 4, Water resources protection strategy: Final report.** USDOE Albuquerque Field Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Oct 1992. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE93010471. Source: OSTI; NTIS; INIS; GPO Dep.

To achieve compliance with the proposed US Environmental Protection Agency (EPA) groundwater protection standards the US Department of Energy (DOE) proposes to meet background concentrations or the EPA maximum concentration limits (MCLs) for hazardous constituents in groundwater in the uppermost aquifer at the point of compliance (POC) at the Gunnison Uranium Mill Tailings Remedial Action (UMTRA) Project disposal site near Gunnison, Colorado. The proposed remedial action will ensure protection of human health and the environment. A summary of the principal features of the water resources protection strategy for the Gunnison disposal site is included in this report.

1725 (DOE/UMTRA-050508-0000-Attach.5) **Remedial Action Plan and site design for stabilization of the inactive uranium mill tailings site at Gunnison, Colorado: Attachment 5, Supplemental radiological data: Final report.** USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Oct 1992. 174p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE93010472. Source: OSTI; NTIS; INIS; GPO Dep.

Diffusion coefficients for radon gas in earthen materials are required to design suitable radon-barrier covers for uranium tailings impoundments and other materials that emit radon gas. Many early measurements of radon diffusion coefficients relied on the differences in steady-state radon fluxes measured from radon source before and after installation of a cover layer of the material being tested. More recent measurements have utilized the small-sample transient (SST) technique for greater control on moistures and densities of the test soils, greater measurement precision, and reduced testing time and costs. Several of the project sites for the US Department of Energy's Uranium Mill Tailings Remedial Action (UMTRA) Program contain radiologically contaminated subsurface material composed predominantly of cobbles, gravels and sands. Since remedial action designs require radon diffusion coefficients for the source materials as well as the cover materials, these cobbly and gravelly materials also must be tested. This report contains the following information: a description of the test materials used and the methods developed to conduct the

SST radon diffusion measurements on cobbly soils; the protocol for conducting radon diffusion tests on cobbly soils; the results of measurements on the test samples; and modifications to the FITS computer code for analyzing the time-dependent radon diffusion data.

1726 (DOE/UMTRA-050510-0000-Rev.1-Vol.1) **Remedial action plan and site design for stabilization of the inactive uranium mill tailings site at Lakeview, Oregon: Volume 1, Text and appendices A through D: Final report: Revision 1.** Chernoff, A.R. (USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Project Office); Ervin, C. (USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Project Office; Oregon State Dept. of Energy, Salem, OR (United States). Jul 1992. 183p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE93009101. Source: OSTI; NTIS; INIS; GPO Dep.

The Lakeview inactive uranium processing site is in Lake County, Oregon, approximately one mile northwest of the town of Lakeview, sixteen miles north of the California-Oregon border, and 96 miles east of Klamath Falls. The total designated site covers an area of 258 acres consisting of a tailings pile (30 acres), seven evaporation ponds (69 acres), the mill buildings, and related structures. The mill buildings and other structures have been decontaminated and are currently being used by Goose Lake Lumber Company. The tailings pile at the processing site was originally stabilized by Atlantic Richfield with an earthen cover 18–24 inches thick. The average depth of the tailings, including the cover, varied from six to eight feet. There were estimated to be 662,000 cubic yards of tailings, windblown contaminated materials, and vicinity property materials. During remedial action under the Uranium Mill Tailings Remedial Action (UMTRA) Project, approximately 264,000 cubic yards of additional contaminated materials were identified from excavations required to remove thorium- and arsenic-contaminated soils. The remedial action for the Lakeview site consisted of the cleanup, relocation, consolidation, and stabilization of all residual radioactive materials and thorium- and arsenic-contaminated materials in a partially below-grade disposal cell at a location approximately seven miles northwest of the tailings site, identified as the Collins Ranch site. A cover, including a radon/infiltration barrier and rock layer for protection from erosion, was placed on top of the tailings. A rock-soil matrix covers the topslope and provides a growth medium for vegetation. The US Department of Energy (DOE) will retain the license and surveillance and maintenance responsibilities for the final restricted site of 13 acres.

1727 (DOE/UMTRA-050510-0000-Rev.1-Vol.2) **Remedial action plan and site design for stabilization of the inactive uranium mill tailings site at Lakeview, Oregon: Volume 2, Appendices E through G: Final report: Revision 1.** USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Project Office. Jul 1992. 398p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE93008953. Source: OSTI; NTIS; INIS; GPO Dep.

Volume two contains appendices for: final plans and specifications; compliance strategy for the proposed EPA groundwater standards; and comment and response document.

1728 (DOE/UMTRA-050510-0000-Rev.1-Vol.3) **Remedial action plan and site design for stabilization of the inactive uranium mill tailings site at Lakeview, Oregon:**

Volume 3, Attachments A and B to Appendix F: Final report: Revision 1. USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Project Office. Jul 1992. 465p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC04-84AL20534. Order Number DE93009025. Source: OSTI; NTIS; INIS; GPO Dep.

Volume three contains attachments A and B for appendix F, compliance strategy for the proposed EPA groundwater standards. Attachment A has water quality data by location for the Lakeview processing site and Collins Ranch disposal site (1984 through 1991). Attachment B consists of water quality statistics data and water quality data by location (1984 through 1988).

1729 (DOE/UMTRA-050510-CARD) Comment and response document on the final remedial action plan and site design for stabilization of the inactive Uranium Mill Tailings Site at Lakeview, Oregon. USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Oct 1991. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE93009100. Source: OSTI; NTIS; INIS; GPO Dep.

This report contains comments provided by the Oregon Department of Energy and responses to these comments on the final remedial action plan for the inactive uranium mill tailings site at Lakeview, Oregon.

1730 (DOE/UMTRA-050510-GRNO) Modifications to the Remedial Action Plan and site design for stabilization of the inactive uranium mill tailings site at Green River, Utah: RAP Modification No. 1: Final report. USDOE Albuquerque Field Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Oct 1991. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-82AL14086 ; FC04-81AL16309. Order Number DE93009102. Source: OSTI; NTIS; INIS; GPO Dep.

This modification to the Green River Final Remedial Action Plan (FRAP) represents the changes made to the document in accordance with a joint agreement between the US Department of Energy (DOE) and the US Nuclear Regulatory Commission (NRC) outlined in a letter dated August 7, 1991. As specified in this letter, methylene chloride will no longer be analyzed in groundwater samples collected from on-site monitor wells. All references to methylene chloride sampling have been deleted from the FRAP, as indicated by the pages in Section 2.0 of this document.

1731 (DOE/UMTRA-050510-GRNO-Vol.1) Remedial Action Plan and final design for stabilization of the inactive uranium mill tailings at Green River, Utah: Volume 1, Text, Appendices A, B, and C: Final report. Matthews, M.L. (USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office); Alkema, K. USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office; Utah Dept. of Health, Salt Lake City, UT (United States). Environmental Health Div. Mar 1991. 168p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-82AL14086 ; FC04-82AL16257. Order Number DE93008967. Source: OSTI; NTIS; INIS; GPO Dep.

This Remedial Action Plan (RAP) has been developed to serve a threefold purpose. It presents the series of activities that are proposed by the US Department of Energy (DOE) to accomplish long-term stabilization and control of radioactive materials at the inactive uranium processing site located near Green River, Utah. It provides a characterization of the

present conditions of the site. It also serves to document the concurrence of the state of Utah and the US Nuclear Regulatory Commission (NRC) in the remedial action. This agreement, upon execution by the DOE and the state of Utah, and concurrence by the NRC, becomes Appendix 8 of the Cooperative Agreement.

1732 (DOE/UMTRA-050510-GRNO-Vol.2A) Remedial action plan and final design for stabilization of the inactive uranium mill tailings at Green River, Utah: Volume 2A, Appendix D, Supplement, site characterization, Appendix E, Groundwater protection strategy: Final report. USDOE Albuquerque Field Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Mar 1991. 215p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-82AL14086 ; FC04-81AL16309. Order Number DE93008968. Source: OSTI; NTIS; INIS; GPO Dep.

This volume includes: appendix D supplement on groundwater hydrology; and appendix E on water resources protection strategy.

1733 (DOE/UMTRA-050510-GRNO-Vol.3) Remedial Action Plan and final design for stabilization of the inactive uranium mill tailings at Green River, Utah: Volume 3, Appendix F, Final design, specifications, and drawings: Final report. USDOE Albuquerque Field Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office; Morrison-Knudsen Engineers, Inc., San Francisco, CA (United States). Jan 1989. 217p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-82AL14086 ; FC04-82AL16257. Order Number DE93009099. Source: OSTI; NTIS; INIS; GPO Dep.

This volume contains: bidding requirements; terms and conditions; specifications for general requirements and site-work; and subcontract drawings.

1734 (DOE/UMTRA-050512-0000) Remedial action plan and site design for stabilization of the inactive uranium mill tailings site at Lowman, Idaho: Remedial action selection report for the Lowman UMTRA project site, Idaho: Final report. Matthews, M.L. (USDOE Albuquerque Field Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office); Nagel, J. USDOE Albuquerque Field Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office; Idaho Dept. of Health and Welfare, Boise, ID (United States). Div. of Environmental Quality. Sep 1991. 86p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE93009143. Source: OSTI; NTIS; INIS; GPO Dep.

The inactive uranium mill tailings site near Lowman, Idaho, was designated as one of 24 abandoned uranium tailings sites to be remediated by the US Department of Energy (DOE) under the Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA). The UMTRCA requires that the US Nuclear Regulatory Commission (NRC) concur with the DOE's remedial action plan and certify that the remedial action complies with the standards promulgated by the US Environmental Protection Agency (EPA). The remedial action plan (RAP), which includes this remedial action selection report (RAS), has been developed to serve a two-fold purpose. First, it describes the activities that are proposed by the DOE to accomplish long-term stabilization and control of residual radioactive materials at the inactive uranium processing site near Lowman, Idaho. Second, this document and the remainder of the RAP, upon concurrence and execution by

the DOE, the State of Idaho, and the NRC, becomes Appendix B of the Cooperative Agreement (No. DE-FC04-85AL20535) between the DOE and the State of Idaho.

1735 (DOE/UMTRA-050512-0000-App.B-Attach.3) Remedial action plan and site design for stabilization of the inactive uranium mill tailings site at Lowman, Idaho: Appendix B: Attachment 3, Groundwater hydrology report: Final report. USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Sep 1991. 237p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350 ; FC04-85AL20535. Order Number DE93009146. Source: OSTI; NTIS; INIS; GPO Dep.

The US Environmental Protection Agency (EPA) has established health and environmental regulations to correct and prevent groundwater contamination resulting from former uranium processing activities at inactive uranium processing sites (40 CFR 192). According to the Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA), the US Department of Energy (DOE) is responsible for assessing the inactive uranium processing sites. The DOE has decided that each assessment shall include information on hydrogeologic site characterization. The water resources protection strategy that describes how the proposed action will comply with the EPA groundwater protection standards is presented in Attachment 4. Site characterization activities discussed in this section include: Definition of the hydrogeologic characteristics of the environment, including hydrostratigraphy, aquifer parameters, areas of aquifer recharge and discharge, potentiometric surfaces, and groundwater velocities. Definition of background groundwater quality and comparison with the proposed EPA groundwater protection standards. Evaluation of the physical and chemical characteristics of the contaminant source and/or residual radioactive materials. Definition of existing groundwater contamination by comparison with the EPA groundwater protection standards. Description of the geochemical processes that affect the downward migration of the source contaminants at the processing site. Description of water resource utilization, including availability, current and future use and value, and alternate water supplies.

1736 (DOE/UMTRA-050512-0000-Attach.2) Remedial action plan and site design for stabilization of the inactive uranium mill tailings site at Lowman, Idaho: Attachment 2, Geology report: Final report. USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Project Office. Sep 1991. 90p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE93009145. Source: OSTI; NTIS; INIS; GPO Dep.

Detailed investigations of geologic, geomorphic, and seismic conditions at the Lowman site in central Idaho were conducted by the Technical Assistance Contractor. The purpose of these investigations was basic site characterization and the identification of potential geologic hazards that could affect long-term site stability. Subsequent engineering studies (e.g., analyses of the hydrologic regime and liquefaction potential) use this data. The geomorphic analysis is employed in the design of effective erosion protection. Studies of the regional and local seismotectonic setting, which included a detailed search for possible capable faults within a 65-km (40-mile) radius of the site, provided the basis for estimating seismic design parameters.

1737 (DOE/UMTRA-050512-0000-Attach.4) Remedial action plan and site design for stabilization of the inactive Uranium Mill Tailings Site at Lowman, Idaho: Attachment 4, Water resources protection strategy: Final report. USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Sep 1991. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC04-85AL20535. Order Number DE93009147. Source: OSTI; NTIS; INIS; GPO Dep.

The DOE proposes to achieve compliance with the proposed EPA groundwater protection standards (Subparts A and B of 40 CFR 192) by meeting the EPA maximum concentration limits (MCLs) or background concentrations for designated hazardous constituents in groundwater in the uppermost aquifer (alluvium/weathered granodiorite) at the point of compliance (POC) at the Lowman disposal site near Lowman, Idaho. The proposed remedial action in conjunction with existing hydrogeological conditions at the Lowman site will ensure sufficient protection of human health and the environment. The DOE has concluded that the EPA groundwater protection standards will be met at the POC because, with the exception of antimony, none of the hazardous constituents that exceed laboratory method detection limits within the radioactive sand pore fluids were above the proposed concentration limits. The DOE has demonstrated that antimony will meet the proposed concentration limits at the POC through attenuation in subsoils beneath the disposal cell and by dilution in groundwater underflow. The Lowman processing site is in compliance with Subpart B of 40 CFR 192 because statistical analyses of groundwater samples indicate no groundwater contamination.

1738 (DOE/UMTRA-050512-App.B-Attach.1) Remedial action plan and site design for stabilization of the inactive Uranium Mill Tailings Site at Lowman, Idaho: Attachment 1, Specifications and design drawings, LOW; Subcontract Documents: Bid schedule, special conditions, specifications, subcontract drawings: Final design for construction, Appendix B of the Cooperative Agreement. USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office; Morrison-Knudsen Engineers, Inc., San Francisco, CA (United States). Sep 1991. 184p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350 ; FC04-85AL20535. Order Number DE93009144. Source: OSTI; NTIS; INIS; GPO Dep.

This volume contains subcontract documents which include: bidding requirements; terms and conditions; specifications; and subcontract drawings.

1739 (DOE/UMTRA-050515-0000-Vol.1) Remedial Action Plan and site conceptual design for stabilization of the inactive uranium mill tailings site at Spook, Wyoming: Volume 1, Text, Appendices A, B, C, D, and E: Final report. Matthews, M.L. (USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office); Sullivan, M. (USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Apr 1990. 681p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-82AL14086 ; FC04-83AL19454. Order Number DE93010465. Source: OSTI; NTIS; INIS; GPO Dep.

This Remedial Action Plan (RAP) has been developed to serve a threefold purpose. It presents the series of activities which are proposed by the US Department of Energy (DOE)

to accomplish long-term stabilization and control of radioactive materials at an inactive uranium processing site northeast of Casper, Wyoming, and referred to as the Spook site. It provides a characterization of the present conditions at the site and also serves to document the concurrence of the State of Wyoming and the US Nuclear Regulatory Commission (NRC) in the remedial action. This agreement, upon execution by the DOE and the State of Wyoming, and concurrence by the NRC, becomes Appendix B of the Cooperative Agreement.

1740 (DOE/UMTRA-050515-0000-Vol.2-App.F) **Remedial Action Plan and site conceptual design for stabilization of the inactive uranium mill tailings site at Spook, Wyoming: Volume 2, Appendix F, Final plans and specifications: Final report.** USDOE Albuquerque Field Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office; Jacobs Engineering Group, Inc., Pasadena, CA (United States); Wyoming State Government, Cheyenne, WY (United States). Apr 1990. 220p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-82AL14086 ; FC04-83AL19454. Order Number DE93010466. Source: OSTI; NTIS; INIS; GPO Dep.

Contents of this volume include: bidding requirements; terms and conditions; specifications for general requirements; specifications for sitework; and subcontract drawings.

1741 (DOE/UMTRA-050516-0000-Vol.1) **Remedial action plan and site conceptual design for stabilization of the inactive uranium mill tailings site at Ambrosia Lake, New Mexico: Volume 1, Text, Appendices A, B, and C: Final report.** Matthews, M.L. (USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office); Mitzelfelt, R. USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office; New Mexico Health and Environment Dept., Santa Fe, NM (United States). Environmental Improvement Div. Nov 1991. 117p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350 ; FC04-85AL20533. Order Number DE93009137. Source: OSTI; NTIS; INIS; GPO Dep.

This Remedial Action Plan (RAP) has been developed to serve a dual purpose. It presents the series of activities that is proposed by the US Department of Energy (DOE) to stabilize and control radioactive materials at the inactive Phillips/United Nuclear uranium processing site designated as the Ambrosia Lake site in McKinley County, New Mexico. It also serves to document the concurrence of both State of New Mexico and the US Nuclear Regulatory Commission (NRC) in the remedial action. This agreement, upon execution by the DOE and the state and concurrence by NRC, becomes Appendix B of the Cooperative Agreement.

1742 (DOE/UMTRA-050516-0000-Vol.2) **Remedial action plan and site conceptual design for stabilization of the inactive uranium mill tailings site at Ambrosia Lake, New Mexico: Volume 2, Appendices D and E: Final.** USDOE Albuquerque Field Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Nov 1991. 493p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350 ; FC04-85AL20533. Order Number DE93009138. Source: OSTI; NTIS; INIS; GPO Dep.

This volume contains appendices for site characterization and ground water protection strategy.

1743 (DOE/UMTRA-050516-0000-Vol.3) **Remedial action plan and site conceptual design for stabilization of**

the inactive uranium mill tailings site at Ambrosia Lake, New Mexico: Volume 3, Appendix F, Final plans and specifications: Final report. USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Nov 1991. 251p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350 ; FC04-85AL20533. Order Number DE93009139. Source: OSTI; NTIS; INIS; GPO Dep.

This volume deals with the main construction subcontract for the uranium mill tailings remedial action of Ambrosia Lake, New Mexico. Contents of subcontract documents AMB-4 include: bidding requirements; terms and conditions; specifications which cover general requirements and site-work; and subcontract drawings.

1744 (DOE/UMTRA-050518-0000-App.A-C) **Remedial action plan and site design for stabilization of the inactive uranium mill tailings site at Tuba City, Arizona: Text, Appendices A, B, and C: Final report.** USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Aug 1989. 123p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-82AL14086. Order Number DE93009593. Source: OSTI; NTIS; INIS; GPO Dep.

This Remedial Action Plan (RAP) has been developed to serve a threefold purpose. It presents the series of activities which are proposed by the US Department of Energy (DOE) to accomplish long-term stabilization and control of radioactive materials at the inactive uranium processing site near Tuba City, Arizona. It provides a characterization of the present conditions of the site. It also serves to document the concurrence of the Navajo Nation, the Hopi Tribe, US Bureau of Indian Affairs (BIA), and the US Nuclear Regulatory Commission (NRC) in the remedial action. This agreement, upon execution by DOE, the Navajo Nation, and the Hopi Tribe, and concurrence by NRC, becomes Appendix B of the Cooperative Agreement. Following the introduction, contents are as follows: Section 2.0 presents the EPA standards, including a discussion of their objectives. Section 3.0 summarizes the present site characteristics and provides a definition of site-specific problems. Section 4.0 is the site design for the proposed action. Section 5.0 summarizes the plan for ensuring environmental, health, and safety protection for the surrounding community and the on-site workers. Section 6.0 presents a detailed listing of the responsibilities of the project participants. Section 7.0 describes the features of the long-term surveillance and maintenance plan. Section 8.0 presents the quality assurance aspects of the project. Section 9.0 documents the ongoing activities to keep the public informed and participating in the project.

1745 (DOE/UMTRA-050518-0000-App.E) **Remedial action plan and site design for stabilization of the inactive uranium mill tailings site at Tuba City, Arizona: Phase 2, Construction, Subcontract documents: Appendix E, final report: Appendix B of the cooperative agreement.** USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Aug 1989. 177p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-82AL14086. Order Number DE93009595. Source: OSTI; NTIS; INIS; GPO Dep.

This appendix discusses Phase II construction and subcontract documents uranium mill site near Tuba City, Arizona. It contains the bid schedule, special conditions, specifications, and subcontract drawings.

1746 (DOE/UMTRA-050520-0000) **Remedial Action Plan and site design for stabilization of the inactive uranium mill tailings site at Falls City, Texas: Remedial action selection report: Attachment 2, Geology report; Attachment 3, Groundwater hydrology report; Attachment 4, Water resources protection strategy: Final report.** Chernoff, A.R. (USDOE Albuquerque Field Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office); Lacker, D.K. USDOE Albuquerque Field Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office; Texas State Dept. of Health, Austin, TX (United States). Bureau of Radiation Control. Sep 1992. 734p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350 ; FC04-87AL20532. Order Number DE93010886. Source: OSTI; NTIS; INIS; GPO Dep.

The uranium processing site near Falls City, Texas, was one of 24 inactive uranium mill sites designated to be remediated by the US Department of Energy (DOE) under Title I of the Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA). The UMTRCA requires that the US Nuclear Regulatory Commission (NRC) concur with the DOE's remedial action plan (RAP) and certify that the remedial action conducted at the site complies with the standards promulgated by the US Environmental Protection Agency (EPA). The RAP, which includes this summary remedial action selection report (RAS), serves a two-fold purpose. First, it describes the activities proposed by the DOE to accomplish long-term stabilization and control of the residual radioactive materials at the inactive uranium processing site near Falls City, Texas. Second, this document and the remainder of the RAP, upon concurrence and execution by the DOE, the State of Texas, and the NRC, becomes Appendix B of the Cooperative Agreement between the DOE and the State of Texas.

1747 (DOE/UMTRA-050522-0000-Vol.1) **Remedial Action Plan for stabilization of the inactive uraniumiferous lignite processing sites at Belfield and Bowman, North Dakota: Volume 1, Text, Appendices A through C: Final report.** USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Dec 1990. 185p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-82AL14086 ; FC04-83AL20536. Order Number DE93010888. Source: OSTI; NTIS; INIS; GPO Dep.

This remedial action plan (RAP) has been developed to serve a threefold purpose. It presents the series of activities that are proposed by the US Department of Energy (DOE) to accomplish long-term stabilization and control of radioactive materials at the inactive uraniumiferous lignite processing sites at Belfield and near Bowman (at the former Griffin town site), North Dakota. It provides a characterization of the present conditions of the sites. It also serves to document the concurrence of the state of North Dakota and the US Nuclear Regulatory Commission (NRC) in the remedial action. This agreement, upon execution by the DOE and the state of North Dakota and concurrence by the NRC, becomes Appendix B of the Cooperative Agreement.

1748 (DOE/UMTRA-050522-0000-Vol.2) **Remedial Action Plan for stabilization of the inactive uraniumiferous lignite processing sites at Belfield and Bowman, North Dakota: Volume 2, Appendices D and E: Final report.** USDOE Albuquerque Field Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Dec 1990. 567p. Sponsored by USDOE, Washington, DC (United

States). DOE Contract AC04-82AL14086 ; FC04-83AL20536. Order Number DE93010889. Source: OSTI; NTIS; INIS; GPO Dep.

This appendix is an assessment of the present conditions relative to the inactive uraniumiferous lignite processing sites at Belfield and near Bowman, North Dakota. It consolidates available engineering, radiological, geotechnical, hydrological, and other information pertinent to the design of the Remedial Action Plan (RAP). The objective of the information is to characterize the conditions at the tailings sites so that the Remedial Action Contractor (RAC) may complete final design for stabilization of all contaminated materials.

1749 (EGG-M-91419) **Sulfur polymer cement, a new stabilization agent for mixed and low-level radioactive waste.** Darnell, G.R. EG and G Idaho, Inc., Idaho Falls, ID (United States). [1991]. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. (CONF-910840-11: 2. BMFT materials research symposium, Dresden (Germany), 26-29 Aug 1991). Order Number DE92017889. Source: OSTI; NTIS; INIS; GPO Dep.

Solidification and stabilization agents for radioactive, hazardous, and mixed wastes are failing to pass governmental tests at alarming rates. The Department of Energy's National Low-Level Waste Management Program funded testing of Sulfur Polymer Cement (SPC) by Brookhaven National Laboratory during the 1980s. Those tests and tests by the US Bureau of Mines (the original developer of SPC), universities, states, and the concrete industry have shown SPC to be superior to hydraulic cements in most cases. Superior in what wastes can be successfully combined and in the quantity of waste that can be combined and still pass the tests established by the US Environmental Protection Agency and the US Nuclear Regulatory Commission.

1750 (EGG-M-92186) **Sulfur polymer cement, a solidification and stabilization agent for hazardous and radioactive wastes.** Darnell, G.R. EG and G Idaho, Inc., Idaho Falls, ID (United States). [1992]. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. (CONF-9204175-1: 3. international biannual symposium on sulfur, Washington, DC (United States), 1-4 Apr 1992). Order Number DE92017888. Source: OSTI; NTIS; INIS; GPO Dep.

Hydraulic cements have been the primary radioactive waste stabilization agents in the United States for 50 years. Twelve years ago, Brookhaven National Laboratory was funded by the Department of Energy's Defense Low-Level Waste Management Program to test and develop sulfur polymer cement (SPC). It has stabilized routine wastes as well as some troublesome wastes with high waste-to-agent ratios. The Department of Energy's Hazardous Waste Remedial Action Program joined the effort by providing funding for testing and developing sulfur polymer cement as a hazardous-waste stabilization agent. Sulfur polymer cement has passed all the laboratory scale tests required by the US Environmental Protection Agency and US Nuclear Regulatory Commission. Two decades of tests by the US Bureau of Mines and private concrete contractors indicate this agent is likely to exceed other agents in longevity. This bulletin provides technical data from pertinent tests conducted by these various entities.

1751 (EGG-WM-10974) **A simulation study of moisture movement in proposed barriers for the subsurface disposal area, INEL.** Magnuson, S.O. EG and G Idaho,

Inc., Idaho Falls, ID (United States). Sep 1993. 96p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94008524. Source: OSTI; NTIS; INIS; GPO Dep.

This document presents a simulation study that was conducted to investigate moisture movement within two engineered barriers, which are proposed for use in eventual closure of the Subsurface Disposal Area. The results of the study are intended to guide the design and implementation of field test plots that will be constructed to test the barrier designs. Discussed are the sensitivity of barrier performance to changes in the conceptual model, which was used to simulate the barriers, and to changes in hydrologic parameters, which were used to describe the materials composing the barriers. In addition, estimates are presented concerning the time required for the moisture profile within the barriers to come into equilibrium with the meteorological conditions at the surface. In addition, the performance of the barriers under conditions of supplemental precipitation and ponding is presented.

1752 (EGG-WTD-9408) Final report for the Idaho National Engineering Laboratory Central Facilities Area Landfill 2. Doornbos, M.H.; Morgan, M.E.; Hubbell, J.M. EG and G Idaho, Inc., Idaho Falls, ID (United States). Apr 1991. 30p. Sponsored by USDOE, Washington, DC (USA). DOE Contract AC07-76ID01570. Order Number DE91014153. Source: OSTI; NTIS; INIS; GPO Dep.

This report summarizes activities completed during FY-88 through FY-91 for the US Department of Energy's (DOE's) Hazardous Waste Remedial Actions Program (HAZWRAP) at the Idaho National Engineering Laboratory (INEL) Central Facilities Area (CFA) Landfill 2. The objectives of this program are to demonstrate new technologies or innovative uses of existing technologies for the identification and remediation of hazardous wastes within a municipal-type landfill. The site was chosen as a candidate site because it represents a problem typical of both DOE and public landfills. The HAZWRAP Technology Demonstration Project began at the INEL CFA Landfill 2 in 1987. During characterization and identification activities, several organic "hotspots" or anomalies were identified. Proposals were then solicited from the private sector for innovative technologies to remediate the isolated areas. Remediation was planned to be implemented using horizontal wells installed underneath a portion of the landfill. These innovative technologies and the well installation were planned to support the current goals of the DOE and the Environmental Protection Agency to treat hazardous waste in place. 2 refs., 2 figs., 2 tabs.

1753 (ES/ER/TM-7) Summary of the landfill remediation problems and technology needs of the Oak Ridge Reservation Environmental Restoration Programs. Oak Ridge National Lab., TN (United States). Jan 1991. 97p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92003714. Source: OSTI; NTIS; INIS; GPO Dep.

Presented by D.W. Swindle, Director, Technical Integration, Environmental Restoration Division at the DOE workshop on robotics for landfill remediation, Panama City, FL, January 9-10, 1991.

This report discusses the following topics: brief description of the Oak Ridge Reservation Environmental Restoration Program; descriptions of representative waste burials at each site; ongoing, planned, or potential remediation; known or anticipated remediation problems; potential

applications for robotics in the remediation of Oak Ridge Reservation landfills.

1754 (LA-UR-94-570) Design document for landfill capping Prototype Decision Support System: Draft 1.0. Stone, J.J. (Los Alamos National Lab., NM (United States)); Paige, G.; Hakonson, T.E.; Lane, L.J. Los Alamos National Lab., NM (United States). Jan 1994. 46p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE94007577. Source: OSTI; NTIS; INIS; GPO Dep.

The overall objective of the Prototype Decision Support System for shallow land burial project is to "Develop a Decision Support System tool which incorporates simulation modeling and multi-objective decision theory for the purpose of designing and evaluating alternative trench cap designs for mixed waste landfill covers. The goal is to improve the quality of technical information used by the risk manager to select landfill cover designs while taking into account technological, economical, and regulatory factors." The complexity of the technical and non-technical information, and how the information varies in importance across sites, points to the need for decision analysis tools that provide a common basis for integrating, synthesizing, and valuing the decision input. Because the cost of remediating thousands of contaminated DOE sites is projected to be in the 10's-100's of billions of dollars, methods will be needed to establish cleanup priorities and to help in the selection and evaluation of cost effective remediation alternatives. Even at this early stage in DOE's cleanup program, it is certain that capping technologies will be heavily relied upon to remediate the 3000+ landfills on DOE property. Capping is favored in remediating most DOE landfills because, based on preliminary baseline risk assessments, human and ecological risks are considered to be low at most of these sites and the regulatory requirements for final closure of old landfills can be met using a well designed cap to isolate the buried waste. This report describes a program plan to design, develop, and test a decision support system (DSS) for assisting the DOE risk manager in evaluating capping alternatives for radioactive and hazardous waste landfills. The DOE DSS will incorporate methods for calculating, integrating and valuing technical, regulatory, and economic criteria.

1755 (LA-UR-94-593) Capping as an alternative for remediating radioactive and mixed waste landfills. Hakonson, T.E. (Colorado State Univ., Fort Collins, CO (United States). Dept. of Fishery and Wildlife Biology). Los Alamos National Lab., NM (United States). [1994]. 37p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE94007570. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes some of the regulatory and technical issues concerning the use of capping as a containment strategy for radioactive and hazardous waste. Capping alternatives for closure of landfills is not just an engineering problem, but rather involves complex physical, biological, and chemical processes requiring a multidisciplinary approach to develop designs that will work over the long haul and are cost-effective. Much of the information has been distilled from regulatory and guidance documents and a compilation of research activities on waste disposal, contaminant transport processes, and technology development for landfills that has been conducted over the last 21 years.

1756 (ORNL/ER-36) SWSA 6 Interim corrective measures environmental monitoring: FY 1990 results:

Environmental Restoration Program. Ashwood, T.L.; Spalding, B.P. Oak Ridge National Lab., TN (United States). Jul 1991. 162p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92003728. Source: OSTI; NTIS; INIS; GPO Dep. Environmental Sciences Division Publication 3722.

This report presents the results and conclusions from a multifaceted monitoring effort associated with the high-density polyethylene caps installed in Solid Waste Storage Area (SWSA) 6 at Oak Ridge National Laboratory (ORNL) as an interim corrective measure (ICM). The caps were installed between November 1988 and June 1989 to meet Resource Conservation and Recovery Act (RCRA) requirements for closure of those areas of SWSA 6 that had received RCRA-regulated wastes after November 1980. Three separate activities were undertaken to evaluate the performance of the caps: (1) wells were installed in trenches to be covered by the caps, and water levels in these intra-trench wells were monitored periodically; (2) samples were taken of the leachate in the intratrench wells and were analyzed for a broad range of radiological and chemical contaminants; and (3) water levels in wells outside the trenches were monitored periodically. With the exception of the trench leachate sampling, each of these activities spanned the preconstruction, construction, and postconstruction periods. Findings of this study have important implications for the ongoing remedial investigation in SWSA 6 and for the design of other ICMs. 51 figs., 2 tabs.

1757 (ORNL/ER-87) SWSA 6 Interim corrective measures environmental monitoring: FY 1991 results: Environmental Restoration Program. Clapp, R.B.; Marshall, D.S. Oak Ridge National Lab., TN (United States). Jun 1992. 68p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92018070. Source: OSTI; NTIS; INIS; GPO Dep. Environmental Sciences Division Publication 3849.

In 1988, interim corrective measures (ICMs) were implemented at Solid Waste Storage Area (SWSA) 6 at Oak Ridge National Laboratory. The SWSA 6 site was regulated under the Resource Conservation and Recovery Act (RCRA). The ICMs consist of eight large high-density polyethylene sheets placed as temporary caps to cover trenches known to contain RCRA-regulated materials. Environmental monitoring for FY 1991 consisted of collecting water levels at 13 groundwater wells outside the capped areas and 44 wells in or near the capped areas in order to identify any significant loss of hydrologic isolation of the wastes. Past annual reports show that the caps are only partially effective in keeping the waste trenches dry and that many trenches consistently or intermittently contain water.

1758 (PNL-8391) Testing and monitoring plan for the permanent isolation surface barrier prototype. Gee, G.W.; Cadwell, L.L.; Freeman, H.D.; Ligothe, M.W.; Link, S.O.; Romine, R.A.; Walters, W.H. Jr. Pacific Northwest Lab., Richland, WA (United States). Jun 1993. 71p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93016710. Source: OSTI; NTIS; GPO Dep.

This document is a testing and monitoring plan for a prototype barrier to be constructed at the Hanford Site in 1993. The prototype barrier is an aboveground structure engineered to demonstrate the basic features of an earthen cover system, designed to permanently isolate waste from the biosphere. These features include multiple layers of soil and rock materials and a low-permeability asphalt sublayer.

The surface of the barrier consists of silt loam soil, vegetated with plants. The barrier sides are reinforced with rock or coarse earthen-fill to protect against wind and water erosion. The sublayers inhibit plant and animal intrusion and percolation of water. A series of tests will be conducted on the prototype over the next several years to evaluate barrier performance under extreme climatic conditions.

1759 (PNL-8498) Model assessment of protective barriers: Part 4, Status of FY 1992 work. Fayer, M.J. Pacific Northwest Lab., Richland, WA (United States). Mar 1993. 40p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93010604. Source: OSTI; NTIS; INIS; GPO Dep.

Protective barriers are being considered for use at the Hanford Site to enhance the isolation of radioactive wastes from water, plant, and animal intrusion. This study is part of an ongoing effort to assess the effectiveness of protective barriers for isolation of wastes from water. Part I of this study was the original modeling assessment by Pacific Northwest Laboratory of various protective barrier designs (e.g., soil type, vegetation). In Part 11 of this study, additional barrier designs were reviewed and several barrier modeling assumptions were tested. A test plan was then produced that detailed the requirement for hydrologic modeling of protective barriers. Part III of this study summarized the status of work in FY 1990 dealing with two-dimensional flow beneath the barrier and with validation testing using lysimeter data. This report (Part IV) addresses the application of a calibrated model to a much longer data set, the application of the calibrated model to a lysimeter that received a different treatment, and the effect of hysteresis on the behavior of water in the protective barrier.

1760 (PNL-8741) Hanford Site Permanent Isolation Surface Barrier Development Program: Fiscal year 1992 and 1993 highlights. Cadwell, L.L.; Link, S.O.; Gee, G.W. (eds.). Pacific Northwest Lab., Richland, WA (United States). Sep 1993. 56p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94001086. Source: OSTI; NTIS; INIS; GPO Dep.

The Hanford Site Permanent Isolation Surface Barrier Development Program was jointly developed by the Pacific Northwest Laboratory and Westinghouse Hanford Company to design and test an earthen cover system that can be used to inhibit water infiltration; plant, animal, and human intrusion; and wind and water erosion. Kaiser Engineers Hanford Company provided engineering design support for the program. Work on barrier design has been under way at Hanford for nearly 10 years. The comprehensive development of a long-term barrier, formerly the Hanford Site Protective Barrier Development Program, was initiated in FY 1986, and a general field-tested design is expected to be completed by FY 1998. Highlights of efforts in FY 1992 and FY 1993 included the resumption of field testing, the completion of the prototype barrier design, and the convening of an external peer review panel, which met twice with the barrier development team. The review panel provided helpful guidance on current and future barrier development activities, while commending the program for its significant technical contributions to innovative barrier technology development.

1761 (PNL-8841) An investigation of berm mounds as analogs to erosion control factors on protective barriers. Chamness, M.A. Pacific Northwest Lab., Richland, WA (United States). Sep 1993. 58p. Sponsored by USDOE,

Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94001085. Source: OSTI; NTIS; INIS; GPO Dep.

Included in several of the final disposal strategies proposed in the Interim Hanford Waste Management Plan (DOE-RL 1986a) is design of a protective barrier to isolate the underlying waste sites from the environment. The conceptual protective barrier design requires a fine-grained sediment to retain precipitation near the top of the barrier where evapotranspiration can recycle the moisture back into the atmosphere. The design incorporates gravel into the topsoil as one way to reduce its erosion. Information is needed to determine the optimal ratio of gravel to topsoil needed to reduce erosion without significantly reducing evapotranspiration, and its effect on erosion. Bergmounds are mounds with a gravelly surface that were formed about 13,000 years ago and represent natural analogs to the topsoil portion of the protective barrier. The primary goal of this study was to identify characteristics of bergmounds and the effects of these characteristics, especially the gravelly surface, on the amount and rate of erosion. A secondary goal was to apply a technique normally used to estimate vegetation cover to measure percent gravel cover, and to compare this technique with particle size distribution based on weight percent. Four bergmounds were investigated for this study, two in a windy site and two in a more sheltered site. Each bergmound was sampled in eight locations. Two methods were used to estimate the amount of surface gravel: the ocular point-intercept method which estimates the percent gravel cover, and sieved samples of the surface sediments which measure the percent gravel by weight. Holes were dug at each bergmound's eight sampling sites to examine and sample the subsurface sediments.

1762 (PNL-8935) Plant reestablishment after soil disturbance: Effects of soils, treatment, and time. Brandt, C.A.; Alford, K.; McIlveny, G.; Tijerina, A. Pacific Northwest Lab., Richland, WA (United States). Nov 1993. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94003677. Source: OSTI; NTIS; INIS; GPO Dep.

The Pacific Northwest Laboratory examined plant growth and establishment on 16 sites where severe land disturbance had taken place. The purpose of the study was to evaluate the relative effectiveness of the different methods in term of their effects on establishment of native and alien plants. Disturbances ranged from 1 to 50 years in age. Revegetation using native plants had been attempted at 14 of the sites; the remainder were abandoned without any further management. Revegetation efforts variously included seeding, fertilizer application, mulching with various organic sources, compost application, application of Warden silt loam topsoil over sand and gravel soils, and moderate irrigation.

1763 (PNL-8949) Water erosion field tests for Hanford protective barriers: FY 1992 status report. Gilmore, B.G.; Walters, W.H. Pacific Northwest Lab., Richland, WA (United States). Nov 1993. 70p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94004375. Source: OSTI; NTIS; INIS; GPO Dep.

Pacific Northwest Laboratory (PNL) conducted this study for the Office of Technology Development and the Office of Environmental Restoration of the US Department of Energy. The purpose of the study was to investigate the erosion potential of barrier soil covers from high-intensity rainfall

events and to propose erosion mitigation criteria for the soil cover. Two sets of field plots were used in the testing program. Small plots (1 m²) were used initially for scoping studies and larger plots (32.5 m²) were used for a more comprehensive study of soil cover erosion. The study investigated the use of pea gravel admix and naturally established vegetation to reduce erosion of barrier soil covers.

1764 (SAND-94-0488C) Technical and economic evaluation of selected technologies of the Landfill Characterization System. Floran, R.J. Sandia National Labs., Albuquerque, NM (United States). [1993]. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-931095-80: Department of Energy environmental remediation conference, Augusta, GA (United States), 24-28 Oct 1993). Order Number DE94007852. Source: OSTI; NTIS; GPO Dep.

In 1992 and 1993, numerous innovative and emerging technologies for characterizing metal and mixed waste contaminants and their migration beneath landfills in and environments were field tested at Sandia's Chemical Waste Landfill. Many of these technologies are being evaluated as part of the Landfill Characterization System (LCS). The LCS emphasizes minimally intrusive technologies and downhole sensors that strive to be cheaper, better, safer and faster than conventional methods. Major aims of the LCS are to demonstrate, test and evaluate these technologies, and determine whether substantial cost saving over traditional baseline methods can be realized. To achieve these goals, the LCS uses an integrated systems approach that stresses the application of complementary and compatible technologies. Successful field demonstrations combined with favorable economics, will greatly assist the commercialization of these technologies to the private sector and to Environmental Restoration groups throughout the DOE Complex. In this paper, a technical and economic evaluation of selected technologies that comprise the LCS is presented. Because sampling and analysis is the most costly part of a characterization effort, the economic evaluation presented here focuses specifically on these activities. LCS technologies discussed include the "Smart Sampling Methodology" and two field screening analytical methods, stripping voltammetry and x-ray fluorescence.

1765 (SAND-94-0982C) The mixed waste landfill integrated demonstration. Burford, T.D.; Williams, C.V. Sandia National Labs., Albuquerque, NM (United States). [1994]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-940499-8: Federal environmental restoration and waste minimization conference and exhibition, New Orleans, LA (United States), 25-29 Apr 1994). Order Number DE94010799. Source: OSTI; NTIS; INIS; GPO Dep.

The Mixed Waste Landfill Integrated Demonstration (MWLID) focuses on "in-situ" characterization, monitoring, remediation, and containment of landfills in arid environments that contain hazardous and mixed waste. The MWLID mission is to assess, demonstrate, and transfer technologies and systems that lead to faster, better, cheaper, and safer cleanup. Most important, the demonstrated technologies will be evaluated against the baseline of conventional technologies and systems. The comparison will include the cost, efficiency, risk, and feasibility of using these innovative technologies at other sites.

1766 (SAND-94-1202C) An overview of the mixed waste landfill integrated demonstration. Williams, C.V.;

Burford, T.D. Sandia National Labs., Albuquerque, NM (United States). [1994]. 4p. Sponsored by US-DOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9404161-1: 4. annual waste-management education and research consortium technology development conference, Las Cruces, NM (United States), 10-15 Apr 1994). Order Number DE94012919. Source: OSTI; NTIS; INIS; GPO Dep.

Prior to May 1992, field demonstrations of characterization technologies were performed at an uncontaminated site near the Chemical Waste Landfill. In mid-1992 through summer 1993, both non-intrusive and intrusive characterization techniques were demonstrated at the Chemical Waste Landfill. Subsurface and dry barrier demonstrations were started in summer 1993 and will continue into 1995. Future plans include demonstrations of innovative drilling, characterization and long-term monitoring, and remediation techniques. Demonstrations were also scheduled in summer 1993 at the Kirtland Air Force HSWA site and will continue in 1994. The first phase of the Thermal Enhanced Vapor Extraction System (TEVES) project occurred in April 1992 when two holes were drilled and vapor extraction wells were installed at the Chemical Waste Landfill. Obtaining the engineering design and environmental permits necessary to implement this field demonstration will take until early 1994. Field demonstration of the vapor extraction system will occur in 1994.

1767 (WHC-EP-0630) Regulatory analysis for closure of a treatment and storage tank as a landfill. Smith, E.H. Westinghouse Hanford Co., Richland, WA (United States). Mar 1993. 41p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93011281. Source: OSTI; NTIS; INIS; GPO Dep.

The Hanford Site single-shell tanks (SST) represent the most challenging waste remediation activity for the Hanford Site. Activities are currently underway to develop and demonstrate waste retrieval technologies to meet milestones established in the Hanford Federal Facility Agreement and Consent Order and to ultimately accomplish closure of the SSTs. A closure plan, providing detailed information for closure of the SSTs, will be submitted to the State of Washington Department of Ecology (Ecology) by the year 2004. Because of the high radiation associated with SST waste and the technical difficulties associated with waste retrieval, a potential closure alternative for the SSTs may include leaving one or more of the tanks and residual waste in place and performing final closure in accordance with the closure and postclosure care requirements for a landfill. This document provides an analysis of the regulatory requirements applicable to closing a hazardous waste treatment and storage tank system as a landfill.

1768 (WHC-SA-1158) Use of lysimeters to monitor a sanitary landfill. Wittreich, C.D.; Wilson, C.R. Westinghouse Hanford Co., Richland, WA (United States). Mar 1991. 10p. Sponsored by USDOE, Washington, DC (USA). DOE Contract AC06-87RL10930. (CONF-910794-1: International symposium on lysimetry, Honolulu, HI (United States), 23-25 Jul 1991). Order Number DE91010106. Source: OSTI; NTIS; GPO Dep.

A vadose zone monitoring program has been developed using basin lysimeters to evaluate the environmental impacts of a sanitary waste landfill. Lysimeter systems, consisting of collection basins and collection sumps and risers, will be installed beneath the landfill to collect leachate.

Leachate chemistry and production information will be evaluated using a set of analytical steps to assess the impact of leachate on ground water quality. 2 refs., 4 figs.

FACILITY TRANSITIONING, DECOMMISSIONING, AND FINAL DISPOSITION

Refer also to citation(s) 19, 34, 223, 282, 288, 673, 691, 692, 1591, 2120, 2269, 2270, 2380

1769 (ANL/CMT/CP-79432) Cleanup standards and pathways analysis methods. Devgun, J.S. Argonne National Lab., IL (United States). [1993]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930906-12: '93 international conference on nuclear waste management and environmental remediation, Prague (Czech Republic), 5-11 Sep 1993). Order Number DE93040246. Source: OSTI; INIS; NTIS; GPO Dep.

Remediation of a radioactively contaminated site requires that certain regulatory criteria be met before the site can be released for unrestricted future use. Since the ultimate objective of remediation is to protect the public health and safety, residual radioactivity levels remaining at a site after cleanup must be below certain preset limits or meet acceptable dose or risk criteria. Release of a decontaminated site requires proof that the radiological data obtained from the site meet the regulatory criteria for such a release. Typically release criteria consist of a composite of acceptance limits that depend on the radionuclides, the media in which they are present, and federal and local regulations. In recent years, the US Department of Energy (DOE) has developed a pathways analysis model to determine site-specific soil activity concentration guidelines for radionuclides that do not have established generic acceptance limits. The DOE pathways analysis computer code (developed by Argonne National Laboratory for the DOE) is called RESRAD (Gilbert et al. 1989). Similar efforts have been initiated by the US Nuclear Regulatory Commission (NRC) to develop and use dose-related criteria based on genetic pathways analyses rather than simplistic numerical limits on residual radioactivity. The focus of this paper is radionuclide contaminated soil. Cleanup standards are reviewed, pathways analysis methods are described, and an example is presented in which RESRAD was used to derive cleanup guidelines.

1770 (ANL/CP-74455) Managing large-scale environmental impact assessments. Pentecost, E.D. Argonne National Lab., IL (United States). [1991]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9106239-2: 11. International Association for Impact Assessment (IAIA) annual meeting, Champaign, IL (United States), 7-11 Jun 1991). Order Number DE92003407. Source: OSTI; NTIS; GPO Dep.

This report describes management techniques of environmental impact assessment projects. Document preparation and review is briefly discussed. (CBS)

1771 (ANL/CP-74663) Issuance of the CERCLA rod for an operable unit remedial action at the Weldon Spring Site: Lessons learned. McCracken, S.H. (USDOE, St. Charles, MO (United States)); Peterson, J.M.; MacDonell, M.M.; Ferguson, R.D. Argonne National Lab., IL (United States). [1991]. 3p. Sponsored by USDOE, Washington, DC

(United States). DOE Contract W-31109-ENG-38. (CONF-910981-48: Environmental remediation '91 conference, Pasco, WA (United States), 8-11 Sep 1991). Order Number DE92003522. Source: OSTI; NTIS; INIS; GPO Dep.

Remedial action needs of the Weldon Springs Site are briefly discussed.

1772 (ANL/DIS/CP-80940) Department of Energy decontamination and decommissioning project experience. Price, W.J. Argonne National Lab., IL (United States). [1994]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940225-22: Waste management '94, Tucson, AZ (United States), 27 Feb - 3 Mar 1994). Order Number DE94006827. Source: OSTI; NTIS; INIS; GPO Dep.

An integrated risk-based approach has been developed to address the human health risks of radiological and chemical releases from potential facility accidents in support of the U.S. Department of Energy (DOE) Environmental Restoration and Waste Management (EM) Programmatic Environmental Impact Statement (PEIS). Accordingly, the facility accident analysis has been developed to allow risk-based comparisons of EM PEIS strategies for consolidating the storage and treatment of wastes at different sites throughout the country. The analysis has also been developed in accordance with the latest DOE guidance by considering the spectrum of accident scenarios that could occur in implementing the various actions evaluated in the EM PEIS. The individual waste storage and treatment operations and inventories at each site are specified by the functional requirements defined for each waste management alternative to be evaluated. For each alternative, the accident analysis determines the risk-dominant accident sequences and derives the source terms from the associated releases. This information is then used to perform health effects and risk calculations that are used to evaluate the various alternatives.

1773 (ANL/EA/CP-78779) A comparison of radiological risk assessment methods for environmental restoration. Dunning, D.E. Jr.; Peterson, J.M. Argonne National Lab., IL (United States). [1993]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930746-3: Annual meeting of the Health Physics Society (HPS), Atlanta, GA (United States), 11-15 Jul 1993). Order Number DE93040823. Source: OSTI; NTIS; INIS; GPO Dep.

Evaluation of risks to human health from exposure to ionizing radiation at radioactively contaminated sites is an integral part of the decision-making process for determining the need for remediation and selecting remedial actions that may be required. At sites regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), a target risk range of 10^{-4} to 10^{-6} incremental cancer incidence over a lifetime is specified by the US Environmental Protection Agency (EPA) as generally acceptable, based on the reasonable maximum exposure to any individual under current and future land use scenarios. Two primary methods currently being used in conducting radiological risk assessments at CERCLA sites are compared in this analysis. Under the first method, the radiation dose equivalent (i.e., Sv or rem) to the receptors of interest over the appropriate period of exposure is estimated and multiplied by a risk factor (cancer risk/Sv). Alternatively, incremental cancer risk can be estimated by combining the EPA's cancer slope factors (previously termed potency factors) for radionuclides with estimates of radionuclide intake

by ingestion and inhalation, as well as radionuclide concentrations in soil that contribute to external dose. The comparison of the two methods has demonstrated that resulting estimates of lifetime incremental cancer risk under these different methods may differ significantly, even when all other exposure assumptions are held constant, with the magnitude of the discrepancy depending upon the dominant radionuclides and exposure pathways for the site. The basis for these discrepancies, the advantages and disadvantages of each method, and the significance of the discrepant results for environmental restoration decisions are presented.

1774 (ANL/EA/CP-79947) Applying ALARA to cleanup criteria for a mixed waste site. MacDonell, M. (Argonne National Lab., IL (United States)); Peterson, J.; Haroun, L.; Blunt, D.; Dunning, D.; Green, S. Argonne National Lab., IL (United States). [1993]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-931095-57: Department of Energy environmental remediation conference, Augusta, GA (United States), 24-28 Oct 1993). Order Number DE94003215. Source: OSTI; NTIS; GPO Dep.

The process of reducing exposures to levels as low as reasonably achievable (ALARA) is applied by the US Department of Energy (DOE) to the management of radioactive materials. A site-specific application of the ALARA process was incorporated into the development of cleanup criteria for both surface water and soil at a DOE environmental restoration site. Factoring ALARA considerations into the development of cleanup criteria demonstrated DOE's commitment to maintaining both protectiveness and reason, and it also provided a working range for verifying residual levels after the cleanup actions have been completed.

1775 (ANL/EA/CP-79948) Lessons learned integrating CERCLA and NEPA at the Weldon Spring site. MacDonell, M.; Peterson, J. Argonne National Lab., IL (United States). [1993]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-931095-58: Department of Energy environmental remediation conference, Augusta, GA (United States), 24-28 Oct 1993). Order Number DE94003216. Source: OSTI; NTIS; GPO Dep.

Values of the National Environmental Policy Act (NEPA) are being incorporated into the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process at US Department of Energy (DOE) environmental restoration sites. This integration raises a number of issues that must be resolved during the assessment phase for a project before cleanup actions begin. These range from constraints on interim actions and the type and level of impacts evaluated to the format, content, and sign-off process for assessment and decision documents. A number of helpful lessons were learned in applying an integrated process at DOE's Weldon Spring site. Overall, integrating CERCLA and NEPA had a positive effect on environmental compliance for this remedial action project.

1776 (ANL/EA/CP-79949) From work plan to rod and beyond: Lessons learned on regulatory issues at the Weldon Spring Site. MacDonell, M. (Argonne National Lab., IL (United States)); Peterson, J.; Uhlmeier, T.; Ferguson, R. Argonne National Lab., IL (United States). [1993]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-931095-61: Department of Energy environmental remediation conference,

Augusta, GA (United States), 24-28 Oct 1993). Order Number DE94003217. Source: OSTI; NTIS; INIS; GPO Dep.

Compliance with applicable or relevant and appropriate requirements (ARARs) is a key element of successful cleanup activities at environmental restoration sites. A number of ARAR issues were raised during the, planning, assessment, and implementation of restoration activities at a US Department of Energy (DOE) mixed waste site in Missouri. Resolutions were developed for issues ranging from storage time requirements to land disposal restrictions. This paper discusses ARAR issues and resolutions.

1777 (ANL/EA/CP-80790) Developing an integrated project plan for the preparation of a Remedial Investigation/Feasibility Study Work Plan. Swanston, B. Argonne National Lab., IL (United States). Apr 1994. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9404114-1: 10. Performance Management Association (PMA) annual conference, San Antonio, TX (United States), 20-22 Apr 1994). Order Number DE94007646. Source: OSTI; NTIS; GPO Dep.

The purpose of project planning is to develop a formalized baseline project plan that is used during project execution to track and monitor project performance. The baseline project plan developed under the guidelines presented in this paper integrates the technical scope, schedule, and budget so that the objectives of the project can be accomplished. During project execution, performance data are collected and measured against this baseline project plan. When performance varies from the plan, timely actions can be taken to alleviate potential problems. Thus, effective performance measurement is ultimately a function of the quality of the baseline project plan. When viewed in this light, the importance of a quality baseline project plan cannot be overemphasized.

1778 (ANL/EA/CP-80824) Comprehensive transportation risk assessment system based on unit-consequence factors. Biwer, B.M.; Monette, F.A.; LePoire, D.J.; Chen, S.Y. Argonne National Lab., IL (United States). [1994]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940225-24: Waste management '94, Tucson, AZ (United States), 27 Feb - 3 mar 1994). Order Number DE94006829. Source: OSTI; NTIS; INIS; GPO Dep.

The U.S. Department of Energy (DOE) Environmental Restoration and Waste Management Programmatic Environmental Impact Statement requires a comprehensive transportation risk analysis of radioactive waste shipments for large shipping campaigns. Thousands of unique shipments involving truck and rail transport must be analyzed; a comprehensive risk analysis is impossible with currently available methods. Argonne National Laboratory developed a modular transportation model that can handle the demands imposed by such an analysis. The modular design of the model facilitates the simple addition/updates of transportation routes and waste inventories, as required, and reduces the overhead associated with file maintenance and quality assurance. The model incorporates unit-consequences factors generated with the RADTRAN 4 transportation risk analysis code that are combined with an easy-to-use, menu-driven interface on IBM-compatible computers running under DOS. User selection of multiple origin/destination site pairs for the shipment of multiple radioactive waste inventories is permitted from pop-up lists. Over 800 predefined routes are available among more than 30 DOE sites and waste inventories that include high-level waste,

spent nuclear fuel, transuranic waste, low-level waste, low-level mixed waste, and greater-than-Class C waste.

1779 (ANL/EA/CP-80825) Transportation radiological risk assessment for the programmatic environmental impact statement: An overview of methodologies, assumptions, and input parameters. Monette, F.; Biwer, B.; LePoire, D.; Chen, S.Y. Argonne National Lab., IL (United States). [1994]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940225-20: Waste management '94, Tucson, AZ (United States), 27 Feb - 3 mar 1994). Order Number DE94006823. Source: OSTI; NTIS; INIS; GPO Dep.

The U.S. Department of Energy is considering a broad range of alternatives for the future configuration of radioactive waste management at its network of facilities. Because the transportation of radioactive waste is an integral component of the management alternatives being considered, the estimated human health risks associated with both routine and accident transportation conditions must be assessed to allow a complete appraisal of the alternatives. This paper provides an overview of the technical approach being used to assess the radiological risks from the transportation of radioactive wastes. The approach presented employs the RADTRAN 4 computer code to estimate the collective population risk during routine and accident transportation conditions. Supplemental analyses are conducted using the RISKIND computer code to address areas of specific concern to individuals or population subgroups. RISKIND is used for estimating routine doses to maximally exposed individuals and for assessing the consequences of the most severe credible transportation accidents. The transportation risk assessment is designed to ensure - through uniform and judicious selection of models, data, and assumptions - that relative comparisons of risk among the various alternatives are meaningful. This is accomplished by uniformly applying common input parameters and assumptions to each waste type for all alternatives. The approach presented can be applied to all radioactive waste types and provides a consistent and comprehensive evaluation of transportation-related risk.

1780 (ANL/EA/CP-80956) Overview of the facility accident analysis for the U.S. Department of Energy Environmental Restoration and Waste Management Programmatic Environmental Impact Statement. Mueller, C. (Argonne National Lab., IL (United States)); Habegger, L.; Huizenga, D. Argonne National Lab., IL (United States). [1994]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940225-21: Waste management '94, Tucson, AZ (United States), 27 Feb - 3 mar 1994). Order Number DE94006825. Source: OSTI; NTIS; INIS; GPO Dep.

An integrated risk-based approach has been developed to address the human health risks of radiological and chemical releases from potential facility accidents in support of the U.S. Department of Energy (DOE) Environmental Restoration and Waste Management (EM) Programmatic Environmental Impact Statement (PEIS). Accordingly, the facility accident analysis has been developed to allow risk-based comparisons of EM PEIS strategies for consolidating the storage and treatment of wastes at different sites throughout the country. The analysis has also been developed in accordance with the latest DOE guidance by considering the spectrum of accident scenarios that could occur in implementing the various actions evaluated in the

EM PEIS. The individual waste storage and treatment operations and inventories at each site are specified by the functional requirements defined for each waste management alternative to be evaluated. For each alternative, the accident analysis determines the risk-dominant accident sequences and derives the source terms from the associated releases. This information is then used to perform health effects and risk calculations that are used to evaluate the various alternatives.

1781 (ANL/EA/CP-80957) Methodology for integrated evaluation of alternative siting and treatment, storage, and disposal strategies for U.S. Department of Energy waste management. Avci, H.; Habegger, L.; Kotek, T. Argonne National Lab., IL (United States). [1994]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940225-29: Waste management '94, Tucson, AZ (United States), 27 Feb - 3 mar 1994). Order Number DE94006536. Source: OSTI; NTIS; INIS; GPO Dep.

A computational model named WASTE-MGMT has been developed by Argonne National Laboratory in support of the U.S. Department of Energy (DOE) Environmental Restoration and Waste Management (EM) Programmatic Environmental Impact Statement (PEIS) to assist in the analysis of alternative approaches to the management of existing and future radioactive wastes at DOE facilities. Input to the model includes waste inventory and characterization data at each DOE site; unit operations data for the facilities used for treatment, storage and disposal (TSD) of the wastes; and information about the alternative approaches for the TSD of the wastes and for the siting of such TSD facilities. The quantities calculated by the model include the air emissions of radionuclides and hazardous chemicals during operation of the TSD facilities, the quantities and characteristics of the wastes processes annually at these facilities, and the quantities and characteristics of the waste shipped among sites. These quantities are then used as input to calculate the cost and the environmental and socioeconomic impacts resulting from the TSD of the DOE wastes under various alternative management approaches considered in the EM PEIS.

1782 (ANL/EA/CP-80969) Methodology and computational framework used for the US Department of Energy Environmental Restoration and Waste Management Programmatic Environmental Impact Statement accident analysis. Mueller, C. (Argonne National Lab., IL (United States)); Roglans-Ribas, J.; Folga, S.; Huttenga, A.; Jackson, R.; TenBrook, W.; Russell, J. Argonne National Lab., IL (United States). [1994]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940225-36: Waste management '94, Tucson, AZ (United States), 27 Feb - 3 mar 1994). Order Number DE94006815. Source: OSTI; NTIS; INIS; GPO Dep.

A methodology, computational framework, and integrated PC-based database have been developed to assess the risks of facility accidents in support of the US Department of Energy (DOE) Environmental Restoration and Waste Management Programmatic Environmental Impact Statement. The methodology includes the following interrelated elements: (1) screening of storage and treatment processes and related waste inventories to determine risk-dominant facilities across the DOE complex, (2) development and frequency estimation of the risk-dominant sequences of accidents, and (3) determination of the evolution of and final compositions of radiological or chemically hazardous source terms predicted to be released as a function of the storage

inventory or treatment process throughput. The computational framework automates these elements to provide source term input for the second part of the analysis which includes (1) development or integration of existing site-specific demographics and meteorological data and calculation of attendant unit-risk factors and (2) assessment of the radiological or toxicological consequences of accident releases to the general public and to the occupational work force.

1783 (ANL/EA/CP-80976) Hazardous waste transportation risk assessment for the US Department of Energy Environmental Restoration and Waste Management Programmatic Environmental Impact Statement - human health endpoints. Hartmann, H.M.; Policastro, A.J.; Lazaro, M.A. Argonne National Lab., IL (United States). [1994]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940225-49: Waste management '94, Tucson, AZ (United States), 27 Feb - 3 mar 1994). Order Number DE94007696. Source: OSTI; NTIS; INIS; GPO Dep.

In this presentation, a quantitative methodology for assessing the risk associated with the transportation of hazardous waste (HW) is proposed. The focus is on identifying air concentrations of HW that correspond to specific human health endpoints.

1784 (ANL/EA/CP-82021) Accident analysis for high-level waste management alternatives in the US Department of Energy Environmental Restoration and Waste Management Programmatic Environmental Impact Statement. Folga, S.; Mueller, C.; Roglans-Ribas, J. Argonne National Lab., IL (United States). [1994]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940225-39: Waste management '94, Tucson, AZ (United States), 27 Feb - 3 mar 1994). Order Number DE94006813. Source: OSTI; NTIS; INIS; GPO Dep.

A comparative generic accident analysis was performed for the programmatic alternatives for high-level waste (HLW) management in the US Department of Energy Environmental Restoration and Waste Management Programmatic Environmental Impact Statement (EM PEIS). The key facilities and operations of the five major HLW management phases were considered: current storage, retrieval, pretreatment, treatment, and interim canister storage. A spectrum of accidents covering the risk-dominant accidents was analyzed. Preliminary results are presented for HLW management at the Hanford site. A comparison of these results with those previously advanced shows fair agreement.

1785 (ANL/EA/CP-82328) An improved assessment approach for noise impacts from stationary point and traffic sources on humans and wildlife. Chang, Young-Soo; Chun, K.C. Argonne National Lab., IL (United States). [1994]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940632-8: Annual meeting and exhibition of the Air and Waste Management Association, Cincinnati, OH (United States), 19-24 Jun 1994). Order Number DE94009728. Source: OSTI; NTIS; GPO Dep.

This paper presents an improved, efficient approach for assessing noise impacts associated with a complex set of noise sources at multiple receptor locations; noise impacts from typical remedial activities at a contaminated industrial site are used as an example. The noise sources associated with remedial activities at the site and surrounding areas are

described, the noise-propagation modeling methods and results are presented, and an impact assessment of the contaminated site is discussed with regard to applicable regulatory standards and individual and community responses. Also discussed is the improved noise assessment approach. The improved features demonstrated are automate approaches for (1) inputting long-term hourly meteorological data (e.g., 8,760 hours for a one-year period) into a long-range noise-propagation model for computing noise-level increases at receptor locations and (2) analyzing potential individual and community responses to intrusive noises using the IAP and modified CNR.

1786 (ANL/EAD/TM-9) Derivation of uranium residual radioactive material guidelines for the former Alba Craft Laboratory site, Oxford, Ohio. Nimmagadda, M.; Faillace, E.; Yu, C. Argonne National Lab., IL (United States). Jan 1994. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE94006424. Source: OSTI; NTIS; INIS; GPO Dep.

Residual radioactive material guidelines for uranium were derived for the former Alba Craft Laboratory site in Oxford, Ohio. This site has been identified for remedial action under the Formerly Utilized Sites Remedial Action Program (FUSRAP) of the US Department of Energy (DOE). Single nuclide and total uranium guidelines were derived on the basis of the requirement that the 50-year committed effective dose equivalent to a hypothetical individual who lives or works in the immediate vicinity of the former Alba Craft Laboratory site should not exceed a dose of 30 mrem/yr following remedial action for the current use and likely future use scenarios or a dose of 100 mrem/yr for less likely future use scenarios (Yu et al. 1993). The DOE residual radioactive material guideline computer code, RESRAD, which implements the methodology described in the DOE manual for implementing residual radioactive material guidelines, was used in this evaluation.

1787 (ANL/EAD/TM-13) Air pathway analysis for cleanup at the chemical plant area of the Weldon Spring site. Chang, Y.S. Argonne National Lab., IL (United States). Jan 1994. 82p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE94011140. Source: OSTI; NTIS; INIS; GPO Dep.

The Weldon Spring site is a mixed waste site located in St. Charles County, Missouri. Cleanup of the site is in the planning and design stage, and various engineering activities were considered for remedial action, including excavating soils, dredging sludge, treating various contaminated media in temporary facilities, transporting and staging supplies and contaminated material, and placing waste in an engineered disposal cell. Both contaminated and uncontaminated emissions from these activities were evaluated to assess air quality impacts and potential health effects for workers and the general public during the cleanup period. A site-specific air quality modeling approach was developed to address several complex issues, such as a variety of emission sources, an array of source/receptor configurations, and complicated sequencing/scheduling. This approach can be readily adapted to reflect changes in the expected activities as engineering plans are finalized.

1788 (ANL/EAIS/CP-79748) The strategy for assessing risks associated with remediation of the former production area at Fernald. Davis, M. (Argonne National Lab., IL (United States)); Avci, H.; Picel, K.; Janke, R.J. Argonne National Lab., IL (United States). [1993]. 10p.

Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-931095-18: Department of Energy environmental remediation conference, Augusta, GA (United States), 24-28 Oct 1993). Order Number DE94001292. Source: OSTI; NTIS; INIS; GPO Dep.

The strategy for assessing the risks associated with the remediation of the former Production Area at the Fernald Environmental Management Project is discussed. The general approach to risk assessment is strongly influenced by a number of factors related to the nature of the site and to management proposals that have been made concerning the site. How these factors affect the approach to assessing baseline risks, to assessing risks associated with remedial activity, and to establishing cleanup criteria are examined.

1789 (ANL/EAIS/TM-78) Off-site population radiological dose and risk assessment for potential airborne emissions from the Weldon Spring Site. Avci, H.I.; Biwer, B.M.; Blunt, D.L. Argonne National Lab., IL (United States). Environmental Assessment and Information Sciences Div. Nov 1992. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE93006033. Source: OSTI; NTIS; GPO Dep.

Radiological doses and health risks to the population around the Weldon Spring site from potential airborne emissions during remedial action at the chemical plant area of the site have been assessed with the Clean Air Act Assessment Package-1988 computer code. Two treatment options are being considered for waste produced by site cleanup activities: chemical stabilization/solidification and vitrification. Over the entire cleanup period of 7 years, the collective dose received by the people who live within 80 km (50 mi) of the site (about 3 million persons) is estimated to be about 34 person-rem for the chemical stabilization/solidification option and 32 person-rem for the vitrification option. By comparison, the same population is expected to receive about 6×10^6 person-rem from natural background radiation during that time. If only the population within a reasonable radius of impact is considered (about 10,700 persons live within 5 km [3 mi] of the site), the remedial action activities are estimated to result in about 5 person-rem over the entire cleanup period; the same population is expected to receive about 20,000 person-rem from natural background radiation during that time. Because the doses are low, no cancers or genetic effects are expected to occur among the population around the Weldon Spring site as a result of exposures resulting from potential radioactive releases to the atmosphere during remediation of the chemical plant area.

1790 (ANL/EAIS/TM-80) Biological assessment for the remedial action at the chemical plant area of the Weldon Spring site. Hlohowskyj, I.; Dunn, C.P. Argonne National Lab., IL (United States). Environmental Assessment and Information Sciences Div. Nov 1992. 59p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE93004381. Source: OSTI; NTIS; GPO Dep.

The Weldon Spring site in St. Charles County, Missouri, became contaminated during the 1940s through the 1960s as a result of explosives production by the US Army and uranium and thorium processing by the predecessor agency of the US Department of Energy (DOE). The site is listed on the National Priorities List of the US Environmental Protection Agency, and DOE is responsible for its cleanup. Contaminants are present in soil, surface water, and aquatic sediments. Alternatives identified for site remediation are no action (included as baseline for comparison), treatment and

disposal of the wastes at the Weldon Spring site, and on-site treatment followed by off-site disposal at either a commercial facility near Clive, Utah, or at DOE's Hanford site near Richland, Washington. In accordance with the requirements of the Endangered Species Act, this biological assessment has been prepared to evaluate the potential effects of proposed remedial action alternatives on federal listed (endangered or threatened) and candidate species at the respective sites. The assessment includes consideration of the environmental setting at each site; the federal listed and candidate species that could occur at each site; the construction, excavation, and treatment activities under each alternative; and the amount of land area affected at each site.

1791 (ANL/EAIS/TM-94) Derivation of strontium-90 and cesium-137 residual radioactive material guidelines for the Laboratory for Energy-Related Health Research, University of California, Davis. Nimmagadda, M.; Yu, C. Argonne National Lab., IL (United States). Environmental Assessment and Information Sciences Div. Apr 1993. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE93013113. Source: OSTI; NTIS; INIS; GPO Dep.

Residual radioactive material guidelines for strontium-90 and cesium-137 were derived for the Laboratory for Energy-Related Health Research (LEHR) site in Davis, California. The guideline derivation was based on a dose limit of 100 mrem/yr. The US Department of Energy (DOE) residual radioactive material guideline computer code, RESRAD, was used in this evaluation; this code implements the methodology described in the DOE manual for implementing residual radioactive material guidelines. Three potential site utilization scenarios were considered with the assumption that, for a period of 1,000 years following remedial action, the site will be utilized without radiological restrictions. The defined scenarios vary with regard to use of the site, time spent at the site, and sources of food consumed. The results of the evaluation indicate that the basic dose limit of 100 mrem/yr will not be exceeded within 1,000 years for either strontium-90 or cesium-137, provided that the soil concentrations of these radionuclides at the LEHR site do not exceed the following levels: 71,000 pCi/g for strontium-90 and 91 pCi/g for cesium-137 for Scenario A (researcher: the expected scenario); 160,000 pCi/g for strontium-90 and 220 pCi/g for cesium-137 for Scenario B (recreationist: a plausible scenario); and 37 pCi/g for strontium-90 and 32 pCi/g for cesium-137 for Scenario C (resident farmer ingesting food produced in the contaminated area: a plausible scenario). The derived guidelines are single-radionuclide guidelines and are linearly proportional to the dose limit used in the calculations. In setting the actual strontium-90 and cesium-137 guidelines for the LEHR site, DOE will apply the as low as reasonably achievable (ALARA) policy to the decision-making process, along with other factors such as whether a particular scenario is reasonable and appropriate.

1792 (ANL/EAIS/TM-103) A compilation of radionuclide transfer factors for the plant, meat, milk, and aquatic food pathways and the suggested default values for the RESRAD code. Wang, Y.Y.; Biwer, B.M.; Yu, C. Argonne National Lab., IL (United States). Aug 1993. 43p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE94000632. Source: OSTI; NTIS; GPO Dep.

The ongoing development and revision of the RESRAD computer code at Argonne National Laboratory requires update of radionuclide transfer factors for the plant, meat, milk,

and aquatic food pathways. Default values for these transfer factors used in published radiological assessment reports are compiled and compared with values used in RESRAD. The differences among the reported default values used in different radiological assessment codes and reports are also discussed. In data comparisons, values used in more recent reports are given more weight because more recent experimental work tends to be conducted under better-defined laboratory or field conditions. A new default value is suggested for RESRAD if one of the following conditions is met: (1) values used in recent reports are an order of magnitude higher or lower than the default value currently used in RESRAD, or (2) the same default value is used in several recent radiological assessment reports.

1793 (ANL/ER/CP-79013) Development of technology performance specifications for volatile organic compounds. Purdy, C. (Dept. of Energy, Germantown, MD (US)). Office of Environmental and Waste Management; Schutte, W.E.; Erickson, M.D.; Carpenter, S.C.; Doskey, P.V.; Lindahl, P.C.; Pflug, A.D. Argonne National Lab., IL (United States). [1993]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9307101-2: 9. annual waste testing and quality assurance symposium, Arlington, VA (United States), 12-16 Jul 1993). Order Number DE93017705. Source: OSTI; NTIS; INIS; GPO Dep.

The Office of Technology Development (OTD) within the Office of Environmental Restoration and Waste Management of the Department of Energy has a mission to deliver needed and usable technologies to its customers. The primary customers are individuals and organizations performing environmental characterization and remediation, waste cleanup, and pollution prevention at DOE sites. DOE faces a monumental task in cleaning up the dozen or so major sites and hundreds of smaller sites that were or are used to produce the US nuclear weapons arsenal and to develop nuclear technologies for national defense and for peaceful purposes. Contaminants and waste materials include the radionuclides associated with nuclear weapons, such as plutonium and tritium, and more common pollutants and wastes of industrial activity such as chromium, chlorinated solvents, and polychlorinated biphenyls (PCBs). Quite frequently hazardous wastes regulated by the Environmental Protection Agency are co-mingled with radioactive wastes regulated by the Nuclear Regulatory Commission to yield a "mixed waste," which increases the cleanup challenges from several perspectives. To help OTD and its investigators meet DOE's cleanup goal, technology performance specifications are being implemented for research and development and DT&E projects. Technology performance specifications or "performance goals" describe, quantitatively where possible, the technology development needs being addressed. These specifications are used to establish milestones, evaluate the status of ongoing projects, and determine the success of completed projects.

1794 (ANL/ER/CP-80564) Expedited Site Characterization: A rapid, cost-effective process for preremedial site characterization. Burton, J.C.; Walker, J.L.; Jennings, T.V.; Aggarwal, P.K.; Hastings, B.; Meyer, W.T.; Rose, C.M.; Rosignolo, C.L. Argonne National Lab., IL (United States). [1993]. 18p. Sponsored by USDOE, Washington, DC (United States); Department of Agriculture, Washington, DC (United States); New Mexico State Government, Santa Fe, NM (United States). DOE Contract W-31109-ENG-38.

Agreement YA651-IA9-340002; Agreement 04 P2-92-USDA-CCC. (CONF-9311122-1: Superfund 14, Washington, DC (United States), 30 Nov - 2 Dec 1993). Order Number DE94002910. Source: OSTI; NTIS; INIS; GPO Dep.

Argonne National Laboratory has developed a unique, cost- and time-effective, technically innovative process for preremedial site characterization, referred to as Expedited Site Characterization (ESC). The cost of the ESC field sampling process ranges from 1/10 to 1/5 of the cost of traditional site characterization. The time required for this ESC field activity is approximately 1/30 of that for current methods. Argonne's preremedial site investigations based on this approach have been accepted by the appropriate regulatory agencies. The ESC process is flexible and neither site nor contaminant dependent. The process has been successfully tested and applied in site investigations of multiple contaminated landfills in New Mexico (for the US Department of the Interior's Bureau of Land Management [BLM]) and at former grain storage facilities in Nebraska and Kansas, contaminated with carbon tetrachloride (for the Department of Agriculture's Commodity Credit Corporation [CCC/USDA]). A working demonstration of this process was sponsored by the US Department of Energy (DOE) Office of Technology Development as a model of the methodology needed to accelerate site characterizations at DOE facilities. This report describes the application of the process in New Mexico, Nebraska and Kansas.

1795 (BNL-48777) Pilot study risk assessment for selected problems at the Fernald Environmental Management Project (FEMP). Hamilton, L.D. (Brookhaven National Lab., Upton, NY (United States)); Meinhold, A.F.; Baxter, S.L.; Holtzman, S.; Morris, S.C.; Pardi, R.; Rowe, M.D.; Sun, C.; Anspaugh, L.; Layton, D. Brookhaven National Lab., Upton, NY (United States); Lawrence Livermore National Lab., CA (United States). Mar 1993. 184p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE93012535. Source: OSTI; NTIS; INIS; GPO Dep.

Two important environmental problems at the USDOE Fernald Environmental Management Project (FEMP) facility in Fernald, Ohio were studied in this human health risk assessment. The problems studied were radon emissions from the K-65 waste silos, and offsite contamination of ground water with uranium. Waste from the processing of pitchblende ore is stored in the K-65 silos at the FEMP. Radium-226 in the waste decays to radon gas which escapes to the outside atmosphere. The concern is for an increase in lung cancer risk for nearby residents associated with radon exposure. Monitoring data and a gaussian plume transport model were used to develop a source term and predict exposure and risk to fence-line residents, residents within 1 and 5 miles of the silos, and residents of Hamilton and Cincinnati, Ohio. Two release scenarios were studied: the routine release of radon from the silos and an accidental loss of one silo dome integrity. Exposure parameters and risk factors were described as distributions. Risks associated with natural background radon concentrations were also estimated.

1796 (CAPE-3054) Uranium Mill Tailings Remedial Action Project (UMTRAP), Rifle, Colorado: Phase 2, Construction drawings [Engineering Materials]. USDOE Albuquerque Field Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office; Morrison-Knudsen Engineers, Inc., San Francisco, CA (United States). 13 May 1991. 40p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC04-82AL16257. Source: OSTI.

40 35-mm aperture cards. These drawings accompany report no. DOE/UMTRA-050506-Vol.3-App.F.

This document consists of engineering drawings related to the remedial action of the Old Rifle Processing site, the New Rifle Processing site, and the Estes Gulch disposal site. This report is intended to accompany report DOE/UMTRA-050506 volume 3, appendix F.

1797 (CAPE-3063) UNC Closure Project, Y-12 Site access plan and drawings index [Engineering Materials]. Martin Marietta Energy Systems, Inc., Oak Ridge, TN (United States). [1993]. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OS21400. Source: OSTI.

These drawings accompany report No. DOE/OR-01-1128-D1. 9 35 mm aperture cards.

Detailed drawings of the Y-12 Plants are included. Specific details such as elevation data given.

1798 (CAPE-3064) Remedial investigation for the chemical plant area of the Weldon Spring Site: Plates [Engineering Materials]. USDOE Oak Ridge Field Office, TN (United States). Weldon Spring Site Remedial Action Project. Nov 1992. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-86OR21548. Source: OSTI.

These drawings accompany report nos. DOE/EIS-0185D-074-Vol. 1 and DOE/EIS-0185D-074-Vol. 2. 3 35-mm aperture cards.

This report consists of drawings related to the remedial action of the Weldon Springs Chemical plant.

1799 (CAPE-3065) [Miscellaneous Information regarding operation and inventory of 68-11 Burial Ground] [Engineering Materials]. Westinghouse Hanford Co., Richland, WA (United States). [1993]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Source: OSTI.

These drawings accompany report no. WHC-MR-0416. 4 35-mm aperture cards.

This report is a set of engineering drawings for the design of the 300 WYE Burial Ground at Hanford. Dated March 1967, this report accompanies report number WHC-MR-0416.

1800 (CONF-910164-) Mining workshop for nuclear waste cleanup. American Society of Mechanical Engineers, New York, NY (United States). ©1991. 145p. Sponsored by USDOE, Washington, DC (United States); American Society of Mechanical Engineers, New York, NY (United States); Colorado Center for Environmental Management, CO (United States); American Mining Congress, Washington, DC (United States); Department (CRTD-22). From Mining workshop for nuclear waste cleanup; Colorado Springs, CO (United States); 24-25 Jan 1991. Source: American Society of Mechanical Engineers, 345 East 47th St., New York, NY 10017.

Discussions are presented concerning the integration of mining techniques and opportunities with remedial action activities of DOE facilities.

1801 (CONF-910277-12) Environmental restoration: Oak Ridge National Laboratory perspective. Garland, S.B. II. Oak Ridge National Lab., TN (United States). [1991]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 18. annual

WATtec interdisciplinary technical conference and exhibition; Knoxville, TN (United States); 19-22 Feb 1991. Order Number DE91016944. Source: OSTI; NTIS; GPO Dep.

The Oak Ridge National Laboratory (ORNL), located in Oak Ridge, Tennessee, is a multipurpose research facility managed by Martin Marietta Energy Systems, Inc. (Energy Systems) for the US Department of Energy-Oak Ridge Operations (DOE). The operation of ORNL has resulted in a legacy of contaminated and potentially contaminated facilities, research areas, and waste management areas that may require remediation. The most recent inventory of remediation sites has identified approximately 400 individual sites that will require investigation and possibly remediation. The Remedial Action program (RAP) was established at ORNL in 1985 to conduct the investigations, studies, and remediation necessary to prevent unacceptable risks to the environment and to the public from this legacy of contaminated sites. Then, in 1989 a central Environmental Restoration program (ERP) was established that consolidates the previous RAPs at all five sites managed by Energy Systems for DOE. This paper describes how a program was developed to solve the large and diverse problems associated with the environmental restoration of the ORNL. 3 figs., 1 tab.

1802 (CONF-9108124-2) **TSD capacity model interface with waste reduction planning in the Environmental Restoration Program.** Phifer, B.E. Jr.; Grumski, J.T. Oak Ridge National Lab., TN (United States). [1991]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 7. DOE waste reduction workshop; Kansas City, MO (United States); 6-8 Aug 1991. Order Number DE92000733. Source: OSTI; NTIS; INIS; GPO Dep.

This report provides a picture of how the integration of waste generation forecasting with treatment, storage, and disposal (TSD) capacity modeling interfaces with waste reduction planning in the Environmental Restoration Program. Background information is given for the major activities at the seven Martin Marietta Energy Systems, Inc., sites: (1) Oak Ridge National Laboratory; (2) Oak Ridge Y-12 Plant; (3) Oak Ridge K-25 Site; (4) Paducah Gaseous Diffusion Plant; (5) Portsmouth Gaseous Diffusion Plant; (6) Oak Ridge Associated Universities; and (7) the off-site contaminated areas near DOE facilities. A perspective is provided for strategies to achieve waste reduction, how waste generation forecasts rates were developed, and how those forecasted waste generation rates will be used in TSD capacity modeling. The generation forecasting in combination with TSD modeling allows development of quantifiable goals and subsequent waste reduction. 2 figs.

1803 (CONF-9110168-8) **Regulatory compliance issues related to the White Oak Creek Embayment time-critical removal action.** Leslie, M. (CDM Federal Programs Corp., Oak Ridge, TN (United States)); Kimmel, B.L. Oak Ridge National Lab., TN (United States). [1991]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Department of Energy model conference; Oak Ridge, TN (United States); 14-17 Oct 1991. Order Number DE92002685. Source: OSTI; NTIS; INIS; GPO Dep.

In September 1990, Martin Marietta Energy Systems (Energy Systems) discovered high levels of Cesium-137 (¹³⁷Cs) in surface sediments near the mouth of White Oak Creek Embayment (WOCE). White Oak Creek (WOC) receives surface water drainage from Oak Ridge National Laboratory. Since this discovery, the Department of Energy (DOE) and

Energy Systems have pursued actions designed to stabilize the contaminated WOCE sediments under provisions of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), and the implementing regulations in the National Contingency Plan (NCP) (40 CFR Part 300), as a time-critical removal action. By definition, a time-critical removal is an action where onsite activities are initiated within six months of the determination that a removal action is appropriate. Time-critical removal actions allow comparatively rapid mobilization to protect human health and the environment without going through the lengthy and extensive CERCLA Remedial Investigation/Feasibility Study/Record of Decision process. Many aspects of the project, in terms of compliance with the substantive requirements of the NCP and ARARs, have exceeded the regulatory requirements, despite the fact that there is no apparent authority on conducting removal actions at Federal facilities. Much of the interpretation of the NCP was groundbreaking in nature for both EPA and DOE. 4 refs., 2 figs.

1804 (CONF-9111188-1) **Determining the number of samples required for decisions concerning remedial actions at hazardous waste sites.** Skiles, J.L.; Redfearn, A.; White, R.K. Oak Ridge National Lab., TN (United States). [1991]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 1991 Air, Water, and Waste Technologies (AWAWT) conference; Detroit, MI (United States); 11-14 Nov 1991. Order Number DE92008254. Source: OSTI; NTIS; INIS; GPO Dep.

The processing of collecting, analyzing, and assessing the data needed to make to make decisions concerning the cleanup of hazardous waste sites is quite complex and often very expensive. This is due to the many elements that must be considered during remedial investigations. The decision maker must have sufficient data to determine the potential risks to human health and the environment and to verify compliance with regulatory requirements, given the availability of resources allocated for a site, and time constraints specified for the completion of the decision making process. It is desirable to simplify the remedial investigation procedure as much as possible to conserve both time and resources while, simultaneously, minimizing the probability of error associated with each decision to be made. With this in mind, it is necessary to have a practical and statistically valid technique for estimating the number of on-site samples required to "guarantee" that the correct decisions are made with a specified precision and confidence level. Here, we will examine existing methodologies and then develop our own approach for determining a statistically defensible sample size based on specific guidelines that have been established for the risk assessment process.

1805 (CONF-920307-15) **Removal of contaminated concrete surfaces by microwave heating: Phase 1 results.** White, T.L.; Grubb, R.G.; Pugh, L.P.; Foster, D. Jr.; Box, W.D. Oak Ridge National Lab., TN (United States). [1992]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Waste management '92; Tucson, AZ (United States); 1-5 Mar 1992. Order Number DE92007675. Source: OSTI; NTIS; INIS; GPO Dep.

Oak Ridge National Laboratory (ORNL) is developing a microwave heating process to remove radiologically contaminated surface layers from concrete. The microwave energy is directed at the concrete surface and heats the concrete and free water present in the concrete matrix. Continued heating produces steam-pressure-induced mechanical

stresses that cause the concrete surface to burst. The concrete particles from this steam explosion are small enough to be removed by a vacuum system, yet less than 1% of the debris is small enough to pose an airborne contamination hazard. The first phase of this program has demonstrated reliable removal of noncontaminated concrete surfaces at frequencies of 2.45 GHz and 10.6 GHz. Continuous concrete removal rates of 1.07 cm³/s with 5.2 kW of 2.45-GHz power and 2.11 cm³/s with 3.6 kW of 10.6-GHz power have been demonstrated. Figures-of-merit for microwave removal of concrete have been calculated to be 0.21 cm³/s/kW at 2.45 GHz and 0.59 cm³/s/kW at 10.6 GHz. The amount of concrete removed in a single pass can be controlled by choosing the frequency and power of the microwave system.

1806 (CONF-920577-1) Decision-making process to shut down, refurbish/modify, or decommission research reactors. Stover, R.L. (Oak Ridge National Lab., TN (United States)); Murphie, W.E. Oak Ridge National Lab., TN (United States). [1992]. 32p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Interregional seminar on ageing, decommissioning and/or major refurbishment of research reactors; Bangkok (Thailand); 18-22 May 1992. Order Number DE92014500. Source: OSTI; NTIS; INIS; GPO Dep.

Most US research reactors were built more than 20 years ago and some more than 40 years ago. Many have undergone refurbishments and modifications to update their safety systems and experimental capabilities. But changing safety bases, social concerns, and budget constraints have required research reactor operators to continually make decisions to shut down or refurbish/modify their facilities. These decisions involve potential replacement of reactor equipment that has reached its lifetime limits. Changes in philosophy and operation of the reactors are also factors to be considered. In this paper, each of the four factors involved in the decision-making process are discussed in detail. Then, several examples from DOE research reactors in the United States are discussed. Finally, some general conclusions are given to aid in the decision-making process.

1807 (CONF-920851-22) Impacts of the use of institutional controls on risk assessments for Department of Energy Facilities. White, R.K. (Oak Ridge National Lab., TN (United States)); Redfearn, A.; Shaw, R.A.; King, A.D. Oak Ridge National Lab., TN (United States). [1992]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Spectrum '92: nuclear and hazardous waste management international topical meeting; Boise, ID (United States); 23-27 Aug 1992. Order Number DE92015085. Source: OSTI; NTIS; INIS; GPO Dep.

This paper summarizes some of the major issues related to the use of institutional controls at hazardous waste sites under the auspices of the Department of Energy Field Office, Oak Ridge/Environmental Restoration Division (DOE-OR/ERD). The impacts that assumptions regarding institutional controls have on the results and interpretation of the risk assessment, both in the Remedial Investigation (RI) and the Feasibility Study (FS) are addressed. The approaches and assumptions relating to institutional controls focus on the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), since it is the regulatory driver for hazardous waste sites at Department of Energy (DOE) facilities. In order to provide a contrast to approaches adopted under CERCLA, the Resource Conservation and Recovery Act (RCRA) and radiation regulatory

authorities are briefly outlined. To demonstrate the implications of the use of institutional controls at DOE facilities, the approaches and results of a recent baseline risk assessment for Solid Waste Storage Area 6 at Oak Ridge National Laboratory (ORNL) are summarized.

1808 (CONF-921029-1) Stabilization and shutdown of Oak Ridge National Laboratory's Radiolabelled Production Facility. Eversole, R.E. Oak Ridge National Lab., TN (United States). [1992]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Annual Department of Energy model conference on waste management and environmental restoration; Oak Ridge, TN (United States); 19-22 Oct 1992. Order Number DE92019187. Source: OSTI; NTIS; INIS; GPO Dep.

The Oak Ridge National Laboratory (ORNL) has been involved in the production and distribution of a variety of radioisotopes for medical, scientific and industrial applications since the late 1940s. Production of these materials was concentrated in a number of facilities primarily built in the 1950s and 1960s. Due to the age and deteriorating condition of these facilities, it was determined in 1989 that it would not be cost effective to upgrade these facilities to bring them into compliance with contemporary environmental, safety and health standards. The US Department of Energy (DOE) instructed ORNL to halt the production of isotopes in these facilities and maintain the facilities in safe standby condition while preparing a stabilization and shutdown plan. The goal was to place the former isotope production facilities in a radiologically and industrially safe condition to allow a 5-year deferral of the initiation of environmental restoration (ER) activities. In response to DOE's instructions, ORNL identified 17 facilities for shutdown, addressed the shutdown requirements for each facility, and prepared and implemented a three-phase, 4-year plan for shutdown of the facilities. The Isotopes Facilities Shutdown Program (IFSP) office was created to execute the stabilization and shutdown plan. The program is entering its third year in which the actual shutdown of the facilities is initiated. Accomplishments to date have included consolidation of all isotopes inventory into one facility, DOE approval of the IFSP Environmental Assessment (EA), and implementation of a detailed management plan for the shutdown of the facilities.

1809 (CONF-921029-3) RCRA closure of the Building 3001 Storage Canal. Etheridge, J.T.; Thompson, W.T. Oak Ridge National Lab., TN (United States). Sep 1992. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Annual Department of Energy model conference on waste management and environmental restoration; Oak Ridge, TN (United States); 19-22 Oct 1992. Order Number DE92040870. Source: OSTI; NTIS; INIS; GPO Dep.

The 3001 Storage Canal is located under portions of Buildings 3001 and 3019 at Oak Ridge National Laboratory (ORNL) and has a capacity of approximately 62,000 gallons of water. The term canal has historically been used to identify this structure, however, the canal is an in-ground reinforced concrete structure satisfying the regulatory definition of a tank. From 1943 through 1963, the canal in Building 3001 was designed to be an integral part of the system for handling irradiated fuel from the Oak Ridge Graphite Reactor. Because one of the main initial purposes of the reactor was to produce plutonium for the chemical processing pilot plant in Building 3019, the canal was designed to be the connecting link between the reactor and

the pilot plant. During the war years, natural uranium slugs were irradiated in the reactor and then pushed out of the graphite matrix into the system of diversion plates and chutes which directed the fuel into the deep pit of the canal. After shutdown of the reactor, the canal was no longer needed for its designed purpose. Since 1964, the canal has only been used to store radioisotopes and irradiated samples under a water pool for radiation protection. This report describes closure alternatives.

1810 (CONF-921029-7) An integrated performance measure for environmental restoration at Oak Ridge National Laboratory. Boston, H.L.; Kuhaida, A.J. Jr.; Garland, S.B. Oak Ridge National Lab., TN (United States). [1992]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Annual Department of Energy model conference on waste management and environmental restoration; Oak Ridge, TN (United States); 19-22 Oct 1992. Order Number DE93000438. Source: OSTI; NTIS; INIS; GPO Dep.

A number of contaminated sites at the Oak Ridge National Laboratory (ORNL) require remediation. A strategy has been developed to support the remediation of individual sites, while providing an integrated measure of contaminant release from all sites and serving as a performance measure for remedial efforts. Most ORNL facilities are in one watershed and groundwater pathways are known to be localized within the watershed. Thus the stream system is the receptor for contaminants released from individual sites and a conduit for contaminant transport off site. Monitoring at key locations in the watershed is linked with information from environmental investigations to: (1) identify and quantify contaminant fluxes; (2) identify the pathways of greatest concern for human health and ecological risk; (3) improve conceptual models of contaminant movement; (4) evaluate remedial alternatives; (5) prioritize sites for remediation; and, (6) document reduced contaminant fluxes following remediation. The contaminants of greatest concern are associated with soil and aquatic sediment. The subjects of investigations range from soil processes and bioindicators of contaminant exposure, to phenomena at the watershed-level such as models predicting contaminant movement during large storms and predicting groundwater transport of contaminants. These efforts provide the foundation needed to coordinate the remediation of individual sites and to assess the overall performance of remedial actions.

1811 (CONF-921029-12) A risk-based approach for initial prioritization of operable units for remediation. Kucera, S. (CH2M Hill, Oak Ridge, TN (United States)); Pfeiffer, J.; Liedle, J.; Kaiser, L. Oak Ridge National Lab., TN (United States). Oct 1992. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Annual Department of Energy model conference on waste management and environmental restoration; Oak Ridge, TN (United States); 19-22 Oct 1992. Order Number DE93003021. Source: OSTI; NTIS; INIS; GPO Dep.

Prioritization of operable units (OUs) for remediation under a remedial investigation/feasibility study (RI/FS) is an important consideration to provide the best protection of human health and the environment. Because of budgetary and operational constraints, not all OUs can be remediated concurrently; therefore, a risk-based approach to prioritization of OUs has been developed to identify the most significant OUs, in terms of potential risk, for remediation activities. The

prioritization system incorporates a qualitative and a quantitative assessment to establish an initial ranked order of OUs; those with the greatest need for near-term remediation are ranked highest. However, priority is determined without consideration of circumstances that can affect remediation activities such as funding constraints, ongoing facility operations, or demolition and construction plans. Such issues are ultimately incorporated within the prioritization process to modify the initial priority, if necessary.

1812 (CONF-930160-4) Performance assessment activities of the Uranium Soils Integrated Demonstration. Armstrong, A.Q. Oak Ridge National Lab., TN (United States). [1993]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 2. semi-annual Office of Technology Development (OTD) information meeting; Houston, TX (United States); 26-28 Jan 1993. Order Number DE93006222. Source: OSTI; NTIS; GPO Dep.

One of the major problems facing the US Department of Energy's (DOE) Environmental Restoration Program is the remediation of uranium-contaminated soils. In response to this problem, the Office of Technology Development (OTD) has initiated an Integrated Demonstration program to evaluate and compare the versatility, efficiency, and economics of various technologies that may be combined into systems for the characterization and remediation of uranium contaminated soils. The Fernald Environmental Management Project (FEMP) was selected as the host site for the Uranium Soils Integrated Demonstration (ID) program based on its past operating history and known environmental problems. The goals of the ID are to demonstrate advanced technologies for field characterization and precision excavation of soils, to demonstrate advanced technologies to decontaminate uranium contaminated soils, and to specify a system of technologies which work effectively together to characterize, excavate, decontaminate, and dispose of wastes remaining after the treatment of uranium contaminated soils (Nuhfer, 1991). Ultimately, the technologies which prove effective will be transferred to other DOE restoration programs and the private sector.

1813 (CONF-930205-55) An innovative approach to multimedia waste reduction measuring performance for environmental cleanup programs. Phifer, B.E. Jr. Oak Ridge National Lab., TN (United States). [1993]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400 ; AC05-76OR00001. From Waste management '93; Tucson, AZ (United States); 28 Feb - 4 mar 1993. Order Number DE93009728. Source: OSTI; NTIS; INIS; GPO Dep.

One of the greatest challenges we now face in environmental clean up is measuring the progress of minimizing multimedia transfer releases and achieving waste reduction. Briefly, multimedia transfer refers to the air, land, and water where pollution is not just controlled, concentrated, and moved from one media to another. An example of multimedia transfer would be heavy metals in waste water sludges moved from water to land disposal. Over two billion dollars has been budgeted for environmental restoration site cleanups by the Department of Energy for fiscal year 1994. Unless we reduce the huge waste volumes projected to be generated in the near future, then we will devote more and more resources to manage and dispose of these wastes.

1814 (CONF-940225-74) Developing public affairs counseling skills to support a public participation focus

at Fernald. Hoopes, J. (Fernald Environmental Restoration Management Corp., Cincinnati, OH (United States)). USDOE Albuquerque Field Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. [1994]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. From Waste management '94; Tucson, AZ (United States); 27 Feb - 3 mar 1994. Order Number DE94008609. Source: OSTI; NTIS; GPO Dep.

To provide closer coordination between the Public Affairs Division and environmental restoration management and technical staff, the Fernald Environmental Restoration Management Corporation (FERMCO) matrixed Public Affairs staffers as counselors to project teams within FERMCO. Close coordination between technical staff and public affairs staff is essential for effective public communication in a public participation, environmental risk communication environment. Two-way symmetrical communication (public participation) represents a paradigm shift for public affairs staff who have developed skills primarily in a public information (asymmetrical communication) environment. While there has been much focus in the literature and workshops on management changes needed to support a public participation environment, less attention has been paid to identifying and developing the skills needed by public affairs professionals to support public participation. To support the new counseling role of public affairs staffers, FERMCO used a public affairs training consultant to design and deliver a workshop to initiate development of the skills needed for the public affairs counseling role. This paper describes FERMCO's matrixed counseling program and the training to develop public affairs counseling skills for the public participation environment.

1815 (DOE/AL-0347) Environmental assessment of remedial action at the Maybell uranium mill tailings site near Maybell, Colorado. Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Sep 1993. 129p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94001479. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this environmental assessment (EA) is to evaluate the environmental impacts resulting from remedial action at the Maybell uranium mill tailings site near Maybell, Colorado. A biological assessment (Attachment 1) and a floodplain/wetlands assessment (Assessment 2) are included as part of this EA. The following sections and attachments describe the proposed action, affected environment, and environmental impacts associated with the proposed remedial action, including impacts to threatened and endangered species listed or proposed for listing by the US Fish and Wildlife Service.

1816 (DOE/AL/62350-10F) Comment and response document for the long-term surveillance plan for the Collins Ranch Disposal Site Lakeview, Oregon. Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Nov 1993. 36p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94004829. Source: OSTI; NTIS; GPO Dep.

Twenty-nine comments from the US Nuclear Regulatory Commission and six from the Grand Junction Project Office for the long-term surveillance plan for the Collins Ranch Disposal Site, Lakeview, Oregon are documented along with their corresponding responses.

1817 (DOE/AL/62350-19F-Rev.2) Long-term surveillance plan for the Collins Ranch Disposal Site,

Lakeview, Oregon: Revision 2. Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Dec 1993. 145p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94004830. Source: OSTI; NTIS; INIS; GPO Dep.

This long-term surveillance plan (LTSP) for the Lakeview, Oregon, Uranium Mill Tailings Remedial Action (UMTRA) Project disposal site describes the surveillance activities for the Lakeview (Collins Ranch) disposal cell, which will be referred to as the Collins Ranch disposal cell throughout this document. The US Department of Energy (DOE) will carry out these activities to ensure that the disposal cell continues to function as designed. This final LTSP was prepared as a requirement for acceptance under the US Nuclear Regulatory Commission (NRC) general license for custody and long-term care of residual radioactive materials. This LTSP documents whether the land and interests are owned by the United States or an Indian tribe, and details how the long-term care of the disposal site will be carried out. It is based on the DOE's Guidance for Implementing the UMTRA Project Long-term Surveillance Program (DOE, 1992a).

1818 (DOE/AL/62350-36PF) Long-term surveillance plan for the Lowman, Idaho, disposal site. Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Sep 1993. 119p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94001475. Source: OSTI; NTIS; INIS; GPO Dep.

This report supersedes report number DOE/AL-350212.0000.

The long-term surveillance plan (LTSP) for the Lowman, Idaho, Uranium Mill Tailings Remedial Action (UMTRA) Project disposal site describes the surveillance activities for the Lowman disposal cell. The US Department of Energy (DOE) will carry out these activities to ensure that the disposal cell continues to function as designed. This preliminary final LTSP is being submitted to the US Nuclear Regulatory Commission (NRC) as a requirement for issuance of a general license for custody and long-term care for the disposal site. The general license requires that the disposal cell be cared for in accordance with the provisions of this LTSP. The LTSP documents whether the land and interests are owned by the United States or an Indian tribe, and describes, in detail, how the long-term care of the disposal site will be carried out through the UMTRA Project long-term surveillance program. The Lowman, Idaho, LTSP is based on the DOE's Guidance for Implementing the UMTRA Project Long-term Surveillance Program, (DOE, 1992).

1819 (DOE/AL/62350-36-Rev.1) Long-term surveillance plan for the Lowman, Idaho, Disposal site: Revision 1. Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Apr 1994. 117p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94011032. Source: OSTI; NTIS; INIS; GPO Dep.

The long-term surveillance plan (LTSP) for the Lowman, Idaho, Uranium Mill Tailings Remedial Action (UMTRA) Project disposal site describes the surveillance activities for the Lowman disposal site, which will be referred to as the Lowman site throughout this document. The US Department of Energy (DOE) will carry out these activities to ensure that the disposal cell continues to function as designed. The radioactive sands at the Lowman site were stabilized on the site. This final LTSP is being submitted to the US Nuclear Regulatory Commission (NRC) as a requirement for issuance of a general license for custody and long-term care

for the disposal site. The general license requires that the disposal cell be cared for in accordance with the provisions of this LTSP. The LTSP documents whether the land and interests are owned by the United States or a state, and describes, in detail, how the long-term care of the disposal site will be carried out through the UMTRA Project long-term surveillance program. The Lowman, Idaho, LTSP is based on the DOE's Guidance for Implementing the UMTRA Project Long-term Surveillance Program, (DOE, 1992).

1820 (DOE/AL/62350-47D) Public Participation Plan. Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Jul 1993. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE93040746. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this Public Participation Plan is to describe the US Department of Energy's (DOE) plan for involving the public in the decision-making process for the Uranium Mill Tailings Remedial Action (UMTRA) Project. The plan describes how the DOE will meet the public participation requirements of the Uranium Mill Tailings Radiation Control Act (UMTRCA) of 1978, as amended, and of the National Environmental Policy Act (NEPA) of 1969. It includes the UMTRA Project Office plans for complying with DOE Order 5440.1D and for implementing the DOE's Public Participation Policy for Environmental Restoration and Waste Management (1992) and Public Participation Guidance for Environmental Restoration and Waste Management (1993).

1821 (DOE/AL/62350-60F) Long-term surveillance plan for the Shiprock disposal site, Shiprock, New Mexico. Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Dec 1993. 118p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94004832. Source: OSTI; NTIS; INIS; GPO Dep.

The long-term surveillance plan (LTSP) for the Shiprock, New Mexico, Uranium Mill Tailings Remedial Action (UMTRA) Project disposal site describes the surveillance activities for the Shiprock disposal cell. The US Department of Energy (DOE) will carry out these activities to ensure that the disposal cell continues to function as designed. This final LTSP is being submitted to the US Nuclear Regulatory Commission (NRC) as a requirement for issuance of a general license for custody and long-term care for the disposal site. The general license requires that the disposal cell be cared for in accordance with the provisions of this LTSP. This Shiprock, New Mexico, LTSP documents whether the land and interests are owned by the US or an Indian tribe and describes in detail the long-term care program through the UMTRA Project Office.

1822 (DOE/AL/62350-74D) Annual report on the US Department of Energy's cultural resource activities at Colorado UMTRA Project sites for October 1991-September 1992. Jacobs Engineering Group, Inc., Albuquerque, NM (United States). 6 Oct 1993. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94003074. Source: OSTI; NTIS; INIS; GPO Dep.

This report summarizes the US Department of Energy's (DOE) cultural resource studies that were undertaken in support of the DOE's Uranium Mill Tailings Remedial Action (UMTRA) Project in the state of Colorado for the period of October 1, 1991, through September 30, 1992. This report fulfills the DOE's obligation to provide an annual report to

the state of Colorado on the status and results of cultural resource studies conducted during the above period of record. This requirement is stated in a programmatic memorandum of agreement executed between the DOE, the Advisory Council on Historic Preservation, and the Colorado State Historic Preservation Officer in December 1984. Previous reports were based on a calendar year reporting period. However, in order to be more consistent with the programmatic memorandum of agreement, the period of record for this and subsequent annual reports has been changed to the Federal fiscal year. The current status and summaries of 1992 cultural resource surveys are provided for all UMTRA Project sites in Colorado. The sites are Durango, Grand Junction, Gunnison, Maybell, Naturita, Rifle, and Slick Rock.

1823 (DOE/AL/62350-77) Long-term surveillance plan for the Bodo Canyon Disposal Site, Durango, Colorado. Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Mar 1994. 118p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94011047. Source: OSTI; NTIS; INIS; GPO Dep.

This long-term surveillance plan (LTSP) for the Durango, Colorado, Uranium Mill Tailings Remedial Action (UMTRA) Project disposal site describes the surveillance activities for the Durango (Bodo Canyon) disposal site, which will be referred to as the disposal site throughout this document. The US Department of Energy (DOE) will carry out these activities to ensure that the disposal site continues to function as designed. This LTSP was prepared as a requirement for acceptance under the US Nuclear Regulatory Commission (NRC) general license for custody and long-term care of residual radioactive materials (RRM). RRM include tailings and other uranium ore processing wastes still at the site, which the DOE determines to be radioactive. This LTSP is based on the DOE's Guidance for Implementing the UMTRA Project Long-term Surveillance Program (DOE, 1992).

1824 (DOE/EA-0441) Environmental Assessment: Transportation, receipt, and storage of Fort St. Vrain spent fuel at the Irradiated Fuel Storage Facility at the Idaho Chemical Processing Plant, Idaho National Engineering Laboratory. USDOE Assistant Secretary for Nuclear Energy, Washington, DC (United States). Feb 1991. 86p. Sponsored by USDOE, Washington, DC (United States). Order Number DE91015814. Source: OSTI; NTIS; INIS; GPO Dep.

This Environmental Assessment (EA) addresses the proposed transportation, receipt, and storage of up to 1482 blocks of spent nuclear fuel from the Fort St. Vrain (FSV) reactor, located in Platteville, Colorado, to the Idaho National Engineering Laboratory (INEL). The purpose of this EA is to analyze the impacts which may result from this proposed action. Decommissioning of the FSV reactor necessitates the storage of irradiated reactor fuel until final disposition can be accomplished. In accordance with existing agreements between DOE and Public Service Company of Colorado (PSC), the spent fuel would be transported to the INEL by PSC in compliance with applicable transportation requirements and using shipping casks certified by the Nuclear Regulatory Commission (NRC). The spent fuel blocks would be removed from the shipping casks and transferred to the storage area of the Irradiated Fuel Storage Facility (IFSF) which was specifically designed for interim storage of this fuel. 56 refs., 11 figs., 9 tabs.

1825 (DOE/EA-0785) Environmental assessment for the decommissioning and decontamination of contaminated facilities at the Laboratory for Energy-Related Health Research University of California, Davis. Battelle Memorial Inst., Richland, WA (United States). Sep 1992. 96p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93016873. Source: OSTI; NTIS; INIS; GPO Dep.

The Laboratory for Energy-Related Health Research (LEHR) was established in 1958 at its present location by the Atomic Energy Commission. Research at LEHR originally focused on the health effects from chronic exposures to radionuclides, primarily strontium 90 and radium 226, using beagles to simulate radiation effects on humans. In 1988, pursuant to a memorandum of agreement between the US Department of Energy (DOE) and the University of California, DOE's Office of Energy Research decided to close out the research program, shut down LEHR, and turn the facilities and site over to the University of California, Davis (UCD) after remediation. The decontamination and decommissioning (D&D) of LEHR will be managed by the San Francisco Operations Office (SF) under DOE's Environmental Restoration Program. This environmental assessment (EA) addresses the D&D of four site buildings and a tank trailer, and the removal of the on-site cobalt 60 (Co-60) source. Future activities at the site will include D&D of the Imhoff building and the outdoor dog pens, and may include remediation of underground tanks, and the landfill and radioactive disposal trenches. The remaining buildings on the LEHR site are not contaminated. The environmental impacts of the future activities cannot be determined at this time because the extent of contamination has not yet been ascertained. The impacts of these future activities (including the cumulative impacts of the future activities and those addressed in this EA) will be addressed in future National Environmental Policy Act (NEPA) documentation.

1826 (DOE/EM-0079) Report to Congress: Rocky Flats Transition Plan. USDOE, Washington, DC (United States). Jul 1992. 58p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93000946. Source: OSTI; NTIS; GPO Dep.

The Department of Energy has prepared this Formal Transition Plan to apprise the Congress about proposed plans to change the mission of the Rocky Flats Plant near Denver, Colorado. The change in mission involves phasing out weapons production at Rocky Flats and focusing on remediation and environmental cleanup to prepare the site for alternative uses, including uses by private industry. The full implementation of plans is predicated on the completion of environmental documentation, such as the Nuclear Weapons Complex Reconfiguration Programmatic Environmental Impact Statement and the environmental assessment for the transfer of nonnuclear production to other sites. This document is a summary of a comprehensive and detailed effort that has addressed the future mission of Rocky Flats and developed a plan for achieving that mission. It addresses both the technical aspects of the transition and efforts to assist displaced and redeployed workers, provide assistance to local communities, and promote the involvement of affected and interested parties. In addition, ideas for the potential economic development of the site for commercial and industrial uses are discussed. While the transition at Rocky Flats is in progress, some programmatic and operational activities will be continued at the site. Examples of these activities are research and development work, ongoing environmental restoration, waste

management, a residue-elimination program, and the maintenance of a limited production contingency. This Transition Plan addresses only the actions and efforts related to the transition process. The transition process, covering the building-by-building cleanup process, responding to the regulatory and oversight requirements, and accommodating the social and economic impacts, is complex and quite dynamic. The Plan is a goal-oriented plan that represents the best understanding of the situation as of June 1992.

1827 (DOE/EM-0123P) Rocky Flats Compliance Program: Technology summary. USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). Office of Technology Development. Feb 1994. 42p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94008855. Source: OSTI; NTIS; INIS; GPO Dep.

The Department of Energy (DOE) established the Office of Technology Development (EM-50) (OTD) as an element of Environmental Restoration and Waste Management (EM) in November 1989. The primary objective of the Office of Technology Development, Rocky Flats Compliance Program (RFCP), is to develop alternative treatment technologies for mixed low-level waste (wastes containing both hazardous and radioactive components) to use in bringing the Rocky Flats Plant (RFP) into compliance with Federal and state regulations and agreements. Approximately 48,000 cubic feet of untreated low-level mixed waste, for which treatment has not been specified, are stored at the RFP. The cleanup of the Rocky Flats site is driven by agreements between DOE, the Environmental Protection Agency (EPA), and the Colorado Department of Health (CDH). Under these agreements, a Comprehensive Treatment and Management Plan (CTMP) was drafted to outline the mechanisms by which RFP will achieve compliance with the regulations and agreements. This document describes DOE's strategy to treat low-level mixed waste to meet Land Disposal Restrictions and sets specific milestones related to the regulatory aspects of technology development. These milestones detail schedules for the development of technologies to treat all of the mixed wastes at the RFP. Under the Federal Facilities Compliance Act (FFCA), the CTMP has been incorporated into Rocky Flats Plant Conceptual Site Treatment Plan (CSTP). The CSTP will become the Rocky Flats Plant Site Treatment Plan in 1995 and will supersede the CTMP.

1828 (DOE/EM-0142P) Decommissioning Handbook. USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). Mar 1994. 529p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94012855. Source: OSTI; NTIS; INIS; GPO Dep.

The Decommissioning Handbook is a technical guide for the decommissioning of nuclear facilities. The decommissioning of a nuclear facility involves the removal of the radioactive and, for practical reasons, hazardous materials to enable the facility to be released and not represent a further risk to human health and the environment. This handbook identifies and technologies and techniques that will accomplish these objectives. The emphasis in this handbook is on characterization; waste treatment; decontamination; dismantling, segmenting, demolition; and remote technologies. Other aspects that are discussed in some detail include the regulations governing decommissioning, worker and environmental protection, and packaging and transportation of the waste materials. The handbook describes in general terms the overall decommissioning

project, including planning, cost estimating, and operating practices that would ease preparation of the Decommissioning Plan and the decommissioning itself. The reader is referred to other documents for more detailed information. This Decommissioning Handbook has been prepared by Enserch Environmental Corporation for the US Department of Energy and is a complete restructuring of the original handbook developed in 1980 by Nuclear Energy Services. The significant changes between the two documents are the addition of current and the deletion of obsolete technologies and the addition of chapters on project planning and the Decommissioning Plan, regulatory requirements, characterization, remote technology, and packaging and transportation of the waste materials.

1829 (DOE/EM-0157P) Quality assurance guidance for laboratory assessment plates in support of EM environmental sampling and analysis activities. USDOE Assistant Secretary for Environmental Management, Washington, DC (United States). Analytical Services Div. May 1994. 84p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94013040. Source: OSTI; NTIS; INIS; GPO Dep.

This document is one of several guidance documents developed to support the EM (DOE Environmental Restoration and Waste Management) Analytical Services program. Its purpose is to introduce assessment plates that can be used to conduct performance assessments of an organization's or project's ability to meet quality goals for analytical laboratory activities. These assessment plates are provided as non-prescriptive guidance to EM-support organizations responsible for collection of environmental data for remediation and waste management programs at DOE facilities. The assessments evaluate objectively all components of the analytical laboratory process to determine their proper selection and use.

1830 (DOE/EM-94007053) Site maps and facilities listings. USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). Nov 1993. 227p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94007053. Source: OSTI; NTIS; INIS; GPO Dep.

In September 1989, a Memorandum of Agreement among DOE offices regarding the environmental management of DOE facilities was signed by appropriate Assistant Secretaries and Directors. This Memorandum of Agreement established the criteria for EM line responsibility. It stated that EM would be responsible for all DOE facilities, operations, or sites (1) that have been assigned to DOE for environmental restoration and serve or will serve no future production need; (2) that are used for the storage, treatment, or disposal of hazardous, radioactive, and mixed hazardous waste materials that have been properly characterized, packaged, and labelled, but are not used for production; (3) that have been formally transferred to EM by another DOE office for the purpose of environmental restoration and the eventual return to service as a DOE production facility; or (4) that are used exclusively for long-term storage of DOE waste material and are not actively used for production, with the exception of facilities, operations, or sites under the direction of the DOE Office of Civilian Radioactive Waste Management. As part of the implementation of the Memorandum of Agreement, Field Offices within DOE submitted their listings of facilities, systems, operation, and sites for which EM would have line responsibility. It is intended that EM facility listings will be revised on a yearly

basis so that managers at all levels will have a valid reference for the planning, programming, budgeting and execution of EM activities.

1831 (DOE/EW/40017-T1) Apollo Pennsylvania Nuclear Fuel Facility D&D Project: Quarterly technical progress report, October 1, 1991–December 31, 1991. Babcock and Wilcox Co., Apollo, PA (United States). 3 Feb 1992. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG01-91EW40017. Order Number DE92008135. Source: OSTI; NTIS; GPO Dep.

The Apollo Pennsylvania Nuclear Fuel Facility D & D Project involves the site characterization, remediation, decontamination, and deconstruction of a former commercial nuclear fuel manufacturing site. The Apollo site is located in an industrial complex in the Borough of Apollo, Pennsylvania. To organize, manage, and control decommissioning activities, the Apollo Nuclear Fuel Facility D & D Project site has been broken down into three areas: the main building, the parking lot, and an offsite area. The former fuel manufacturing operations were performed in the main building (i.e., the east bay) and three attached buildings: the west way, the box shop, and the annex. These buildings are on B & W owned property and are located on the east side of the site. They consist of approximately one acre of roofed area bounded on the north, south, and west by a metals processing facility located on the offsite property. These buildings are two-story structure and house the former nuclear fuel manufacturing operations, laboratories, and other support operations. This report discusses progress in the characterization, remediation, decontamination and deconstruction activities.

1832 (DOE/EW/40017-T2) Apollo Pennsylvania Nuclear Fuel Facility D and D Project: Quarterly technical progress report, January 1, 1992–March 31, 1992. Babcock and Wilcox Co., Apollo, PA (United States). 8 Jun 1992. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG01-91EW40017. Order Number DE92016095. Source: OSTI; NTIS; GPO Dep.

The Apollo Pennsylvania Nuclear Fuel Facility D&D Project involves the site characterization, remediation, decontamination, and deconstruction of a former commercial nuclear fuel manufacturing site. These nuclear fuel manufacturing operations were performed under Nuclear Regulatory Commission (NRC) License No. SNM-145. The Apollo site is located in an industrial complex in the Borough of Apollo, Pennsylvania. To organize, manage, and control decommissioning activities, the Apollo Nuclear Fuel Facility D&D Project site has been broken down into three areas: the Apollo Facility, the parking lot, and an offsite area. The former fuel manufacturing operations were performed in the Apollo Facility which consisted of the main building (i.e., the east bay) and several attached buildings including the west bay, the box shop, and the annex. These buildings are on B&W owned property and are located on the east side of the site. They consist of approximately one acre of roofed area bounded on the north, south, and west by a metals processing facility located on the offsite property. These two-story buildings housed the former nuclear fuel manufacturing operations, laboratories, and other support operations.

1833 (DOE/EW/40017-T3) Apollo Pennsylvania Nuclear Fuel Facility D&D Project: Quarterly technical progress report, April 1, 1992–June 30, 1992. Babcock and Wilcox Co., Apollo, PA (United States). [1992]. 23p. Sponsored by USDOE, Washington, DC (United

States). DOE Contract FG01-91EW40017. Order Number DE93002311. Source: OSTI; NTIS; GPO Dep.

The Apollo Pennsylvania Nuclear Fuel Facility D&D Project involves the site characterization, remediation, decontamination, and deconstruction of a former commercial nuclear fuel manufacturing site. These nuclear fuel manufacturing operations were performed under Nuclear Regulatory Commission License No. SNM-145. The Apollo site is located in an industrial complex in the Borough of Apollo, Pennsylvania. To organize, manage, and control decommissioning activities, the Apollo Nuclear Fuel Facility D&D Project site has been broken down into three areas: the Apollo Facility, the parking lot, and an offsite area. The former fuel manufacturing operations were performed in the Apollo Facility which consisted of the main building (i.e., the east bay) and several attached buildings including the west bay, the box shop, and the annex. These buildings are on B&W owned property and are located on the east side of the site. They consist of approximately one acre of roofed area bounded on the north, south, and west by a metals processing facility located on the offsite property. These two-story buildings housed the former nuclear fuel manufacturing operations, laboratories, and other support operations. During the reporting period, work on the 1992 remediation program continued. Total progress for the 1992 work scope is summarized in Table 1. The table also shows the progress on each of the major decommissioning program sub elements (i.e., characterization, engineering, remediation, site restoration, and site release).

1834 (DOE/EW/40017-T4) Apollo Pennsylvania Nuclear Fuel Facility D&D Project: Quarterly technical progress report, July 1, 1992-September 30, 1992. Babcock and Wilcox Co., Apollo, PA (United States). 15 Mar 1993. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG01-91EW40017. Order Number DE93010138. Source: OSTI; NTIS; GPO Dep.

The Apollo Pennsylvania Nuclear Fuel Facility D&D Project involves the site characterization, remediation, decontamination, and deconstruction of a former commercial nuclear fuel manufacturing site. These nuclear fuel manufacturing operations were performed under Nuclear Regulatory Commission (NRC) License No. SNM-145. The Apollo site is located in an industrial site in the Borough of Apollo, Pennsylvania. To organize, manage, and control decommissioning activities, the Apollo Nuclear Fuel Facility D&D Project site has been broken down into three areas: the Apollo Facility, the parking lot, and the offsite area. At the end of this reporting period, the principal remediation activities authorized by the approved Apollo Decommissioning Plan had commenced. The overall status of these activities at the end of this reporting period include: deconstruction of the main building is 93 percent complete. Excavation of potentially contaminated soil is 59 percent complete. Processing of potentially contaminated soil and building rubble is 35 percent complete. Shipment of contaminated materials (soil, block and brick, rubble, and building steel, etc.) is 37 percent complete.

1835 (DOE/EW/40017-T5) Apollo Pennsylvania Nuclear Fuel Facility D&D Project: Technical progress report, October 1, 1992-December 31, 1992. B and W Nuclear Environmental Services, Inc., Vandergrift, PA (United States). 1992. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG01-91EW40017. Order Number DE93011518. Source: OSTI; NTIS; GPO Dep.

The Apollo Pennsylvania Nuclear Fuel Facility D&D Project involves the site characterization, remediation, decontamination, and deconstruction of a former commercial nuclear fuel manufacturing site. These nuclear fuel manufacturing operations were performed under Nuclear Regulatory Commission (NRC) License No. SNM-145. The Apollo facility is located in an industrial site in the Borough of Apollo, Pennsylvania. To organize, manage, and control decommissioning activities, the Apollo Nuclear Fuel Facility D&D Project site has been broken down into three areas: the Apollo Facility, the parking lot, and the offsite area. Decontamination and decommissioning activities generally commenced as production operations ceased. Generally these efforts initially involved the removal and disposal of production equipment followed by the preliminary decontamination and, in some cases, deconstruction of the buildings involved. During the reporting period, work on the 1992 remediation program continued. Total progress for the 1992 work scope is summarized in Table 1. The table also shows the progress on each of the major decommissioning program sub elements (i.e., characterization, engineering, remediation, site restoration, and site release). At the end of the reporting period, measured total progress for the 1992 Apollo Decommissioning Project activities was 77.4 percent complete versus a planned 94.6 percent. The progress shortfalls occurred in remediation (98.5 percent actual versus 100 percent planned), loadout and testing (67.7 percent actual versus 100 percent planned), and transportation activities (65.4 percent actual versus 100 percent planned).

1836 (DOE/HWP-69/R1) Quality control requirements for field methods: Revision 1. Craig, L.E. (Oak Ridge K-25 Site, TN (United States)); Bartling, M.H. (Oak Ridge National Lab., TN (United States)). HAZWRAP Support Contractor Office; Oak Ridge K-25 Site, TN (United States). Jul 1990. 70p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OT21400. Order Number DE91018447. Source: OSTI; NTIS; GPO Dep.

The purpose of this document is to provide quality control (QC) requirements for sampling activities and other types of field analyses and tests that generate data on environmental parameters as part of the Hazardous Waste Remedial Actions Program (HAZWRAP). The requirements of this document apply to HAZWRAP subcontractors and selected vendors during the remedial response actions process. The document is to be used by HAZWRAP Project Managers to provide consistent guidance for field activities. The document will not cover every situation for all projects. HAZWRAP Project Managers will invoke the applicable requirements delineated herein to ensure the QC of data. Deviation from these requirements will be allowed on a site-by-site basis, with approval of the HAZWRAP Project Manager, in consultation with the Analytical Quality Control Specialist (AQCS) of the Analytical Environmental Support Group (AESG), Martin Marietta Energy System, Inc. (Energy Systems). 9 refs., 10 tabs.

1837 (DOE/HWP-102) Hazardous Waste Remedial Actions Program: Annual progress report for the period ending September 30, 1989. Oak Ridge National Lab., TN (United States). HAZWRAP Support Contractor Office. Aug 1990. 331p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OT21400. Order Number DE90016542. Source: NTIS, PC A14/MF A01 - OSTI; GPO Dep.

The objective of the Department of Energy Hazardous Waste Remedial Actions Program (HAZWRAP) is to develop

and promote an integrated approach to Defense Programs (DP) installation compliance with the Comprehensive Environmental Response, Compensation, and Liability Act and the Resource Conservation and Recovery Act that conserves DP resources for its primary missions while providing a technically sound and socially acceptable response that satisfies involved regulatory agencies. The HAZWRAP Support Contractor Office (SCO) continued to provide technical support to HAZWRAP during FY 1989 through programs administered by the Hazardous Waste Remedial Actions Division and the Waste Research and Development Division of the Office of Defense Waste and Transportation Management. The three programs are: Hazardous Waste Compliance Technology Program, Hazardous Chemical Waste Research and Development Program, and Environmental Restoration Program. This report describes the activities of the SCO in support of the three programs, each of which is described in an integrated fashion. This report first presents the activities that the SCO carried out directly. These activities include Environmental Restoration Program support, strategic planning, DP-wide Treatment, Storage and Disposal system planning and implementation, information systems planning and implementation, technology demonstration and development planning and coordination, regulatory analysis, technical analysis, program administration, and technology exchange. Next, detailed stand-alone summaries of the research and development projects that were sponsored in FY 1989 are presented, followed by reports for the soil and groundwater remediation technology demonstration projects and waste operations.

1838 (DOE/HWP-139) An assessment and evaluation for recycle/reuse of contaminated process and metallurgical equipment at the DOE Rocky Flats Plant Site - Building 865: Final report. Oak Ridge National Lab., TN (United States). HAZWRAP Support Contractor Office; Theta Technologies, Inc., Oak Ridge, TN (United States). Aug 1993. 177p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94010115. Source: OSTI; NTIS; INIS; GPO Dep.

An economic analysis of the potential advantages of alternatives for recycling and reusing equipment now stored in Building 865 at the Rocky Flats Plant (RFP) in Colorado has been conducted. The inventory considered in this analysis consists primarily of metallurgical and process equipment used before January 1992, during development and production of nuclear weapons components at the site. The economic analysis consists of a thorough building inventory and cost comparisons for four equipment dispositions alternatives. The first is a baseline option of disposal at a Low Level Waste (LLW) landfill. The three alternatives investigated are metal recycling, reuse with the government sector, and release for unrestricted use. This report provides item-by-item estimates of value, disposal cost, and decontamination cost. The economic evaluation methods documented here, the simple cost comparisons presented, and the data provided as a supplement, should provide a foundation for D&D decisions for Building 865, as well as for similar D&D tasks at RFP and at other sites.

1839 (DOE/HWP-147) Energy recovery ventilation as a radon mitigation method for Navy family housing in Guam. USDOE Oak Ridge Operations Office, TN (United States); Oak Ridge National Lab., TN (United States). HAZWRAP Support Contractor Office. Dec 1993. 70p. Sponsored by USDOE, Washington, DC (United

States). DOE Contract AC05-84OR21400. Order Number DE94005146. Source: OSTI; NTIS; INIS; GPO Dep.

Energy recovery ventilation involves the exchange of contaminated indoor air with fresh, uncontaminated outdoor air with recovery of energy. During radon mitigation diagnostics, air change measurements were performed within three typical Navy family houses, and some were found to be well below recommended minimum standards. The only practical way to solve the indoor air quality problem was to increase the ventilation rate. Options were evaluated, and it was decided to install energy recovery ventilation (ERV) systems. An ERV system is a packaged unit complete with blower fans, controls, and air-to-air heat exchanger. However, because of economical limits on the quantity of conditioned air that can be exchanged, ERV has a finite range of application in radon abatement. In Guam, ERV has potential applications in up to 370 units and in an additional 154 units if the mechanical systems are moved indoors. The performance of ERV systems were evaluated during a demonstration program to determine the removal efficiency of radon.

1840 (DOE/ID-10253(FY92)) Environmental Restoration and Waste Management Site-Specific Plan (SSP) for fiscal year 1992 (FY92). USDOE Idaho Field Office, Idaho Falls, ID (United States); EG and G Idaho, Inc., Idaho Falls, ID (United States). Sep 1991. 182p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92017856. Source: OSTI; NTIS; INIS; GPO Dep.

The FY-92 Site-Specific Plan (FY-92 SSP) for environmental restoration and waste management at the Idaho National Engineering Laboratory (INEL) is designed to provide the reader with easy access to the status of environmental restoration and waste management activities at INEL. The first chapter provides background on INEL's physical environment, site history and mission, and general information about the site and its facilities. In addition, this chapter discusses the inter-relationships between the Site Specific Plan, the Environmental Restoration and Waste Management Five-Year Plan, the environmental restoration and waste management prioritization systems, and the Activity Data Sheets (ADSs) for environmental restoration and waste management. This discussion should help readers understand what the SSP is and how it fits into the environmental restoration and waste management process at INEL. This understanding should provide the reader with a better context for understanding the discussions in the SSP as well as a better feel for how and what to comment on during the public comment period that will be held from the first of September through the end of October 1991.

1841 (DOE/ID-10253-FY93) Environmental Restoration and Waste Management Site-Specific Plan for Fiscal Year 1993. USDOE Idaho Field Office, Idaho Falls, ID (United States). Mar 1993. 301p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93016684. Source: OSTI; NTIS; INIS; GPO Dep.

The Idaho National Engineering Laboratory (INEL) is a US Department of Energy (DOE) multiprogram laboratory whose primary mission has been to research nuclear technologies. Working with these technologies and conducting other types of research generates waste, including radioactive and/or hazardous wastes. While most of the waste treatment, storage, and disposal practices have been effective, some practices have led to the release of contaminants to the environment. As a result, DOE has developed (1) an

Environmental Restoration (ER) Program to identify and, where necessary, cleanup releases from inactive waste sites and (2) a Waste Management (WM) Program to safely treat, store, and dispose of DOE wastes generated from current and future activities in an environmentally sound manner. This document describes the plans for FY 1993 for the INEL's ER and WM programs as managed by DOE's Idaho Field Office (DOE-ID).

1842 (DOE/ID-10253-FY94) 1994 INEL site-specific plan. Couch, B. EG and G Idaho, Inc., Idaho Falls, ID (United States). [1994]. 234p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94011024. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents plans for environmental restoration and waste management activities at the Idaho National Engineering Laboratory for fiscal year 1994. This year's plan focuses on issues affecting the Environmental Restoration and Waste Management Programs. The Environmental Restoration Program is concerned with all aspects of assessment and cleanup of inactive operations. It involves assessing and cleaning up (where necessary) inactive INEL waste areas that could release harmful substances into the environment, as well as safely managing surplus nuclear facilities. The Waste Management program involves treatment, storage, and disposal of radioactive, hazardous, mixed, and industrial waste by DOE activities. This program is designed to protect the safety of INEL employees, the public, and the environment in the design, construction, maintenance, and operation of INEL treatment, storage, and disposal facilities. It operates facilities in a cost-effective, environmentally sound, regulatory compliant, and publicly acceptable manner.

1843 (DOE/ID-10317-Rev.1) Closure plan for the Test Area North-726 chromate water storage and Test Area North-726A chromate treatment units: Revision 1. Smith, P.J.; Van Brunt, K.M. EG and G Idaho, Inc., Idaho Falls, ID (United States). Nov 1992. 66p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93007125. Source: OSTI; NTIS; INIS; GPO Dep.

This document describes the proposed plan for closure of the Test Area North-726 chromate water storage and Test Area North-726A chromate treatment units at the Idaho National Engineering Laboratory in accordance with the Resource Conservation and Recovery Act interim status closure requirements. The location, size, capacity, and history of the units are described, and their current status is discussed. The units will be closed by treating remaining waste in storage, followed by thorough decontamination of the systems. Sufficient sampling and analysis, and documentation of all activities will be performed to demonstrate clean closure.

1844 (DOE/ID/12584-103) Monticello Millsite environmental report for calendar year 1991. Chem-Nuclear Geotech, Inc., Grand Junction, CO (United States). May 1992. 112p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-86ID12584. Order Number DE93002870. Source: OSTI; NTIS; INIS; GPO Dep.

This report contains information pertaining to environmental activities conducted during calendar year 1991 at and near the inactive uranium millsite in Monticello, Utah. Environmental activities conducted at the Monticello Millsite during 1991 included those associated with remedial action

and compliance monitoring. Compliance monitoring consisted of both radiological and nonradiological monitoring of air, surface water, and ground water. Radiological and nonradiological air monitoring at the millsite included measurements of atmospheric radon, particulate matter, and gamma radiation. Surface water monitoring included water quality measurements within Montezuma Creek. Ground water monitoring was conducted for two aquifers underlying the Monticello Millsite – a shallow, alluvial aquifer and a deeper, confined Burro Canyon aquifer. The shallow aquifer is contaminated by leached products of uranium mill tailings. During 1991, Uranium Mill Tailings Radiation Control Act and state of Utah ground water standards for arsenic, selenium, molybdenum, uranium 234+238, gross alpha particle activity, and radium-226+228 were exceeded in one or more wells. Samples collected from the deeper Burro Canyon aquifer revealed that no federal or state standards were exceeded.

1845 (DOE/MC/29116-3406) Novel mass spectrometric instrument for gaseous and particulate characterization and monitoring: Technical progress report, January 1, 1993–March 31, 1993. Coggiola, M.J. SRI International, Menlo Park, CA (United States). Apr 1993. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-92MC29116. Order Number DE93019992. Source: OSTI; NTIS; INIS; GPO Dep.

Under contract DE-AC21-92MC29116, SRI International will develop a unique new instrument that will be capable of providing real-time (<1 minute), quantitative, chemical characterization of gaseous and particulate pollutants generated from DOE waste cleanup activities. The instrument will be capable of detecting and identifying volatile organic compounds, polynuclear aromatic hydrocarbons, heavy metals, and transuranic species released during waste cleanup activities. The instrument will be unique in its ability to detect and quantify in real-time these diverse pollutants in both vapor and particulate form. The instrument to be developed under this program will consist of several major components: (1) an isokinetic sampler capable of operating over a wide range of temperatures (up to 500 K) and flow rates; (2) a high pressure to low pressure transition and sampling region that efficiently separates particles from vapor-phase components for separate, parallel analyses; (3) two small mass spectrometers, one optimized for organic analysis using a unique field ionization source and one optimized for particulate characterization using thermal pyrolysis and electron-impact ionization (EI); and (4) a powerful personal computer for control and data acquisition.

1846 (DOE/MC/29116-3575) Novel mass spectrometric instrument for gaseous and particulate characterization and monitoring: [Quarterly] technical progress report, April 1, 1993–June 30, 1993. Coggiola, M.J. SRI International, Menlo Park, CA (United States). Jul 1993. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-92MC29116. Order Number DE94005896. Source: OSTI; NTIS; GPO Dep.

A MS instrument is being developed for real-time (< 1 min) analysis of gaseous and particulate pollutants from DOE waste cleanup activities. The pollutants will include volatile organic compounds, PAHs, heavy metals, and transuranics. Design has been completed for the sampler and its vacuum interface with ion trap detectors and fabrication started. Design, fabrication, and testing of pyrolysis filament for particulate analysis is under way. 4 figs.

1847 (DOE/MC/29119-3524) **Innovative directional and position specific sampling technique: Phase I: Final report, July 28, 1992-April 28, 1993.** Hutzell, W.J.; Foster, E.L. UTD, Inc., Newington, VA (United States). Apr 1993. 34p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-92MC29119. Order Number DE94000049. Source: OSTI; NTIS; INIS; GPO Dep.

UTD, Incorporated has developed a unique real-time, in-situ Position Location (POLO) device which will directly enhance the DOE Environmental Restoration and Waste Management Program through improvements to finding contamination, identifying extent of contamination, remediating, and finally monitoring sites. POLO is smaller than existing technology and is unaffected by the presence of steel and other magnetic materials. The size of the device offers for the first time, the possibility to accurately determine the location of a penetrometer. It will be usable, in its present form, to map the position of a sampling device as that device is inserted into the hole. A three phase program with a 21 month period of performance was proposed to DOE to take the POLO system through the three levels of maturity prior to commercialization. The goal of Phase I of the contract, "Innovative and Position Specific Sampling Technique" was to analyze, test, and refine the individual subsystems of the POLO system. The goals were accomplished and the success criteria met by engineering design and precision construction of the various system components. A prototype module was designed, constructed, and calibrated. The final report presented here details the design, manufacture, and testing of each POLO component (sub-scale) in an experimental configuration. A comprehensive error analysis summarizes the performance and demonstrates that all project goals have been met. Plans for commercialization of POLO are discussed and highlight the expected smooth transition to full scale production.

1848 (DOE/MC/29119-3667) **Innovative directional and position specific sampling technique: Phase 2, Final report, [July 28, 1992-February 15, 1994].** Hutzell, W.J.; Hill, J.L. III; Foster, E.L. UTD, Inc., Newington, VA (United States). Jan 1994. 38p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-92MC29119. Order Number DE94004083. Source: OSTI; NTIS; INIS; GPO Dep.

UTD, Incorporated has developed a unique real-time, in-situ Position Location (POLO) device which will directly enhance the Department of Energy's Environmental Restoration and Waste Management Program through improvements to finding contamination, identifying extent of contamination, remediating, and finally monitoring sites. POLO is smaller than existing technology and is unaffected by the presence of steel and other magnetic materials. The size of the device offers for the first time, the possibility to accurately determine the location of a penetrometer. It will be usable, in its present form, to map the position of a sampling device as that device is inserted into the ground. A three phase program was proposed to DOE to take the POLO System through the three levels of maturity prior to commercialization. Phase 1 included the design and testing of individual components of the device and met or exceeded success criteria. Phase 2 has included laboratory-scale tracking experiments of the integrated POLO System that have met or exceeded the success criterion as well. The success criterion is to demonstrate path tracking accuracy with a total error of less than 0.50% of the distance traveled for distances less than 70 meters. In Phase 3 we will develop and test a full-scale POLO System and conclude with

a field demonstration. The goal of the Phase 3 effort is to achieve the same 0.50% accuracy or better with respect to the distance traveled for distances less than 70 meters in the field as was demonstrated in laboratory tests in the earlier phases. The final report details the design of a realistic laboratory-scale penetrometer path and describes the POLO tracking experiments that were conducted. Plans for demonstrations as well as commercialization and technology transfer with DOE field sites are described, highlighting the expected smooth transition to full-scale production.

1849 (DOE/MC/29120-3498) **Innovative fossil fuel fired vitrification technology for soil remediation: Volume 1, Phase 1: Annual report, September 28, 1992-August 31, 1993.** Vortec Corp., Collegeville, PA (United States). Aug 1993. 206p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-92MC29120. Order Number DE94000059. Source: OSTI; NTIS; INIS; GPO Dep.

Vortex has successfully completed Phase 1 of the "Innovative Fossil Fuel Fired Vitrification Technology for Soil Remediation" program with the Department of Energy (DOE) Morgantown Energy Technology Center (METC). The Combustion and Melting System (CMS) has processed 7000 pounds of material representative of contaminated soil that is found at DOE sites. The soil was spiked with Resource Conservation and Recovery Act (RCRA) metals surrogates, an organic contaminant, and a surrogate radionuclide. The samples taken during the tests confirmed that virtually all of the radionuclide was retained in the glass and that it did not leach to the environment. The organic contaminant, anthracene, was destroyed during the test with a Destruction and Removal Efficiency (DRE) of at least 99.99%. RCRA metal surrogates, that were in the vitrified product, were retained and will not leach to the environment—as confirmed by the TCLP testing. Semi-volatile RCRA metal surrogates were captured by the Air Pollution Control (APC) system, and data on the amount of metal oxide particulate and the chemical composition of the particulate were established for use in the Phase 2 APC system design. This topical report will present a summary of the activities conducted during Phase 1 of the "Innovative Fossil Fuel Fired Vitrification Technology for Soil Remediation" program. The report includes the detail technical data generated during the experimental program and the design and cost data for the preliminary Phase 2 plant.

1850 (DOE/MC/29467-93/C0192) **In-situ bioremediation of chlorinated solvents - A review.** Sack, W.A.; Jones, K.D.; Cuddeback, J.E.; Shiemke, A.K. West Virginia Univ., Morgantown, WV (United States). [1993]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC21-92MC29467. (CONF-930794-2: 25. Mid-Atlantic industrial waste conference, College Park, MD (United States), 7-9 Jul 1993). Order Number DE93015861. Source: OSTI; NTIS; GPO Dep.

This review focuses on the in-situ bioremediation of chlorinated organic solvents. This group of compounds is one of the most widespread contaminant classes and one of the most troublesome to remediate. They are found nationwide in municipal and industrial waste waters, landfills and landfill leachates, industrial sludges, waste disposal sites, and groundwaters. Chlorinated alkanes and alkenes, such as trichloroethane (TCA) and trichloroethylene (TCE), are used as dry cleaning fluids, refrigerants, degreasing agents, solvents, and in the production of decaffeinated coffee. The review will include a discussion of laboratory-scale research,

some field application considerations, and a review of a full-scale remediation study.

1851 (DOE/MC/29467-3475) Decontamination Systems Information and Research Program: Quarterly technical progress report, January 1-March 31, 1993. National Research Center for Coal and Energy, Morgantown, WV (United States). Apr 1993. 133p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC21-92MC29467. Order Number DE94006446. Source: OSTI; NTIS; INIS; GPO Dep.

This reports reports the progress/efforts performed on six technical projects: 1. systematic assessment of the state of hazardous waste clean-up technologies; 2. site remediation technologies (SRT): drain-enhanced soil flushing for organic contaminants removal; 3. SRT: in situ bio-remediation of organic contaminants; 4. excavation systems for hazardous waste sites: dust control methods for in-situ nuclear waste handling; 5. chemical destruction of polychlorinated biphenyls; and 6. development of organic sensors: monolayer and multilayer self-assembled films for chemical sensors.

1852 (DOE/MC/29467-3559) A systematic assessment of the state of hazardous waste clean-up technologies: Quarterly technical progress report, April 1-June 30, 1993. Berg, M.T.; Reed, B.E.; Gabr, M. National Research Center for Coal and Energy, Morgantown, WV (United States). Jul 1993. 307p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC21-92MC29467. Order Number DE94005790. Source: OSTI; NTIS; INIS; GPO Dep.

West Virginia University (WVU) and the US DOE Morgantown Energy Technology Center (METC) entered into a Cooperative Agreement on August 29, 1992 entitled "Decontamination Systems Information and Research Programs." Stipulated within the Agreement is the requirement that WVU submit to METC a series of Technical Progress Report for Year 1 of the Agreement. This report reflects the progress and/or efforts performed on the following nine technical projects encompassed by the Year 1 Agreement for the period of April 1 through June 30, 1993: Systematic assessment of the state of hazardous waste clean-up technologies; site remediation technologies - drain-enhanced soil flushing (DESF) for organic contaminants removal; site remediation technologies - in situ bioremediation of organic contaminants; excavation systems for hazardous waste sites; chemical destruction of polychlorinated biphenyls; development of organic sensors - monolayer and multilayer self-assembled films for chemical sensors; Winfield lock and dam remediation; Assessments of Technologies for hazardous waste site remediation - non-treatment technologies and pilot scale test facility implementation; and remediation of hazardous sites with stream reforming.

1853 (DOE/OR-01-1100-D2) RCRA closure plan for the Bear Creek Burial Grounds B Area and Walk-In Pits at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee. Oak Ridge Y-12 Plant, TN (United States). Jan 1993. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (Y/ER-53-D2). Order Number DE93013201. Source: OSTI; NTIS; INIS; GPO Dep.

In June 1987, the RCRA Closure/Postclosure Plan for the Bear Creek Burial Grounds (BCBG) was submitted to the Tennessee Department of Environment and Conservation (TDEC) for review and approval. TDEC modified and issued the plan approved on September 30, 1987. Subsequently,

this plan was modified again and approved as Y/TS-395, Revised RCRA Closure Plan for the Bear Creek Burial Grounds (February 29, 1988). Y/TS-395 was initially intended to apply to A Area, C-West, B Area, and the Walk-In Pits of BCBG. However, a concept was developed to include the B Area (non-RCRA regulated) in the Walk-In Pits so that both areas would be closed under one cap. This approach included a tremendous amount of site preparation with an underlying stabilization base of 16 ft of sand for blast protection. The plan was presented to the state of Tennessee on March 8, 1990, and the Department of Energy was requested to review other unique alternatives to close the site. This amended closure plan goes further to include inspection and maintenance criteria along with other details.

1854 (DOE/OR-01-1100-D3) RCRA Closure Plan for the Bear Creek Burial Grounds B Area and Walk-In Pits at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee: Energy Systems Environmental Restoration Program; Y-12 Environmental Restoration Program. Oak Ridge Y-12 Plant, TN (United States). Apr 1993. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OS21400. (Y/ER-53-D3). Order Number DE93013251. Source: OSTI; NTIS; INIS; GPO Dep.

In June 1987, the RCRA Closure/Postclosure Plan for the Bear Creek Burial Grounds (BCBG) was submitted to the Tennessee Department of Environment and Conservation (TDEC) for review and approval. TDEC modified and issued the plan approved on September 30, 1987. Y/TS-395 was initially intended to apply to A Area, C-West, B Area, and the Walk-In Pits of BCBG. However, a concept was developed to include the B Area (non-RCRA regulated) in the Walk-In Pits so that both areas would be closed under one cap. This approach included a tremendous amount of site preparation with an underlying stabilization base of 16 ft of sand for blast protection. In January 1993, the Closure Plan was revised to include inspection and maintenance criteria and to reflect that future monitoring and remediation would be conducted as part of the ongoing Comprehensive Environmental Response, Compensation, and Liability Act activities at the Oak Ridge Y-12 Plant. This Closure Plan revision is intended to reflect the placement of the Kerr Hollow Quarry debris at the Walk-In Pits, revise the closure dates, and acknowledge that the disposition of a monitoring well within the closure site cannot be verified.

1855 (DOE/OR-01-1110-D2) Work plan for the removal and subsequent management of specific waste from David Witherspoon, Inc., Knoxville, Tennessee: Environmental Restoration and Waste Management Programs. Martin Marietta Energy Systems, Inc., Oak Ridge, TN (United States); MK-Ferguson of Oak Ridge Co., TN (United States); Radian Corp., Oak Ridge, TN (United States). Jan 1993. 226p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (ORNL/M-2580). Order Number DE93006269. Source: OSTI; NTIS; INIS; GPO Dep.

The Tennessee Department of Environment and Conservation (TDEC) and the Department of Energy (DOE) have made the determination that approximately 258 drums of waste and 10 open-top boxes of waste now located at the site known as David Witherspoon, Inc., (DWI) in south Knoxville, Tennessee, should be repackaged as necessary and transferred to the K-25 Site in Oak Ridge, Tennessee, for management. This work plan addresses the four phases of activity planned and the methods of accomplishment The

lint phase will consist of an assessment to determine requirements for managing the waste. Items to be investigated include site access, site conditions, personal protective equipment, waste characterization needs, packaging and labeling, transportation, receipt and storage of the waste at the K-25 Site, and site controls and monitoring required during the packaging operations to be conducted at DWI. The second phase will include mobilization of on-site support and operating facilities, sampling and transferral of a randomly selected representative fraction of the 232 drums now stored on-site in sea/land containers to storage facilities at the K-25 Site, and sampling of the waste now stored in the 26 drums inside the main process building and the 10 open-top boxes of waste stored outside and adjacent to the building. The third phase will include repackaging and transferral of the 26 drums and 10 boxes of waste to the K-25 Site and placement of the containerized waste into appropriate storage at the K-25 Site. Participants in the fourth phase of activity will demobilize the support and operating facilities from DWI, conduct an on-site evaluation at the K-25 site to verify compliance with storage and other management requirements, prepare a closeout report for the activity assessing the actions, and develop a plan for the final management method for the waste.

1856 (DOE/OR-01-1111-D1) Phase 2 sampling and analysis plan, Quality Assurance Project Plan, and environmental health and safety plan for the Clinch River Remedial Investigation: An addendum to the Clinch River RCRA Facility Investigation plan: Energy Systems Environmental Restoration Program; Clinch River Environmental Restoration Program. Cook, R.B.; Adams, S.M.; Beauchamp, J.J.; Bevelhimer, M.S.; Blaylock, B.G.; Brandt, C.C.; Etnier, E.L.; Ford, C.J.; Frank, M.L.; Gentry, M.J.; Greeley, M.S.; Halbrook, R.S.; Harris, R.A.; Holladay, S.K.; Hook, L.A.; Howell, P.L.; Kszos, L.A.; Levine, D.A.; Oak Ridge National Lab., TN (United States). Dec 1992. 265p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (ORNL/ER-156-D1). Order Number DE93006273. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental Sciences Division Publication 4024.

This document contains a three-part addendum to the Clinch River Resource Conservation and Recovery Act (RCRA) Facility Investigation Plan. The Clinch River RCRA Facility Investigation began in 1989, as part of the comprehensive remediation of facilities on the US Department of Energy Oak Ridge Reservation (ORR). The ORR was added to the National Priorities List in December 1989. The regulatory agencies have encouraged the adoption of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) terminology; therefore, the Clinch River activity is now referred to as the Clinch River Remedial Investigation (CRRI), not the Clinch River RCRA Facility Investigation. Part 1 of this document is the plan for sampling and analysis (S&A) during Phase 2 of the CRRI. Part 2 is a revision of the Quality Assurance Project Plan for the CRRI, and Part 3 is a revision of the Environmental Health and Safety Plan for the CRRI. The Clinch River RI (CRRI) is designed to address the transport, fate, and distribution of waterborne contaminants (radionuclides, metals, and organic compounds) released from the DOE Oak Ridge Reservation (ORR) and to assess potential risks to human health and the environment associated with these contaminants. Primary areas of investigation are Melton Hill Reservoir, the Clinch River from Melton Hill Dam to its confluence with the Tennessee River, Poplar Creek, and Watts

Bar Reservoir. The contaminants identified in the Clinch River/Watts Bar Reservoir (CR/WBR) downstream of the ORR are those associated with the water, suspended particles, deposited sediments, aquatic organisms, and wildlife feeding on aquatic organisms. The purpose of the Phase 2 S&A Plan is to describe the proposed tasks and subtasks developed to meet the primary objectives of the CRRI.

1857 (DOE/OR-01-1122-D3) Interim remedial action work plan for the cesium plots at Waste Area Grouping 13 at Oak Ridge National Laboratory, Oak Ridge, Tennessee. MK-Ferguson of Oak Ridge Co., TN (United States); Oak Ridge National Lab., TN (United States). Jul 1993. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (ORNL/ER-157-D3). Order Number DE93017914. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental Restoration Program.

This remedial action work plan (RAWP) is issued under the Federal Facility Agreement to provide a basic approach for implementing the interim remedial action (IRA) described in Interim Record of Decision for the Oak Ridge National Laboratory Waste Area Grouping 13 Cesium Plots, Oak Ridge, Tennessee. This RAWP summarizes the interim record of decision (IROD) requirements and establishes the strategy for the implementation of the field activities. As documented in the IROD document, the primary goal of this action is to reduce the risk to human health and the environment resulting from current elevated levels of gamma radiation on the site and at areas accessible to the public adjacent to the site. The major steps of this IRA are to: Excavate cesium-contaminated soil; place the excavated soils in containers and transport to Waste Area Grouping (WAG) 6; and backfill excavated plots with clean fill materials. The actual remedial action will be performed by Department of Energy prime contractor, MK-Ferguson of Oak Ridge Company. Remediation of the cesium plots will require approximately 60 days to complete. During this time, all activities will be performed according to this RAWP and the applicable specifications, plans, and procedures referred to in this document. The IRA on WAG 13 will prevent a known source of cesium-contaminated soil from producing elevated levels of gamma radiation in areas accessible to the public, eliminate sources of contamination to the environment, and reduce the risks associated with surveillance and maintenance of the WAG 13 site.

1858 (DOE/OR-01-1128-D1) Postconstruction report of the United Nuclear Corporation Disposal Site at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee: Environmental Restoration Program. Oakley, L.B.; Siberell, J.K.; Voskuil, T.L. Martin Marietta Energy Systems, Inc., Oak Ridge, TN (United States). Jun 1993. 236p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OS21400. (Y/ER-51-D1). Order Number DE93017234. Source: OSTI; NTIS; INIS; GPO Dep.

Engineering drawings for this project are identified as CAPE-3063. Inquiries may be directed to: Office of Scientific and Technical Information, P.O. Box 62, Oak Ridge, TN 37831.

Remedial actions conducted under the auspices of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) were completed at the Y-12 United Nuclear Corporation (UNC) Disposal Site in August 1992. The purpose of this Postconstruction Report is to summarize numerous technical reports and provide CERCLA documentation for completion of the remedial actions.

Other CERCLA reports, such as the Feasibility Study for the UNC Disposal Site, provide documentation leading up to the remedial action decision. The remedial action chosen, placement of a modified RCRA cap, was completed successfully, and performance standards were either met or exceeded. This remedial action provided solutions to two environmentally contaminated areas and achieved the goal of minimizing the potential for contamination of the shallow groundwater downgradient of the site, thereby providing protection of human health and the environment. Surveillance and maintenance of the cap will be accomplished to ensure cap integrity, and groundwater monitoring downgradient of the site will continue to confirm the acceptability of the remedial action chosen.

1859 (DOE/OR-01-1151-D1) Remedial Investigation Work Plan for Upper East Fork Poplar Creek Operable Unit 3 at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee: Environmental Restoration Program. Oak Ridge Y-12 Plant, TN (United States); Science Applications International Corp., Oak Ridge, TN (United States). Aug 1993. 455p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OS21400. (Y/ER-80-D1). Order Number DE94001951. Source: OSTI; NTIS; INIS; GPO Dep.

Upper East Fork Poplar Creek Operable Unit 3 (UEFPC OU 3) is a source term OU composed of seven sites, and is located in the western portion of the Y-12 Plant. For the most part, the UEFPC OU 3 sites served unrelated purposes and are geographically removed from one another. The seven sites include the following: Building 81-10, the S-2 Site, Salvage Yard oil storage tanks, the Salvage Yard oil/solvent drum storage area, Tank Site 2063-U, the Salvage Yard drum deheader, and the Salvage Yard scrap metal storage area. All of these sites are contaminated with at least one or more hazardous and/or radioactive chemicals. All sites have had some previous investigation under the Y-12 Plant RCRA Program. The work plan contains summaries of geographical, historical, operational, geological, and hydrological information specific to each OU 3 site. The potential for release of contaminants to receptors through various media is addressed, and a sampling and analysis plan is presented to obtain objectives for the remedial investigation. Proposed sampling activities are contingent upon the screening level risk assessment, which includes shallow soil sampling, soil borings, monitoring well installation, groundwater sampling, and surface water sampling. Data from the site characterization activities will be used to meet the above objectives. A Field Sampling Investigation Plan, Health and Safety Plan, and Waste Management Plan are also included in this work plan.

1860 (DOE/OR-01-1161-V1-D1) Remedial Investigation work plan for Bear Creek Valley Operable Unit 1 (S-3 Ponds, Boneyard/Burnyard, Oil Landfarm, Sanitary Landfill 1, and the Burial Grounds, including Oil Retention Ponds 1 and 2) at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee: Volume 1, Main text. Science Applications International Corp., Oak Ridge, TN (United States); Oak Ridge Y-12 Plant, TN (United States). Sep 1993. 452p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OS21400. (Y/ER-105/V1-D1). Order Number DE94002755. Source: OSTI; NTIS; INIS; GPO Dep.

The intent and scope of the work plan are to assemble all data necessary to facilitate selection of remediation alternatives for the sites in Bear Creek Valley Operable Unit 1

(BCV OU 1) such that the risk to human health and the environment is reduced to acceptable levels based on agreements with regulators. The ultimate goal is to develop a final Record Of Decision (ROD) for all of the OUs in BCV, including the integrator OU. However, the initial aim of the source OUs is to develop a ROD for interim measures. For source OUs such as BCV OU 1, data acquisition will not be carried out in a single event, but will be carried out in three stages that accommodate the schedule for developing a ROD for interim measures and the final site-wide ROD. The three stages are as follows: Stage 1, Assemble sufficient data to support decisions such as the need for removal actions, whether to continue with the remedial investigation (RI) process, or whether no further action is required. If the decision is made to continue the RI/FS process, then: Stage 2, Assemble sufficient data to allow for a ROD for interim measures that reduce risks to the human health and the environment. Stage 3, Provide input from the source OU that allows a final ROD to be issued for all OUs in the BCV hydrologic regime. One goal of the RI work plan will be to ensure that sampling operations required for the initial stage are not repeated at later stages. The overall goals of this RI are to define the nature and extent of contamination so that the impact of leachate, surface water runoff, and sediment from the OU 1 sites on the integrator OU can be evaluated, the risk to human health and the environment can be defined, and the general physical characteristics of the subsurface can be determined such that remedial alternatives can be screened.

1861 (DOE/OR-01-1175/V1) Final report on the Background Soil Characterization Project at the Oak Ridge Reservation, Oak Ridge, Tennessee: Volume 1: Results of Field Sampling Program. Watkins, D.R. (and others); Ammons, J.T.; Branson, J.L. Oak Ridge National Lab., TN (United States). Oct 1993. 417p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (ES/ER/TM-84/V1). Order Number DE94006283. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental Sciences Division Publication 4144.

This report presents, evaluates, and documents data and results obtained in the Background Soil Characterization Project (BSCP). It is intended to be a stand-alone document for application and use in structuring and conducting remedial investigation and remedial action projects in the Environmental Restoration (ER) Program. The objectives of the BSCP consist of the following: determine background concentrations of organics, metals, and radionuclides in natural soils that are key to environmental restoration projects; provide remediation projects with 100% validated data on background concentrations, which are technically and legally defensible; and quantify baseline risks from background constituents for comparison of risks associated with contaminated sites.

1862 (DOE/OR-01-1175/V2) Final report on the Background Soil Characterization Project at the Oak Ridge Reservation, Oak Ridge, Tennessee: Volume 2: Data. Oak Ridge National Lab., TN (United States). Oct 1993. 547p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (ES/ER/TM-84/V2). Order Number DE94006284. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental Sciences Division Publication 4144.

The Background Soil Characterization Project (BSCP) will provide background concentration levels of selected metals

organic compounds, and radionuclides in soils from uncontaminated on-site areas at the Oak Ridge Reservation (ORR), and off-site in the western part of Roane County and the eastern part of Anderson County. The BSCP will establish a database, recommend how to use the data for contaminated site assessment, and provide estimates of the potential human health and environmental risks associated with the background level concentrations of potentially hazardous constituents. This volume contains the data from the Background Soil Characterization Project. When available, the following validation qualifiers are used in the appendixes. When validation qualifiers are not available, the corresponding contract laboratory data qualifiers appearing on the next page are used.

1863 (DOE/OR-01-1175-V3) Final report on the Background Soil Characterization Project at the Oak Ridge Reservation, Oak Ridge, Tennessee: Volume 3: Project Plan. Hatmaker, T.L. (and others); Hook, L.A.; Jackson, B.L. Oak Ridge National Lab., TN (United States). Oct 1993. 159p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (ES/ER/TM-84/V3). Order Number DE94006285. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental Sciences Division Publication 4144.

The Background Soil Characterization Project (BSCP) will provide background concentration levels of selected metals, organic compounds, and radionuclides in soils from uncontaminated on-site areas at the Oak Ridge Reservation (ORR), and off-site in the western part of Roane County and the eastern part of Anderson County. The BSCP will establish a database, recommend how to use the data for contaminated site assessment, and provide estimates of the potential human health and environmental risks associated with the background level concentrations of potentially hazardous constituents. ORR background soil characterization data will be used for two purposes. The first application will be in differentiating between naturally occurring constituents and site-related contamination. This is a very important step in a risk assessment because if sufficient background data are not available, no constituent known to be a contaminant can be eliminated from the assessment even if the sampled concentration is measured at a minimum level. The second use of the background data will be in calculating baseline risks against which site-specific contamination risks can be compared.

1864 (DOE/OR-01-1192-D1) Environmental Monitoring Plan for Waste Area Grouping 6 at Oak Ridge National Laboratory, Oak Ridge, Tennessee. Oak Ridge National Lab., TN (United States); Science Applications International Corp., Oak Ridge, TN (United States). Sep 1993. 184p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (ORNL/ER-158-D1). Order Number DE94007244. Source: OSTI; NTIS; INIS; GPO Dep.

This document presents the Environmental Monitoring Plan (EMP) for Waste Area Grouping (WAG) 6 at the Oak Ridge National Laboratory (ORNL). Based on the results of the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) and on subsequent discussions with regulators, a decision was made to defer implementing source control remedial measures at the WAG. The alternative selected to address the risks associated with WAG 6 involves maintenance of site access controls prevent public exposure to on-site contaminants, continued monitoring of contaminant releases determine if source control measures

are required, and development of technologies that could support the final remediation of WAG 6. Although active source control measures are not being implemented at WAG 6, environmental monitoring is necessary to ensure that any potential changes in contaminant release from the WAG are identified early enough to take appropriate action. Two types of environmental monitoring will be conducted: baseline monitoring and annual routine monitoring. The baseline monitoring will be conducted to establish the baseline contaminant release conditions at the WAG, confirm the site-related chemicals of concern (COCs), and gather data to confirm the site hydrologic model. The baseline monitoring is expected to begin in 1994 and last for 12-18 months. The annual routine monitoring will consist of continued sampling and analyses of COCs to determine off-WAG contaminant flux and risk, identify mills in releases, and confirm the primary contributors to risk. The annual routine monitoring will continue for ~ 4 years after completion of the baseline monitoring.

1865 (DOE/OR-01-1214-D1) Remedial Investigation report on the abandoned nitric acid pipeline at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee. Oak Ridge Y-12 Plant, TN (United States); Science Applications International Corp., Oak Ridge, TN (United States). Dec 1993. 231p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (Y/ER-149-D1). Order Number DE94010094. Source: OSTI; NTIS; INIS; GPO Dep.

Upper East Fork Poplar Creek OU-2 consists of the Abandoned Nitric Acid Pipeline. This pipeline was installed in 1951 to transport liquid wastes ~ 4,800 ft from Buildings 9212, 9215, and 9206 to the S-3 Ponds. Materials known to have been discharged through the pipeline include nitric acid, depleted and enriched uranium, various metal nitrates, salts, and lead skimmings. A total of nineteen locations were chosen to be investigated along the pipeline for the first phase of this Remedial Investigation. Sampling consisted of drilling down to obtain a soil sample at a depth immediately below the pipeline. Additional samples were obtained deeper in the subsurface depending upon the depth of the pipeline, the depth of the water table, and the point of auger refusal. The nineteen samples collected below the pipeline were analyzed by the Y-12 Plant laboratory for metals, nitrate/nitrite, and isotopic uranium. Samples collected from three boreholes were also analyzed for volatile organic compounds because these samples produced a response with organic vapor monitoring equipment. The results of the baseline human health risk assessment for the Abandoned Nitric Acid Pipeline contaminants of potential concern show no unacceptable risks to human health via incidental ingestion of soil, inhalation of dust, dermal contact with the soil, or external exposure to radionuclides in the ANAP soils, under the construction worker and/or the residential land-use scenarios.

1866 (DOE/OR-01-1214-D2) Remedial Investigation Report on the Abandoned Nitric Acid Pipeline at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee: Energy Systems Environmental Restoration Program; Y-12 Environmental Restoration Program. Oak Ridge Y-12 Plant, TN (United States); Science Applications International Corp., Oak Ridge, TN (United States). Feb 1994. 223p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OS21400. (Y/ER-149-D2). Order Number DE94010030. Source: OSTI; NTIS; GPO Dep.

Upper East Fork Poplar Creek Operable Unit 2 consists of the Abandoned Nitric Acid pipeline (ANAP). This pipeline

was installed in 1951 to transport liquid wastes ~4800 ft from Buildings 9212, 9215, and 9206 to the S-3 Ponds. Materials known to have been discharged through the pipeline include nitric acid, depleted and enriched uranium, various metal nitrates, salts, and lead skimmings. During the mid-1980s, sections of the pipeline were removed during various construction projects. A total of 19 locations were chosen to be investigated along the pipeline for the first phase of this Remedial Investigation. Sampling consisted of drilling down to obtain a soil sample at a depth immediately below the pipeline. Additional samples were obtained deeper in the subsurface depending upon the depth of the pipeline, the depth of the water table, and the point of auger refusal. The 19 samples collected below the pipeline were analyzed by the Oak Ridge Y-12 Plant's laboratory for metals, nitrate/nitrite, and isotopic uranium. Samples collected from three boreholes were also analyzed for volatile organic compounds because these samples produced a response with organic vapor monitoring equipment. Uranium activities in the soil samples ranged from 0.53 to 13.0 pCi/g for ^{238}U , from 0.075 to 0.75 pCi/g for ^{235}U , and from 0.71 to 5.0 pCi/g for ^{239}U . Maximum total values for lead, chromium, and nickel were 75.1 mg/kg, 56.3 mg/kg, and 53.0 mg/kg, respectively. The maximum nitrate/nitrite value detected was 32.0 mg-N/kg. One sample obtained adjacent to a sewer line contained various organic compounds, at least some of which were tentatively identified as fragrance chemicals commonly associated with soaps and cleaning solutions. The results of the baseline human health risk assessment for the ANAP contaminants of potential concern show no unacceptable risks to human health.

1867 (DOE/OR-01-1254-D1) Addendum to the Phase 2 Sampling and Analysis Plan for the Clinch River Remedial Investigation. Oak Ridge National Lab., TN (United States). Mar 1994. 129p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (ORNL/ER-232-D1). Order Number DE94009444. Source: OSTI; NTIS; INIS; GPO Dep.

This document is an addendum to the Phase 2 Sampling and Analysis Plan for the Clinch River Remedial Investigation (DOE 1993). The Department of Energy-Oak Ridge Operations (DOE-ORO) is proposing this addendum to the US Environmental Protection Agency, Region IV (EPA-IV), and the Tennessee Department of Environment and Conservation (TDEC) as a reduced sampling program on the Clinch River arm of Watts Bar Reservoir and on Poplar Creek. DOE-ORO is proposing to maximize the use of existing data and minimize the collection of new data for water, sediment, and biota during Phase 2 of the Clinch River Remedial Investigation. The existing data along with the additional data collected in Phase 2 would be used to perform a baseline risk assessment and make remedial decisions. DOE-ORO considers that the existing data, the additional data collected in Phase 2, and on-site remedial investigation data would be sufficient to understand the nature and extent of the contamination problem in the Clinch River, perform a baseline risk assessment, and make remedial decisions. This addendum is organized in three sections. The first section provides background information and describes a rationale for modifying the Phase 2 Sampling and Analysis Plan. Section 2 presents a summary of the existing data for the Clinch River arm of Watts Bar Reservoir and an evaluation of the sufficiency of this data for a baseline human health and ecological risk assessment. Section 3 describes the revised Phase 2 Sampling and Analysis Plan for surface

water, sediment, and biota in the Clinch River OU and in the Poplar Creek OU.

1868 (DOE/OR-1060-D1) Remedial Investigation work plan for Bear Creek Valley Operable Unit 2 (Rust Spoil Area, SY-200 Yard, Spoil Area 1) at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee. Oak Ridge Y-12 Plant, TN (United States); Science Applications International Corp., Oak Ridge, TN (United States). Sep 1992. 397p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OS21400. (ES/ER-43-D1; Y/ER/Sub-91-99069/1). Order Number DE92041220. Source: OSTI; NTIS; INIS; GPO Dep.

This Remedial Investigation (RI) work plan contains summaries of geographical, historical, operational, geological, and hydrological information specific to the unit. The potential for release of contamination to receptors through the various media is addressed, and a sampling and analysis plan is presented to determine the extent of release of contamination to the surrounding environment. Proposed activities include walkover radiation surveys at all sites, soil borings at SY-200, piezometer installation and water table sampling at SA-1 and SY-200, and surface water and sediment runoff sampling at all three sites. Data from the site characterization activities will be combined with data from ongoing site-wide monitoring programs (i.e., groundwater, surface water, and biological monitoring) to provide input for a screening-level risk assessment and evaluation of alternative remedial actions.

1869 (DOE/OR-1060-D3) Remedial Investigation work plan for Bear Creek Valley Operable Unit 2 (Rust Spoil Area, SY-200 Yard, Spoil Area 1) at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee: Environmental Restoration Program. Oak Ridge Y-12 Plant, TN (United States); Science Applications International Corp., Oak Ridge, TN (United States). May 1993. 393p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OS21400 ; AC05-76OR00001. (Y/ER/SUB-91-99069/1/R3). Order Number DE93018593. Source: OSTI; NTIS; INIS; GPO Dep.

The enactment of the Resource Conservation and Recovery Act (RCRA) in 1976 and the Hazardous and Solid Waste Amendments (HSWA) to RCRA in 1984 created management requirements for hazardous waste facilities. The facilities within the Oak Ridge Reservation (ORR) were in the process of meeting the RCRA requirements when ORR was placed on the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) National Priorities List (NPL) on November 21, 1989. Under RCRA, the actions typically follow the RCRA Facility Assessment (RFA)/RCRA Facility Investigation (RFI)/Corrective Measures Study (CMS)/Corrective Measures implementation process. Under CERCLA the actions follow the PA/SI/Remedial Investigation (RI)/Feasibility Study (FS)/Remedial Design/Remedial Action process. The development of this document will incorporate requirements under both RCRA and CERCLA into an RI work plan for the characterization of Bear Creek Valley (BCV) Operable Unit (OU) 2.

1870 (DOE/OR-1070-D2) Field Sampling and Analysis Plan for the Remedial Investigation of Waste Area Grouping 2 at Oak Ridge National Laboratory, Oak Ridge, Tennessee: Responses to comments. Oak Ridge National Lab., TN (United States). Oct 1992. 63p. Sponsored by USDOE, Washington, DC (United States). DOE

Contract AC05-84OR21400. (ORNL/ER-58-D2). Order Number DE93001421. Source: OSTI; NTIS; INIS; GPO Dep. Environmental Sciences Division Publication 3985.

This report provides responses to US Environmental Protection Agency Region IV EPA-M and Tennessee Department of Environment and Conservation Oversight Division (TDEC-O) comments on report ORNL/ER-58, Field Sampling and Analysis Plan for the Remedial Investigation of Waste Area Grouping 2 at Oak Ridge National Laboratory, Oak Ridge, Tennessee. Waste Area Grouping (WAG) 2 consists of the White Oak Creek (WOC) drainage system downgradient of the major ORNL WAGs in the WOC watershed. A strategy for the remedial investigation (RI) of WAG2 was developed in report ES/ER-14&D1, Remedial Investigation Plan for Waste Area Grouping 2 at Oak Ridge National Laboratory, Oak Ridge, Tennessee. This strategy takes full advantage of WAG2's role as an integrator of contaminant releases from the ORNL WAGs in the WOC watershed, and takes full advantage of WAG2's role as a conduit for contaminants from the ORNL site to the Clinch River. The strategy calls for a multimedia environmental monitoring and characterization program to be conducted in WAG2 while upgradient contaminant sources are being remediated. This monitoring and characterization program will (1) identify and quantify contaminant fluxes, (2) identify pathways of greatest concern for human health and environmental risk, (3) improve conceptual models of contaminant movement, (4) support the evaluation of remedial alternatives, (5) support efforts to prioritize sites for remediation, (6) document the reduction in contaminant fluxes following remediation, and (7) support the eventual remediation of WAG2. Following this strategy, WAG2 has been termed an "integrator WAG," and efforts in WAG2 over the short term are directed toward supporting efforts to remediate the contaminant "source WAGs" at ORNL.

1871 (DOE/OR-1077) Annotated outlines for documents required by FFA and CERCLA for Oak Ridge Reservation sites. Oak Ridge National Lab., TN (United States). Nov 1992. 166p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (ORNL/M-2527). Order Number DE93003590. Source: OSTI; NTIS; GPO Dep.

The annotated outlines approved by the Document Content and Response Committee (DCRC) and issued in "Revision O" of this document include those for preliminary assessments/site inspections, remedial investigation (RI) work plans, RI reports, feasibility studies, Proposed Plans, interim records of decision (IRODs), and records of decision (RODs). These annotated outlines for documents required by the Federal Facility Agreement (FFA) have been developed by the DCRC to ensure document format consistency across the Oak Ridge Reservation. The outlines have been developed to comply with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), integrating National Environmental Policy Act (NEPA), Resource Conservation and Recovery Act, Natural Resources Damages Act requirements and other applicable or relevant and appropriate requirements. Additional annotated outlines for documents required by the FFA that the DCRC plans to issue at a later date include outlines for remedial design work plans, remedial design reports, remedial action work plans, and postconstruction reports. As necessary, these outlines will be revised to reflect new regulatory requirements and/or document comments received from the regulatory agencies as the CERCLA remediation process for the various sites progresses. The outlines prepared by the

DCRC contain important guidelines and provide logical formats for preparation of defensible and consistent documents for the Oak Ridge Reservation (ORR) Environmental Restoration (ER) Program. These outlines were prepared using existing regulatory, DOE, and ER Program guidance or requirements, in order to incorporate several requirements into a single summary.

1872 (DOE/OR-1152-D1) Remedial investigation work plan for Chestnut Ridge Operable Unit 4 (Rogers Quarry/Lower McCoy Branch) at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee. Oak Ridge Y-12 Plant, TN (United States); CDM Federal Programs Corp., Oak Ridge, TN (United States). Sep 1993. 268p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OS21400. (Y/ER-70-D1). Order Number DE94002584. Source: OSTI; NTIS; GPO Dep.

The Oak Ridge Y-12 Plant includes - 800 acres near the northeast corner of the reservation and adjacent to the city of Oak Ridge (Fig. 1-1). The plant is a manufacturing and developmental engineering facility that produced components for various nuclear weapons systems and provides engineering support to other Energy Systems facilities. More than 200 contaminated sites have been identified at the Y-12 Plant that resulted from past waste management practices. Many of the sites have operable units (OUs) based on priority and on investigative and remediation requirements. This Remedial Investigation RI work plan specifically addresses Chestnut Ridge OU 4. Chestnut Ridge OU 4 consists of Rogers Quarry and Lower McCoy Branch (MCB). Rogers Quarry, which is also known as Old Rogers Quarry or Bethel Valley Quarry was used for quarrying from the late 1940s or early 1950s until about 1960. Since that time, the quarry has been used for disposal of coal ash and materials from Y-12 production operations, including classified materials. Disposal of coal ash ended in July 1993. An RI is being conducted at this site in response to CERCLA regulations. The overall objectives of the RI are to collect data necessary to evaluate the nature and extent of contaminants of concern, support an Ecological Risk Assessment and a Human Health Risk Assessment, support the evaluation of remedial alternatives, and ultimately develop a Record of Decision for the site. The purpose of this work plan is to outline RI activities necessary to define the nature and extent of suspected contaminants at Chestnut Ridge OU 4. Potential migration pathways also will be investigated. Data collected during the RI will be used to evaluate the risk posed to human health and the environment by OU 4.

1873 (DOE/OR/21548-243) Work plan for the remedial investigation/feasibility study-environmental assessment for the quarry residuals operable unit at the Weldon Spring Site. USDOE Weldon Spring Site Remedial Action Project, MO (United States); Argonne National Lab., IL (United States). Jan 1994. 148p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-86OR21548. Order Number DE94006381. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy (DOE) is conducting cleanup activities at the Weldon Spring site, which is located in St. Charles County, Missouri, about 48 km (30 mi) west of St. Louis. The Weldon Spring site consists of two noncontiguous areas - the chemical plant area, which includes four raffinate pits, and the quarry. Cleanup activities at the Weldon Spring site are conducted in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, incorporating the

values of the National Environmental Policy Act (NEPA). The contents of the documents prepared for the project are not intended to represent a statement regarding the legal applicability of NEPA to remedial actions conducted under CERCLA. In accordance with the integrated CERCLA/NEPA approach, a remedial investigation/feasibility study-environmental assessment (RI/FS-EA) is being conducted to evaluate conditions and potential responses for the quarry residuals operable unit (QROU). This operable unit consists of the following areas and/or media: the residual material remaining at the Weldon Spring quarry after removal of the pond water and bulk waste; underlying groundwater; and other media located in the surrounding vicinity of the quarry, including adjacent soil, surface water, and sediment in Femme Osage Slough. This work plan identifies the activities within the RI/FS-EA process that are being proposed to address contamination remaining at the quarry area.

1874 (DOE/OR/21949-283) Hazelwood Interim Storage Site annual environmental report for calendar year 1990, Hazelwood, Missouri: Formerly Utilized Sites Remedial Action Program (FUSRAP). Bechtel National, Inc., Oak Ridge, TN (United States). Aug 1991. 125p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-91OR21949. Order Number DE91017592. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental monitoring of the US Department of Energy's (DOE) Hazelwood Interim Storage Site (HISS) and surrounding area began in 1984. This document describes the environmental monitoring program, the program's implementation, and the monitoring results for 1990. HISS was assigned to DOE as part of the decontamination research and development project authorized by Congress under the 1984 Energy and Water Appropriations Act. DOE placed responsibility for HISS under the Formerly Utilized Sites Remedial Action Program, a DOE program to decontaminate or otherwise control sites where residual radioactive materials remain from the early years of the nation's atomic energy program or from commercial operations causing conditions that Congress has authorized DOE to remedy. Environmental monitoring programs have been established at DOE-managed sites to confirm adherence to DOE environmental protection policies; to monitor the potential effects of site operations on human health and the environment; and to ensure compliance with legal and regulatory requirements imposed by federal, state, and local agencies. Environmental monitoring programs are developed and implemented on a site-specific basis to reflect facility characteristics, applicable regulations, hazard potential, quantities and concentrations of materials released, extent and use of affected land and water, and local public interest or concern.

1875 (DOE/OR/21949-284) Colonie Interim Storage Site: Annual environmental report for calendar year 1990, Colonie, New York: Formerly Utilized Sites Remedial Action Program (FUSRAP). Bechtel National, Inc., Oak Ridge, TN (United States). Sep 1991. 170p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-91OR21949. Order Number DE91018921. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental monitoring of the US Department of Energy's (DOE) Colonie Interim Storage Site (CISS) and surrounding area began in 1984. CISS is part of the Formerly Utilized Sites Remedial Action Program (FUSRAP), a DOE program to decontaminate or otherwise control sites where residual radioactive materials remain from the early

years of the nation's atomic energy program or from commercial operations causing conditions that Congress has authorized DOE to remedy. The routine environmental monitoring program at CISS includes sampling networks for external gamma radiation exposures and for radium-226, thorium-232, and total uranium concentrations in surface water, sediment, and groundwater. Additionally, the nonradiological parameters volatile and semivolatile organics, pesticides/polychlorinated biphenyls (PCBs), metals, total organic carbon (TOC), total organic halides (TOX), specific conductivity, and pH are measured in groundwater. 14 refs., 20 figs., 25 tabs.

1876 (DOE/OR/21949-285) Middlesex Sampling Plant: Annual environmental report for calendar year 1990, Middlesex, New Jersey: Formerly Utilized Sites Remedial Action Program (FUSRAP). Bechtel National, Inc., Oak Ridge, TN (United States). Sep 1991. 188p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-91OR21949. Order Number DE91018923. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental monitoring of the US Department of Energy's (DOE) Middlesex Sampling Plant (MSP) and surrounding area began in 1980. MSP is part of the Formerly Utilized Sites Remedial Action Program (FUSRAP), a DOE program to decontaminate or otherwise control sites where residual radioactive materials remain from the early years of the nation's atomic energy program or from commercial operations causing conditions that Congress has authorized DOE to remedy. The environmental monitoring program at MSP includes sampling networks for radon concentrations in air; external gamma radiation exposure; and radium-226, thorium-232, and total uranium concentrations in surface water, sediment, and groundwater. Additionally, several nonradiological parameters were measured in groundwater, surface water, and sediment. 14 refs., 17 figs., 29 tabs.

1877 (DOE/OR/21949-286) Wayne Interim Storage Site: Annual environmental report for calendar year 1990, Wayne, New Jersey: Formerly Utilized Sites Remedial Action Program (FUSRAP). Bechtel National, Inc., Oak Ridge, TN (United States). Sep 1991. 155p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-91OR21949. Order Number DE91018922. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental monitoring of the US Department of Energy's (DOE) Wayne Interim Storage Site (WISS) (a National Priorities List site) and surrounding area began in 1984. WISS is part of the Formerly Utilized Sites Remedial Action Program (FUSRAP), a DOE program to decontaminate or otherwise control sites where residual radioactive materials remain from the early years of the nation's atomic energy program or from commercial operations causing conditions that Congress has authorized DOE to remedy. The environmental monitoring program at WISS includes sampling networks for radon and thoron concentrations in air; external gamma radiation exposure; and radium-226, thorium-232, and total uranium concentrations in surface water, sediment, and groundwater. Sediment samples were also analyzed for thorium-230, and several nonradiological parameters were measured in groundwater. 16 refs., 12 figs., 23 tabs.

1878 (DOE/OR/21949-287) Maywood Interim Storage Site: Annual environmental report for calendar year 1990, Maywood, New Jersey: Formerly Utilized Sites Remedial Action Program (FUSRAP). Bechtel National, Inc., Oak Ridge, TN (United States). Sep 1991. 185p. Sponsored

by USDOE, Washington, DC (United States). DOE Contract AC05-91OR21949. Order Number DE91018920. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental monitoring of the US Department of Energy's (DOE) Maywood Interim Storage Site (MISS) and surrounding area began in 1984. MISS is part of the Formerly Utilized Sites Remedial Action Program (FUSRAP), a DOE program to decontaminate or otherwise control sites where residual radioactive materials remain from the early years of the nation's atomic energy program or from commercial operations causing conditions that Congress has authorized DOE to remedy. The MISS Environmental monitoring programs was established to accommodate facility characteristics, applicable regulations, hazard potential, quantities and concentrations of materials released, extent and use of affected land and water, and local public interest or concern. The environmental monitoring program at MISS includes sampling networks for radon concentrations in air; external gamma radiation exposure; and total uranium, radium-226, and thorium-232 concentrations in surface water, sediment, and groundwater. Additionally, several nonradiological parameters are measured in surface water, sediment, and groundwater. Monitoring results are compared with applicable Environmental Protection Agency (EPA) standards; federal, state, and local applicable or relevant and appropriate requirements (ARARs); and/or DOE derived concentration guidelines (DCGs). Environmental standards, ARARs, and DCGs are established to protect public health and the environment. Results from the 1990 environmental monitoring program show that concentrations of the contaminants of concern were all below applicable standards. Because the site is used only for interim storage and produces no processing effluents, all monitoring, except for radon and direct gamma radiation, was done on a quarterly basis. 18 refs., 17 figs., 28 tabs.

1879 (DOE/OR/21949-288) **St. Louis airport site annual environmental report for calendar year 1990, St. Louis, Missouri: Formerly Utilized Sites Remedial Action Program (FUSRAP).** Bechtel National, Inc., Oak Ridge, TN (United States). Aug 1991. 149p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-91OR21949. Order Number DE91017593. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental monitoring of the US Department of Energy's (DOE) St. Louis Airport Site (SLAPS) and surrounding area began in 1984. SLAPS is part of the Formerly Utilized Sites Remedial Action Program (FUSRAP), a DOE program to decontaminate or otherwise control sites where residual radioactive materials remain from the early years of the nation's atomic energy program or from commercial operations causing conditions that Congress has authorized DOE to remedy. Monitoring results are compared with applicable Environmental Protection Agency (EPA) standards; federal, state, and local applicable or relevant and appropriate requirements (ARARs); and/or DOE derived concentration guidelines (DCGs). Environmental standards, ARARs, and DCGs are established to protect public health and the environment. Results from the 1990 environmental monitoring program demonstrated that the concentrations of contaminants of concern were all below applicable standards, ARARs, and guidelines. Site activities in 1990 were limited to maintenance. SLAPS was in compliance with all applicable regulations during 1990 and has remained in compliance since 1984, when the environmental monitoring program and remedial action began.

1880 (DOE/OR/21949-289) **Niagara Falls storage site annual environmental report for calendar year 1990, Lewiston, New York: Surplus Facilities Management Program (SFMP).** Bechtel National, Inc., Oak Ridge, TN (United States). Aug 1991. 186p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-91OR21949. Order Number DE91017591. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental monitoring of the US DOE Niagara Falls Storage Site (NFSS) and surrounding area began in 1981. NFSS is part of a DOE program to decontaminate or otherwise control sites where residual radioactive materials remain from the early years of the nation's atomic energy program or from commercial operations causing conditions the Congress has authorized DOE to remedy. Environmental monitoring systems at NFSS include sampling networks for radon concentrations in air; external gamma radiation exposure; and total uranium and radium-226 concentrations in surface water sediments, and groundwater. Additionally, several nonradiological parameters are routinely measured in groundwater. During 1990, the average ambient air radon concentration (including background) at NFSS ranged from 0.3 to 0.7 pCi/L (0.01 to 0.03 Bq/L); the maximum at any location for any quarter was 1.6 pCi/L (0.06 Bq/L). The average on-site external gamma radiation exposure level was 69 mR/yr; the average at the property line was 68 mR/yr (including background). The average background radiation level in the area was 66 mR/yr. Average annual concentrations of radium-226 and total uranium in surface water ranged from 0.4E-9 to 0.9E-9 $\mu\text{Ci}/\text{m}^3$ (0.02 to 0.03 Bq/L) and from 5E-9 to 9E-9 $\mu\text{Ci}/\text{m}^3$ (0.2 to 0.3 Bq/L), respectively. Routine analyses of groundwater samples from NFSS included the indicator parameters total organic carbon, total organic halides, pH, and specific conductivity.

1881 (DOE/OR/21949-340) **Hazelwood Interim Storage Site annual environmental report for calendar year 1991, Hazelwood, Missouri.** Bechtel National, Inc., Oak Ridge, TN (United States). Sep 1992. 155p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-91OR21949. Order Number DE93001266. Source: OSTI; NTIS; INIS; GPO Dep.

This document describes the environmental monitoring program at the Hazelwood Interim Storage Site (HISS) and surrounding area, implementation of the program, and monitoring results for 1991. Environmental monitoring of HISS began in 1984 when the site was assigned to the US Department of Energy (DOE) as part of the decontamination research and development project authorized by Congress under the 1984 Energy and Water Development Appropriations Act. DOE placed responsibility for HISS under the Formerly Utilized Sites Remedial Action Program (FUSRAP), a DOE program to decontaminate or otherwise control sites where residual radioactive materials remain from the early years of the nation's atomic energy program or from commercial operations causing conditions that Congress has authorized DOE to remedy. The environmental monitoring program at HISS includes sampling networks for radon concentrations in air; external gamma radiation exposure; and radium-226, thorium-230, and total uranium concentrations in surface water, sediment, and groundwater. Additionally, several nonradiological parameters are measured in groundwater. Monitoring results are compared with applicable Environmental Protection Agency standards, DOE derived concentration guides (DCGs), dose limits, and other requirements in DOE orders. Environmental standards

and DCGs are established to protect public health and the environment.

1882 (DOE/OR/21949-341) Colonie Interim Storage Site annual environmental report for calendar year 1991, Colonie, New York: Formerly Utilized Sites Remedial Action Program (FUSRAP). Bechtel National, Inc., Oak Ridge, TN (United States). Sep 1992. 179p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-91OR21949. Order Number DE93001267. Source: OSTI; NTIS; INIS; GPO Dep.

This document describes the environmental monitoring program at the Colonie Interim Storage Site (CISS) and surrounding area, implementation of the program, and monitoring results for 1991. Environmental monitoring at CISS began in 1984 when Congress added the site to the US Department of Energy's Formerly Utilized Sites Remedial Action Program. CISS property and surrounding areas were radioactively contaminated by operations conducted by National Lead Industries, which manufactured various components from uranium and thorium from 1958 to 1984. The environmental monitoring program at CISS includes sampling networks for external gamma radiation exposure and for radium-226, thorium-232, and total uranium concentrations in surface water, sediment, and groundwater. Additionally, several nonradiological parameters are measured in groundwater. In 1992 the program will also include sampling networks for radioactive and chemical contaminants in stormwater to meet permit application requirements under the Clean Water Act. Monitoring results are compared with applicable Environmental Protection Agency (EPA) standards, DOE derived concentration guides (DCGs), dose limits, and other requirements in DOE orders. Environmental standards are established to protect public health and the environment. Results of environmental monitoring during 1991 indicate that average concentrations of radioactive contaminants of concern were well below applicable standards and DCGs. Concentrations of some chemical contaminants in groundwater were above the New York State Department of Environmental Conservation (Class GA) and EPA guidelines for drinking water. The potential annual radiation exposure (excluding background) calculated for a hypothetical maximally exposed individual is 0.23 mrem (milliroentgen equivalent man), which is less than an individual would receive while traveling in an airplane at 12,000 meters (39,000 feet) for one hour.

1883 (DOE/OR/21949-342) Middlesex Sampling Plant annual environmental report for calendar year 1991, Middlesex, New Jersey: Formerly Utilized Sites Remedial Action Program (FUSRAP). Bechtel National, Inc., Oak Ridge, TN (United States). Sep 1992. 153p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-91OR21949. Order Number DE93001268. Source: OSTI; NTIS; INIS; GPO Dep.

This document describes the environmental monitoring program at the Middlesex Sampling Plant (MSP) and surrounding area, implementation of the program, and monitoring results for 1991. Environmental monitoring of MSP began in 1980 when Congress added the site to the US Department of Energy's (DOE) Formerly Utilized Sites Remedial Action Program (FUSRAP). FUSRAP is a DOE program to decontaminate or otherwise control sites where residual radioactive materials remain from the early years of the nation's atomic energy program or from commercial operations causing conditions that Congress has authorized DOE to remedy. The environmental monitoring program at

MSP includes sampling networks for radon and thoron concentrations in air; external gamma radiation exposure; and radium-226, thorium-232, and total uranium concentrations in surface water, sediment, and groundwater. Additionally, several nonradiological parameters are measured in groundwater, surface water, and sediment. Results of environmental monitoring during 1991 indicate that most concentrations were well below applicable guidelines. The potential radiation dose calculated for a hypothetical maximally exposed individual, based on a conservative but realistic exposure scenario, is 2.3 mrem (milliroentgen equivalent man) per year, which is less than an individual would receive while traveling in an airplane at 12,000 meters for five hours. During 1991, there were no nonroutine releases from the site; MSP was in compliance with applicable regulations for releases from the site. Site activities included environmental monitoring, site maintenance, onsite characterization for the MSP remedial investigation, and additional sediment sampling at the plant outfall to determine the source of the elevated levels of radium-226 and thorium-232.

1884 (DOE/OR/21949-343) Niagara Falls Storage Site annual environmental report for calendar year 1991, Lewiston, New York. Bechtel National, Inc., Oak Ridge, TN (United States). Sep 1992. 186p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-91OR21949. Order Number DE93001262. Source: OSTI; NTIS; INIS; GPO Dep.

This document describes the environmental monitoring program at the Niagara Falls Storage Site (NFSS) and surrounding area, implementation of the program, and monitoring results for 1991. Environmental monitoring at NFSS began in 1981. The site is owned by the US Department of Energy (DOE) and is assigned to the DOE Formerly Utilized Sites Remedial Action Program (FUSRAP). FUSRAP is a program to decontaminate or otherwise control sites where residual radioactive materials remain from the early years of the nation's atomic energy program or from commercial operations causing conditions that Congress has authorized DOE to remedy. The environmental monitoring program at NFSS includes sampling networks for radon concentrations in air; external gamma radiation exposure; and total uranium and radium-226 concentrations in surface water, sediments, and groundwater. Additionally, several nonradiological parameters including seven metals are routinely measured in groundwater. Monitoring results are compared with applicable Environmental Protection Agency (EPA) standards, DOE derived concentration guides (DCGs), dose limits, and other requirements in DOE orders. Environmental standards are established to protect public health and the environment.

1885 (DOE/OR/21949-344) Maywood Interim Storage Site annual environmental report for calendar year 1991, Maywood, New Jersey: Formerly Utilized Sites Remedial Action Program (FUSRAP). Bechtel National, Inc., Oak Ridge, TN (United States). Sep 1992. 189p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-91OR21949. Order Number DE93001263. Source: OSTI; NTIS; INIS; GPO Dep.

This document describes the environmental monitoring program at the Maywood Interim Storage Site (MISS) and surrounding area, implementation of the program, and monitoring results for 1991. Environmental monitoring of MISS began in 1984 when Congress added the site to the US Department of Energy's (DOE) Formerly Utilized Sites Remedial Action Program (FUSRAP). FUSRAP is a DOE

program to identify and decontaminate or otherwise control sites where residual radioactive materials remain from the early years of the nation's atomic energy program or from commercial operations causing conditions that Congress has authorized DOE to remedy. The environmental monitoring program at MISS includes sampling networks for radon and thoron concentrations in air; external gamma radiation-exposure; and total uranium, radium-226, radium-228, thorium-232, and thorium-230 concentrations in surface water, sediment, and groundwater. Additionally, several nonradiological parameters are measured in surface water, sediment, and groundwater. Monitoring results are compared with applicable Environmental Protection Agency standards, DOE derived concentration guides (DCGs), dose limits, and other requirements in DOE orders. Environmental standards are established to protect public health and the environment.

1886 (DOE/OR/21949-345) Wayne Interim Storage Site annual environmental report for calendar year 1991, Wayne, New Jersey: Formerly Utilized Sites Remedial Action Program (FUSRAP). Bechtel National, Inc., Oak Ridge, TN (United States). Sep 1992. 153p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-91OR21949. Order Number DE93001264. Source: OSTI; NTIS; INIS; GPO Dep.

This document describes the environmental monitoring program at the Wayne Interim Storage Site (WISS) and surrounding area, implementation of the program, and monitoring results for 1991. Environmental monitoring of WISS and surrounding area began in 1984 when Congress added the site to the US Department of Energy's (DOE) Formerly Utilized Sites Remedial Action Program (FUSRAP). FUSRAP is a DOE program to decontaminate or otherwise control sites where residual radioactive materials remain from the early years of the nation's atomic energy program or from commercial operations causing conditions that Congress has authorized DOE to remedy. WISS is a National Priorities List site. The environmental monitoring program at WISS includes sampling networks for radon and thoron concentrations in air; external gamma radiation exposure; and radium-226, radium-228, thorium-232, and total uranium concentrations in surface water, sediment, and groundwater. Several nonradiological parameters are also measured in groundwater. Monitoring results are compared with applicable Environmental Protection Agency standards, DOE derived concentration guides, dose limits, and other requirements in DOE orders. Environmental standards are established to protect public health and the environment.

1887 (DOE/OR/21949-346) New Brunswick Site annual environmental report for calendar year 1991, New Brunswick, New Jersey: Formerly Utilized Sites Remedial Action Program (FUSRAP). Bechtel National, Inc., Oak Ridge, TN (United States). Sep 1992. 130p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-91OR21949. Order Number DE93001265. Source: OSTI; NTIS; INIS; GPO Dep.

This document describes the environmental monitoring program at the New Brunswick Site (NBS) and surrounding area, implementation of the program, and monitoring results for 1991. The site, near New Brunswick, New Jersey, is a 5.6-acre vacant, fenced, and grass-covered area. Environmental monitoring of NBS began in 1981 when the site was part of the US Department of Energy's (DOE) Surplus Facilities Management Program. In 1990 responsibility for NBS

was transferred to the Formerly Utilized Sites Remedial Action Program (FUSRAP). FUSRAP is a DOE program to identify and decontaminate or otherwise control sites where residual radioactive materials remain from the early years of the nation's atomic energy program or from commercial operations causing conditions that Congress has authorized DOE to remedy. The environmental monitoring program at NBS includes sampling networks for radon and thoron in air; external gamma radiation exposure; and radium-226, radium-228, thorium-228, thorium-230, thorium-232, americium-241, cesium-137, plutonium-239, and total uranium in surface water, sediment, and groundwater. Several nonradiological parameters are also measured in groundwater, surface water, and sediments. Monitoring results are compared with applicable Environmental Protection Agency standards, DOE derived concentration guides, dose limits, and other requirements in DOE orders. Environmental standards are established to protect public health and the environment.

1888 (DOE/OR/21949-364) Maywood Interim Storage Site environmental report for calendar year 1992, 100 West Hunter Avenue, Maywood, New Jersey: Formerly Utilized Sites Remedial Action Program (FUSRAP). Bechtel National, Inc., Oak Ridge, TN (United States). May 1993. 161p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-91OR21949. Order Number DE93017302. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes the environmental surveillance program at the Maywood Interim Storage Site (MISS) and provides the results for 1992. Environmental monitoring of MISS began in 1984, when the site was assigned to DOE by Congress through the Energy and Water Development Appropriations Act and was placed under DOE's Formerly Utilized Sites Remedial Action Program (FUSRAP). FUSRAP was established to identify and decontaminate or otherwise control sites where residual radioactive materials remain from the early years of the nation's atomic energy program or from commercial operations causing conditions that Congress has authorized DOE to remedy. MISS is part of a National Priorities List (NPL) site. The environmental surveillance program at MISS includes sampling networks for radon and thoron in air; external gamma radiation exposure; and radium-226, radium-228, thorium-232, and total uranium in surface water, sediment, and groundwater. Additionally, chemical analysis includes metals and organic compounds in surface water and groundwater and metals in sediments. This program assists in fulfilling the DOE objective of measuring and monitoring effluents from DOE activities and calculating hypothetical doses to members of the general public. Monitoring results are compared with applicable Environmental Protection Agency (EPA) and state standards, DOE derived concentration guides (DCGs), dose limits, and other DOE requirements. Environmental standards are established to protect public health and the environment. The radiological data for all media sampled support the conclusion that doses to the public are not distinguishable from natural background radiation.

1889 (DOE/OR/21949-365) Wayne Interim Storage Site environmental report for calendar year 1992, 868 Black Oak Ridge Road, Wayne, New Jersey: Formerly Utilized Sites Remedial Action Program (FUSRAP). Bechtel National, Inc., Oak Ridge, TN (United States). May 1993. 150p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-91OR21949. Order Number DE93017303. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes the environmental surveillance program at the Wayne Interim Storage Site (WISS) and provides the results for 1992. The fenced, site, 32 km (20 mi) northwest of Newark, New Jersey, was used between 1948 and 1971 for commercial processing of monazite sand to separate natural radioisotopes - predominantly thorium. Environmental surveillance of WISS began in 1984 in accordance with Department of Energy (DOE) Order 5400.1 when Congress added the site to DOE's Formerly Utilized Sites Remedial Action Program (FUSRAP). The environmental surveillance program at WISS includes sampling networks for radon and thoron in air; external gamma radiation exposure; radium-226, radium-228, thorium-230, thorium-232, total uranium, and several chemicals in surface water and sediment; and total uranium, radium-226, radium-228, thorium-230, thorium-232, and organic and inorganic chemicals in groundwater. Monitoring results are compared with applicable Environmental Protection Agency (EPA) and state standards, DOE derived concentration guides (DCGs), dose limits, and other DOE requirements. This monitoring program assists in fulfilling the DOE policy of measuring and monitoring effluents from DOE activities and calculating hypothetical doses. Results for environmental surveillance in 1992 show that the concentrations of all radioactive and most chemical contaminants were below applicable standards.

1890 (DOE/OR/21949-366) Middlesex Sampling Plant environmental report for calendar year 1992, 239 Mountain Avenue, Middlesex, New Jersey: Formerly Utilized Sites Remedial Action Program (FUSRAP). Bechtel National, Inc., Oak Ridge, TN (United States). May 1993. 135p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-91OR21949. Order Number DE93017304. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes the environmental surveillance program at the Middlesex Sampling Plant (MSP) and provides the results for 1992. The site, in the Borough of Middlesex, New Jersey, is a fenced area and includes four buildings and two storage piles that contain 50,800 m³ of radioactive and mixed hazardous waste. More than 70 percent of the MSP site is paved with asphalt. The MSP facility was established in 1943 by the Manhattan Engineer District (MED) to sample, store, and/or ship uranium, thorium, and beryllium ores. In 1955 the Atomic Energy Commission (AEC), successor to MED, terminated the operation and later used the site for storage and limited sampling of thorium residues. In 1967 AEC activities ceased, onsite structures were decontaminated, and the site was certified for unrestricted use under criteria applicable at that time. In 1980 the US Department of Energy (DOE) initiated a multiphase remedial action project to clean up several vicinity properties onto which contamination from the plant had migrated. Material from these properties was consolidated into the storage piles onsite. Environmental surveillance of MSP began in 1980 when Congress added the site to DOE's Formerly Utilized Sites Remedial Action Program. The environmental surveillance program at MSP includes sampling networks for radon and thoron in air; external gamma radiation exposure; and radium-226, radium-228, thorium-230, thorium-232, and total uranium in surface water, sediment, and groundwater. Additionally, chemical analyses are performed to detect metals and organic compounds in surface water and groundwater and metals in sediments. This program assists in fulfilling the DOE policy of measuring and monitoring effluents from DOE activities and calculating hypothetical doses.

1891 (DOE/OR/21949-367) Niagara Falls Storage Site environmental report for calendar year 1992, 1397 Pletcher Road, Lewiston, New York: Formerly Utilized Sites Remedial Action Program (FUSRAP). Bechtel National, Inc., Oak Ridge, TN (United States). May 1993. 150p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-91OR21949. Order Number DE93018599. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes the environmental surveillance program at the Niagara Falls Storage Site (NFSS) and provides the results for 1992. From 1944 to the present, the primary use of NFSS has been storage of radioactive residues produced as a by-product of uranium production. All onsite areas of residual radioactivity above guidelines have been remediated. Materials generated during remediation are stored onsite in the 4-ha (10-acre) waste containment structure (WCS). The WCS is a clay-lined, clay-capped, and grass-covered storage pile. The environmental surveillance program at NFSS includes sampling networks for radon concentrations in air; external gamma radiation exposure; and total uranium and radium-226 concentrations in surface water, sediments, and groundwater. Several chemical parameters, including seven metals, are also routinely measured in groundwater. This surveillance program assists in fulfilling the DOE policy of measuring and monitoring effluents from DOE activities and calculating hypothetical doses. Monitoring results are compared with applicable Environmental Protection Agency (EPA) and New York State Department of Environmental Conservation (NYSDEC) standards, DOE derived concentration guides (DCGs), dose limits, and other DOE requirements. Results of environmental monitoring during 1992 indicate that levels of the parameters measured were in compliance with all but one requirement: Concentrations of iron and manganese in groundwater were above NYSDEC groundwater quality standards. However, these elements occur naturally in the soils and groundwater associated with this region. In 1992 there were no environmental occurrences or reportable quantity releases.

1892 (DOE/OR/21949-368) Colonie Interim Storage Site environmental report for calendar year 1992, 1130 Central Avenue, Colonie, New York: Formerly Utilized Sites Remedial Action Program (FUSRAP). Bechtel National, Inc., Oak Ridge, TN (United States). May 1993. 193p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-91OR21949. Order Number DE93018600. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes the environmental surveillance program at the Colonie Interim Storage Site (CISS) and provides the results for 1992. The site is located in eastern New York State, approximately 6.4 km (4.0 mi) northwest of downtown Albany. From 1958 to 1984, National Lead (NL) Industries used the facility to manufacture various components from depleted and enriched uranium natural thorium. Environmental monitoring of CISS began in 1984 when Congress added the site to the US Department of Energy's (DOE) Formerly Utilized Sites Remedial Action Program (FUSRAP). FUSRAP is a program established to identify and decontaminate or otherwise control sites where residual radioactive materials remain from the early years of the nation's atomic energy program or from commercial operations causing conditions that Congress has authorized DOE to remedy. The environmental surveillance program at CISS includes sampling networks for external gamma radiation exposure and for thorium-232 and total uranium concentrations

in surface water, sediment, and groundwater. Several chemical parameters are also measured in groundwater, including total metals, volatile organics, and water quality parameters. This surveillance program assists in fulfilling the DOE policy of measuring and monitoring effluents from DOE activities and calculating hypothetical doses. Results are compared with applicable Environmental Protection Agency (EPA) and New York State Department of Environmental Conservation (NYSDEC) standards, DOE derived concentration guides (DCGs), dose limits, and other DOE requirements.

1893 (DOE/OR/21949-369) Hazelwood Interim Storage Site environmental report for calendar year 1992, 9200 Latty Avenue, Hazelwood, Missouri. Bechtel National, Inc., Oak Ridge, TN (United States). May 1993. 159p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-91OR21949. Order Number DE93018338. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes the environmental surveillance program at the Hazelwood Interim storage Site (HISS) and surrounding area, provides the results for 1992, and discusses applicable environmental standards and requirements with which the results were compared. HISS is located in eastern Missouri in the City of Hazelwood (St. Louis County) and occupies approximately 2.2 ha (5.5 acres). Environmental monitoring of HISS began in 1984 when the site was assigned to the US Department of Energy (DOE) as part of the decontamination research and development project authorized by Congress under the 1984 Energy and Water Development Appropriations Act. DOE placed responsibility for HISS under the Formerly Utilized Sites Remedial Action Program (FUSRAP), which was established to identify and decontaminate or otherwise control sites where residual radioactive materials remain from the early years of the nation's atomic energy program or from commercial operations causing conditions that Congress has authorized DOE to remedy. In 1992 there were no environmental occurrences or unplanned contaminant releases as defined in DOE requirements and in the Superfund Amendment and Reauthorization Act (SARA) Title III of CERCLA.

1894 (DOE/OR/21949-374) Colonie Interim Storage Site environmental surveillance report for calendar year 1993. Bechtel National, Inc., Oak Ridge, TN (United States). Jun 1994. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-91OR21949. Order Number DE94012720. Source: OSTI; NTIS; INIS; GPO Dep.

This report summarizes the results of environmental surveillance activities conducted at the Colonie Interim Storage Site (CISS) during calendar year 1993. It includes an overview of site operations, the basis for radiological and nonradiological monitoring, dose to the offsite population, and summaries of environmental programs at CISS. Environmental surveillance activities were conducted in accordance with the site environmental monitoring plan, which describes the rationale and design criteria for the surveillance program, the frequency of sampling and analysis, specific sampling and analysis procedures, and quality assurance requirements. Appendix A contains a discussion of the nature of radiation, the way it is measured, and common sources of it. The primary environmental guidelines and limits applicable to CISS are given in US Department of Energy (DOE) orders and mandated by six federal acts: the Clean Air Act; the Clean Water Act; the Resource Conservation and Recovery Act (RCRA); the Toxic Substances Control Act; the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA); and the National

Environmental Policy Act (NEPA). DOE began environmental monitoring of CISS in 1984 when DOE was authorized by Congress through the Energy and Water Development Appropriations Act to conduct a decontamination research and development program at the site. The site was subsequently assigned to DOE's Formerly Utilized Sites Remedial Action Program (FUSRAP).

1895 (DOE/OR/21949-378) Hazelwood Interim Storage Site environmental surveillance report for calendar year 1993. Bechtel National, Inc., Oak Ridge, TN (United States). Jun 1994. 32p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-91OR21949. Order Number DE94012719. Source: OSTI; NTIS; INIS; GPO Dep.

This report summarizes the results of environmental surveillance activities conducted at the Hazelwood Interim Storage Site (HISS) during calendar year 1993. It includes an overview of site operations, the basis for monitoring for radioactive and non-radioactive parameters, summaries of environmental program at HISS, a summary of the results, and the calculated hypothetical radiation dose to the offsite population. Environmental surveillance activities were conducted in accordance with the site environmental monitoring plan, which describes the rationale and design criteria for the surveillance program, the frequency of sampling and analysis, specific sampling and analysis procedures, and quality assurance requirements. The US Department of Energy (DOE) began environmental monitoring of HISS in 1984, when the site was assigned to DOE by Congress through the energy and Water Development Appropriations Act and subsequent to DOE's Formerly Utilized Sites Remediation Action Program (FUSRAP). Contamination at HISS originated from uranium processing work conducted at Mallinckrodt Chemical Works at the St. Louis Downtown Site (SLDS) from 1942 through 1957.

1896 (DOE/OR/21949-379) Niagara Falls Storage Site environmental surveillance report for calendar year 1993. Bechtel National, Inc., Oak Ridge, TN (United States). Jun 1994. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-91OR21949. Order Number DE94012721. Source: OSTI; NTIS; INIS; GPO Dep.

This report summarizes the results of environmental surveillance activities conducted at the Niagara Falls Storage Site (NFSS) during calendar year 1993. It includes an overview of site operations, the basis for radiological and nonradiological monitoring, a summary of the results, and the estimated dose to the offsite population. Environmental surveillance activities were conducted in accordance with the site environmental monitoring plan, which describes the rationale and design criteria for the surveillance program, the frequency of sampling and analysis, specific sampling and analysis procedures, and quality assurance requirements. NFSS is in compliance with National Emission Standards for Hazardous Air Pollutants (NESHAPs) Subpart H of the Clean Air Act as well as the requirements of the National Pollutant Discharge Elimination System (NPDES) under the Clean Water Act. Located in northwestern New York, the site covers 191 acres. From 1944 to the present, the primary use of NFSS has been storage of radioactive residues that were by-products of uranium production. Most onsite areas of residual radioactivity above regulatory guidelines were remediated during the early 1980s. Additional isolated areas of onsite contamination were remediated in 1989, and the materials were consolidated into the waste containment structure in 1991. Remediation of the site has now been completed.

1897 (DOE/RL-89-28-Rev.1) State Environmental Policy Act (SEPA) Environmental Checklist Form 216-B-3 Expansion Ponds Closure Plan: Revision 1. USDOE Richland Field Office, WA (United States). Dec 1993. 871p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94006345. Source: OSTI; NTIS; INIS; GPO Dep.

The 216-B-3 Expansion Ponds Closure Plan (Revision 1) consists of a Part A Dangerous Waste Permit Application and a Resource Conservation and Recovery Act Closure Plan. An explanation of the Part A submitted with this document is provided at the beginning of the Part A Section. The closure plan consists of nine chapters and five appendices. The 216-B-3 Pond System consists of a series of four earthen, unlined, interconnected ponds and the 216-B-3-3 Ditch that receive waste water from various 200 East Area operating facilities. These four ponds, collectively. Waste water (primarily cooling water, steam condensate, and sanitary water) from various 200 East Area facilities is discharged to the 216-B-3-3 Ditch. Water discharged to the 216-B-3-3 Ditch flows directly into the 216-B-3 Pond. In the past, waste water discharges to B Pond and the 216-B-3-3 Ditch contained mixed waste (radioactive waste and dangerous waste). The radioactive portion of mixed waste has been interpreted by the US Department of Energy (DOE) to be regulated under the Atomic Energy Act of 1954; the non-radioactive dangerous portion of mixed waste is regulated under RCRA. Mixed waste also may be considered a hazardous substance under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) when considering remediation of waste sites.

1898 (DOE/RL-90-03-Rev.2) State Environmental Policy Act (SEPA) environmental checklist forms for 304 Concretion Facility Closure Plan: Revision 2. USDOE Richland Operations Office, WA (United States). Nov 1993. 312p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94007150. Source: OSTI; NTIS; INIS; GPO Dep.

The 300 Area of the Hanford Site contains reactor fuel manufacturing facilities and several research and development laboratories. Recyclable scrap uranium with zircaloy-2 and copper silicon alloy, uranium-titanium alloy, beryllium/zircaloy-2 alloy, and zircaloy-2 chips and fines were secured in concrete billets (7.5-gallon containers) in the 304 Facility, located in the 300 Area. The beryllium/zircaloy-2 alloy and zircaloy-2 chips and fines are designated as mixed waste with the characteristic of ignitability. The concretion process reduced the ignitability of the fines and chips for safe storage and shipment. This process has been discontinued and the 304 Facility is now undergoing closure as defined in the Resource Conservation and Recovery Act (RCRA) of 1976 and the Washington Administrative Code (WAC) Dangerous Waste Regulations, WAC 173-303-040. This closure plan presents a description of the 304 Facility, the history of materials and waste managed, and the procedures that will be followed to close the 304 Facility. The 304 Facility is located within the 300-FF-3 (source) and 300-FF-5 (groundwater) operable units, as designated in the Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement) (Ecology et al. 1992). Contamination in the operable units 300-FF-3 and 300-FF-5 is scheduled to be addressed through the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 remedial action process. Therefore, all soil remedial action at the 304 Facility will be conducted as part of the CERCLA remedial action of operable units 300-FF-3 and 300-FF-5.

1899 (DOE/RL-90-04-Rev.1) 303-K Radioactive Mixed-Waste Storage Facility closure plan: Revision 1. USDOE Richland Operations Office, WA (United States). Nov 1991. 270p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93002176. Source: OSTI; NTIS; INIS; GPO Dep.

The Hanford Site, located northwest of Richland, Washington, houses reactors chemical-separation systems, and related facilities used for the production of special nuclear materials. The 300 Area of the Hanford Site contains reactor fuel manufacturing facilities and several research and development laboratories. The 303-K Radioactive Mixed-Waste Storage Facility (303-K Facility) has been used since 1943 to store various radioactive, and dangerous process materials and wastes generated by the fuel manufacturing processes in the 300 Area. The mixed wastes are stored in US Department of Transportation (DOT)-specification containers (DOT 1988). The north end of the building was used for storage of containers of liquid waste and the outside storage areas were used for containers of solid waste. Because only the north end of the building was used, this plan does not include the southern end of the building. This closure plan presents a description of the facility, the history of materials and wastes managed, and a description of the procedures that will be followed to close the 303-K Facility as a greater than 90-day storage facility. The strategy for closure of the 303-K Facility is presented in Chapter 6.0.

1900 (DOE/RL-90-08) Remedial Investigation/feasibility study work plan for the 100-BC-5 operable unit, Hanford Site, Richland, Washington. USDOE Richland Operations Office, WA (United States); Westinghouse Hanford Co., Richland, WA (United States). Jul 1992. 368p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92018160. Source: OSTI; NTIS; INIS; GPO Dep.

Four areas of the Hanford Site (the 100, 200, 300, and 1100 Areas) have been included on the US Environmental Protection Agency's (EPA's) National Priorities List (NPL) under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA). The Tri-Party Agreement requires that the cleanup programs at the Hanford Site integrate the requirements of CERCLA, RCRA, and Washington State's dangerous waste (the state's RCRA-equivalent) program. This work plan and the attached supporting project plans establish the operable unit setting and the objectives, procedures, tasks, and schedule for conducting the CERCLA remedial investigation/feasibility study (RI/FS) for the 100-BC-5 operable unit. The 100-B/C Area consists of the 100-BC-5 groundwater operable unit and four source operable units. The 100-BC-5 operable unit includes all contamination found in the aquifer soils and water beneath the 100-B/C Area. Source operable units include facilities and unplanned release sites that are potential sources of contamination.

1901 (DOE/RL-90-20) Remedial Investigation/feasibility study work plan for the 100-KR-1 operable unit, Hanford Site, Richland, Washington. USDOE Richland Operations Office, WA (United States). Jul 1992. 314p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93002197. Source: OSTI; NTIS; INIS; GPO Dep.

Four areas of the Hanford Site (the 100, 200, 300, and 1100 Areas) have been included on the US Environmental Protection Agency's (EPA's) National Priorities List (NPL)

under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA). Figure 1-1 shows the location of these areas. Under the Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement, Ecology et al. 1990a), signed by the Washington State Department of Ecology (Ecology), EPA, and the US Department of Energy (DOE), more than 1,000 inactive waste disposal and unplanned release sites on the Hanford Site have been grouped into a number of source and groundwater operable units. These operable units contain contamination in the form of hazardous waste, radioactive/hazardous mixed waste, and other CERCLA hazardous substances. Also included in the Tri-Party Agreement are 55 Resource Conservation and Recovery Act (RCRA) treatment, storage, or disposal (TSD) facilities that will be closed or permitted to operate in accordance with RCRA regulations, under the authority of Chapter 173-303 Washington Administrative Code (WAC). Some of the TSD facilities are included in the operable units. This work plan and the attached supporting project plans establish the objectives, procedures, tasks, and schedule for conducting the CERCLA remedial investigation/feasibility study (RI/FS) for the 100-KR-1 operable unit. The 100-KR-1 source operable unit is one of three source operable units in the 100-K Area. Source operable units include facilities and unplanned release sites that are potential sources of hazardous substance contamination.

1902 (DOE/RL-90-0025-Rev.1) 105-DR Large Sodium Fire Facility closure plan: Revision 1. USDOE Richland Field Office, WA (United States). May 1993. 186p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94003465. Source: OSTI; NTIS; INIS; GPO Dep.

The Hanford Site, located northwest of the city of Richland, Washington, houses reactors, chemical-separation systems, and related facilities used for the production of special nuclear materials, and activities associated with nuclear energy development. The 105-DR Large Sodium Fire Facility (LSFF), which was in operation from about 1972 to 1986, was a research laboratory that occupied the former ventilation supply room on the southwest side of the 105-DR Reactor facility. The LSFF was established to provide a means of investigating fire and safety aspects associated with large sodium or other metal alkali fires in the liquid metal fast breeder reactor (LMFBR) facilities. The 105-DR Reactor facility was designed and built in the 1950's and is located in the 100-D Area of the Hanford Site. The building housed the 105-DR defense reactor, which was shut down in 1964. The LSFF was initially used only for engineering-scale alkali metal reaction studies. In addition, the Fusion Safety Support Studies program sponsored intermediate-size safety reaction tests in the LSFF with lithium and lithium lead compounds. The facility has also been used to store and treat alkali metal waste, therefore the LSFF is subject to the regulatory requirements for the storage and treatment of dangerous waste. Closure will be conducted pursuant to the requirements of the Washington Administrative Code (WAC) 173-303-610. This closure plan presents a description of the facility, the history of waste managed, and the procedures that will be followed to close the LSFF as an Alkali Metal Treatment Facility. No future use of the LSFF is expected.

1903 (DOE/RL-91/09) Hanford 300 Area Development Plan. Daly, K.S. (Westinghouse Hanford Co., Richland, WA (United States)); Seiler, S.W.; Hail, J.C. USDOE Richland Operations Office, WA (United States). Sep

1991. 162p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92012593. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of the Hanford 300 Area Development Plan (Development Plan) is to guide the physical development of the 300 Area in accordance with US Department of Energy (DOE) Order 4320.1B (DOE 1991b) by performing the following: (1) Establishing a land use plan, setting land use categories that meet the needs of existing and proposed activities; (2) Coordinating existing, 5-yr, and long-range development plans and guiding growth in accordance with those plans; (3) Establishing development guidelines to encourage cost-effective development and minimize conflicts between adjacent activities; (4) Identifying site development issues that need further analysis; Integrating program plans with development plans to ensure a logical progression of development; and, (6) Integrating DOE plans with local agency plans (i.e., city, country, state, and Tri-Cities Science and Technology Park plans).

1904 (DOE/RL-91-14) Public comments and responses to the 1989 Hanford cleanup five-year plan. USDOE Richland Operations Office, WA (United States). Jun 1991. 179p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91016782. Source: OSTI; NTIS; INIS; GPO Dep.

In April 1990 the US Department of Energy (DOE) issued a site-specific Five-Year Plan (DOE-RL 1989a) on Hanford's cleanup for public review and comment. The plan guides Hanford in carrying out DOE's national plan for environmental restoration and waste management. During the 90-day public comment period, DOE held nine public meetings to answer questions and gather comments on the plan. This report is in three main sections. The first presents consolidated public comments and responses. These were compiled from both verbal comments from public meetings and written comments. The second section contains comments not responded to in this plan. Those comments were outside this plan's scope, related to how we gathered public comments, or intended for and directed to DOE-Headquarters. In the appendixes are the written comment letters we received and a short glossary and list of special terms we use. The source of comments is shown in parentheses after the comment. The individual who made the comment, the city of the public meeting, or the organization name is generally used. When several sources gave the same comment, a source was not listed. 26 refs.

1905 (DOE/RL-91-25) Environmental restoration and waste management site-specific plan for Richland Operations Office: Hanford site five-year plan, fiscal years 1993-1997. USDOE Richland Operations Office, WA (United States). Sep 1991. 380p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92000891. Source: OSTI; NTIS; INIS; GPO Dep.

This document was prepared to implement and support the US Department of Energy-Headquarters (DOE-HQ) national plan. The national plan, entitled Environmental Restoration and Waste Management Five-Year Plan (DOE 1990b) (hereinafter referred to as the DOE-HQ Five-Year Plan) is the cornerstone of the US Department of Energy's (DOE) long-term strategy in environmental restoration and waste management. The DOE-HQ Five-Year Plan addresses overall philosophy and environmental and waste-related activities under the responsibilities of the DOE Office of Environmental Restoration and Waste Management. The plan also reaffirms DOE-HQ goals to bring its nuclear sites

into environmental compliance in cooperation with its regulators and the public, and to clean up and restore the environment by 2019 (the commitment for the Hanford Site is for one year sooner, or 2018). This document is part of the site-specific plan for the US Department of Energy-Richland Operations Office (DOE-RL). It is the first revision of the original plan, which was dated December 1989 (DOE-RL 1989a). This document is a companion document to the Overview of the Hanford Cleanup Five-Year Plan (DOE-RL 1989d) and The Hanford Site Environmental Restoration and Waste Management Five-Year Plan Activity Data Sheets (DOE-RL 1991). Although there are three documents that make up the complete DOE-RL plan, this detailed information volume was prepared so it could be used as a standalone document. 71 refs., 40 figs., 28 tabs.

1906 (DOE/RL-91-59) Closure report for N Reactor. USDOE Richland Operations Office, WA (United States). Jan 1994. 305p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94005982. Source: OSTI; NTIS; INIS; GPO Dep.

This report has been prepared to satisfy Section 3156(b) of Public Law 101-189 (Reports in Connection with Permanent Closures of Department of Energy Defense Nuclear Facilities), which requires submittal of a Closure Report to Congress by the Secretary of Energy upon the permanent cessation of production operations at a US Department of Energy (DOE) defense nuclear facility (Watkins 1991). This closure report provides: (1) A complete survey of the environmental problems at the facility; (2) Budget quality data indicating the cost of environmental restoration and other remediation and cleanup efforts at the facility; (3) A proposed cleanup schedule.

1907 (DOE/RL-92-18) Semiworks source aggregate area management study report. USDOE Richland Field Office, WA (United States). May 1993. 502p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93013051. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents the results of an aggregate area management study (AAMS) for the Semi-Works Aggregate Area in the 200 Areas of the US Department of Energy (DOE) Hanford Site in Washington State. This scoping level study provides the basis for initiating Remedial Investigation/Feasibility Study (RI/FS) activities under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) or Resource Conservation and Recovery Act (RCRA) Facility Investigations WD and Corrective Measures Studies (CMS) under RCRA. This report also integrates select RCRA treatment storage, or disposal (TSD) closure activities with CERCLA and RCRA past-practice investigations. This approach is described and justified in The Hanford Federal Facility Agreement and Consent Order Change Package. This strategy provides new concepts for: accelerating decision-making by maximizing the use of existing data consistent with data quality objectives (DQOs); and undertaking expedited response actions (ERAS) and/or interim remedial measures (IRMs), as appropriate, to either remove threats to human health and welfare and the environment, or to reduce risk by reducing toxicity, mobility, or volume of contaminants.

1908 (DOE/RL-92-20-Draft) Hanford Site Development Plan. Hathaway, H.B. (Westinghouse Hanford Co., Richland, WA (United States)); Daly, K.S.; Rinne, C.A.; Seiler, S.W. USDOE Richland Field Office, WA (United States); Westinghouse Hanford Co., Richland, WA (United

States). May 1992. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93011253. Source: OSTI; NTIS; INIS; GPO Dep.

The Hanford Site Development Plan (HSDP) provides an overview of land use, infrastructure, and facility requirements to support US Department of Energy (DOE) programs at the Hanford Site. The HSDP's primary purpose is to inform senior managers and interested parties of development activities and issues that require a commitment of resources to support the Hanford Site. The HSDP provides a land use plan for the Hanford Site and presents a picture of what is currently known and anticipated in accordance with DOE Order 4320.1B. Site Development Planning. The HSDP will be updated annually as future decisions further shape the mission and overall site development process. Further details about Hanford Site development are defined in individual area development plans.

1909 (DOE/RL-92-29) Hanford 200 Areas Development Plan. Rinne, C.A.; Daly, K.S. USDOE Richland Operations Office, WA (United States). Aug 1993. 173p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94001179. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of the Hanford 200 Areas Development Plan (Development Plan) is to guide the physical development of the 200 Areas (which refers to the 200 East Area, 200 West Area, and 200 Area Corridor, located between the 200 East and 200 West Areas) in accordance with US Department of Energy (DOE) Order 4320.1B (DOE 1991a) by performing the following: Establishing a land-use plan and setting land-use categories that meet the needs of existing and proposed activities. Coordinating existing, 5-year, and long-range development plans and guiding growth in accordance with those plans. Establishing development guidelines to encourage cost-effective development and minimize conflicts between adjacent activities. Identifying site development issues that need further analysis. Integrating program plans with development plans to ensure a logical progression of development. Coordinate DOE plans with other agencies [(i.e., Washington State Department of Ecology (Ecology) and US Environmental Protection Agency (EPA)]. Being a support document to the Hanford Site Development Plan (DOE-RL 1990a) (parent document) and providing technical site information relative to the 200 Areas.

1910 (DOE/RL-92-43) Phase 1 remedial investigation report for the 300-FF-1 operable unit. USDOE Richland Field Office, WA (United States). Nov 1993. 890p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94003904. Source: OSTI; NTIS; INIS; GPO Dep.

The focus of this remedial investigation (RI) is the 300-FF-1 operable unit, one of five hazardous substance response project units associated with the 300 Aggregate Area of the US Department of Energy's (DOE's) Hanford Site. The 300-FF-1 operable unit contains many of the major active and inactive liquid waste disposal facilities within the 300 Area (DOE-RL 1990a). In November 1989, the US Environmental Protection Agency (EPA) placed the 300 Area on the National Priorities List (NPL) contained within Appendix B of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP, 53 FR 51391 et seq). The EPA took this action pursuant to their authority under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA, 42 USC 9601 et seq.). The DOE

Richland Field Office (RL), EPA, and the Washington Department of Ecology (Ecology) issued the Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement), in May 1989 (Ecology et al. 1989). This agreement, among other things, governs all CERCLA efforts at the Hanford Site. In June 1990, a remedial investigation/feasibility study (RI/FS) work plan for the 300-FF-1 operable unit was issued pursuant to the Tri-Party Agreement. The purpose of the 300-FF-1 operable unit RI is to gather and develop the necessary information to support the development and analysis of remedial alternatives during the FS. The RI analysis will, in turn, be used by Tri-Party Agreement signatories to make a risk-management-based selection of remedies for the releases of hazardous substances that have occurred from the 300-FF-1 plant. This RI report documents the findings of the Phase I RI to allow DOE-RL, EPA, and Ecology to assess the focus of the project, determine the need for further RI activities, and evaluate the FS.

1911 (DOE/RL-92-51) 100 Area soil washing treatability test plan. USDOE Richland Field Office, WA (United States). Mar 1993. 58p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93012617. Source: OSTI; NTIS; INIS; GPO Dep.

This test plan describes specifications, responsibilities, and general methodology for conducting a soil washing treatability study as applied to source unit contamination in the 100 Area. The objective of this treatability study is to evaluate the use of physical separation systems and chemical extraction methods as a means of separating chemically and radioactively contaminated soil fractions from uncontaminated soil fractions. The purpose of separating these fractions is to minimize the volume of soil requiring permanent disposal. It is anticipated that this treatability study will be performed in two phases of testing, a remedy screening phase and a remedy selection phase. The remedy screening phase consists of laboratory- and bench-scale studies performed by Battelle Pacific Northwest Laboratories (PNL) under a work order issued by Westinghouse Hanford Company (Westinghouse Hanford). This phase will be used to provide qualitative evaluation of the potential effectiveness of the soil washing technology. The remedy selection phase, consists of pilot-scale testing performed under a separate service contract to be competitively bid under Westinghouse Hanford direction. The remedy selection phase will provide data to support evaluation of the soil washing technology in future feasibility studies for Interim Remedial Measures (IRMs) or final operable unit (OU) remedies. Performance data from these tests will indicate whether applicable or relevant and appropriate requirements (ARARs) or cleanup goals can be met at the site(s) by application of soil washing. The remedy selection tests will also allow estimation of costs associated with implementation to the accuracy required for the Feasibility Study.

1912 (DOE/RL-92-71) 100-D Ponds closure plan. USDOE Richland Field Office, WA (United States). Mar 1993. 316p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93012620. Source: OSTI; NTIS; INIS; GPO Dep.

The 100-D Ponds is located within the Hanford Site and is a land surface impoundment for the disposal of liquid effluent. This unit has been classified as a Resource Conservation and Recovery Act of 1976 (RCRA) treatment, storage, and/or disposal (TSD) unit because of a potential for having received nonradioactive, regulated dangerous waste. These ponds are no longer being used to receive

waste with a potential to be dangerous and so will be closed as a RCRA-regulated TSD unit consists of a Part A Permit Application (Revision 3) and a closure plan. The Part A Permit Application revisions are explained at the beginning of the Part A section. The closure plan presents a description of the 100-D Ponds structures and boundaries, the history of the waste managed, and the approach that will be followed to close the 100-D Ponds TSD unit. Radionuclides (source, special nuclear, and by-product material) are not within the scope of WAC 173-303 or of this closure plan. The dangerous waste directly leading to the classification of the site as a RCRA TSD unit did not contain radioactive constituents. Information provided on radionuclides is only for general knowledge where appropriate. Only dangerous constituents derived from the 100-D Ponds operations are addressed in this closure plan.

1913 (DOE/RL-92-72-Rev.1) 200 Area Effluent Treatment Facility: Delineating petition: Revision 1. USDOE Richland Operations Office, WA (United States). Aug 1993. 725p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93040412. Source: OSTI; NTIS; INIS; GPO Dep.

Waste water has been generated for over 40 years as a result of operations conducted on the Hanford Site. This waste water previously was discharged to cribs, ponds, or ditches. An example of such waste water includes process condensate that might have been in contact with dangerous waste or mixed waste (containing both radioactive and dangerous components). This petition presents the treatment technologies that are designed into the 200 Area Effluent Treatment Facility to eliminate the dangerous characteristics of the waste and to delist the effluent in accordance with the requirements found in 40 Code of Federal Regulations 260.20 and 260.22. The purpose of this petition is to demonstrate that the 242-A Evaporator process condensate will be treated adequately so that the effluent from the 200 Area Effluent Treatment Facility will no longer require management as a regulated dangerous waste. This demonstration was performed by use of a surrogate (synthetic) waste, designed by the US Department of Energy, Richland Operations Office to include species that represent all organic and inorganic constituents (but not radionuclide species) expected to be found on the Hanford Site. Thus, the surrogate will encompass not only the expected 242-A Evaporator process condensate characteristics, but those of other potential 200 Area Effluent Treatment Facility waste streams and additional 40 CFR Appendix VIII constituents.

1914 (DOE/RL-93-04) 100 area excavation treatability test plan. USDOE Richland Operations Office, WA (United States). May 1993. 58p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94004483. Source: OSTI; NTIS; INIS; GPO Dep.

This test plan documents the requirements for a treatability study on field radionuclide analysis and dust control techniques. These systems will be used during remedial actions involving excavation. The data from this treatability study will be used to support the feasibility study (FS) process. Development and screening of remedial alternatives for the 100 Area, using existing data, have been completed and are documented in the 100 Area Feasibility Study, Phases 1 and 2 (DOE-RL 1992a). Based on the results of the FS, the Treatability Study Program Plan (DOE-RL 1992b) identifies and prioritizes treatability studies for the 100 Area. The data from the treatability study program support future focused FS, interim remedial measures (IRM)

selection, operable unit final remedy selection, remedial design, and remedial actions. Excavation is one of the high-priority, near-term, treatability study needs identified in the program plan (DOE-RL 1992b). Excavation of contaminated soils and buried solid wastes is included in several of the alternatives identified in the 100 Area FS. Although a common activity, excavation has only been used occasionally at the Hanford Site for waste removal applications.

1915 (DOE/RL-93-08) Hanford Mission Plan: Volume 1, Site Guidance. Garrison, H.L. USDOE Richland Field Office, WA (United States). Aug 1993. 72p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93019979. Source: OSTI; NTIS; INIS; GPO Dep.

The 1993 Hanford Mission Plan (HMP), Volume I, Site Guidance, provides technical guidance and direction to Hanford Site programs. Program planning for fiscal year (FY) 1994 and beyond shall be based on this guidance. This technical guidance includes statements of Site and program missions and provides a common set of assumptions on which plans and decisions will be based. It also provides descriptions of important interfaces across mission areas and programs, cross-cutting and sitewide issues that must be resolved, and a methodology to resolve them.

1916 (DOE/RL-93-19) Hanford Site Development Plan. Hathaway, H.B.; Daly, K.S.; Rinne, C.A.; Seiler, S.W. Westinghouse Hanford Co., Richland, WA (United States). May 1993. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94001172. Source: OSTI; NTIS; INIS; GPO Dep.

The Hanford Site Development Plan (HSDP) provides an overview of land use, infrastructure, and facility requirements to support US Department of Energy (DOE) programs at the Hanford Site. The HSDP's primary purpose is to inform senior managers and interested parties of development activities and issues that require a commitment of resources to support the Hanford Site. The HSDP provides an existing and future land use plan for the Hanford Site. The HSDP is updated annually in accordance with DOE Order 4320.1B, Site Development Planning, to reflect the mission and overall site development process. Further details about Hanford Site development are defined in individual area development plans.

1917 (DOE/RL-93-21-Vol.1) Phase I remedial investigation report for the 300-FF-5 operable unit, Volume 1. USDOE Richland Operations Office, WA (United States). Jan 1994. 509p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94008645. Source: OSTI; NTIS; INIS; GPO Dep.

The focus of this remedial investigation (RI) is the 300-FF-5 operable unit, one of five operable units associated with the 300 Area aggregate of the U.S. Department of Energy's (DOE's) Hanford Site. The 300-FF-5 operable unit is a groundwater operable unit beneath the 300-FF-1, 300-FF-2, and 300-FF-3 source operable units. This operable unit was designated to include all contamination detected in the groundwater and sediments below the water table that emanates from the 300-FF-1, 300-FF-2, and 300-FF-3 operable units (DOE-RL 1990a). In November 1989, the U.S. Environmental Protection Agency (EPA) placed the 300 Area on the National Priorities List (NPL) contained within Appendix B of the National Oil and Hazardous Substance Pollution Contingency Plan (NCP, 53 FR 51391 et seq.). The EPA took this action pursuant to their authority under the Comprehensive Environmental Response, Compensation, and

Liability Act of 1980 (CERCLA, 42 USC 9601 et seq.). The DOE Richland Operations Office (DOE-RL), the EPA and Washington Department of Ecology (Ecology) issued the Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement), in May 1989 (Ecology et al. 1992, Rev. 2). This agreement, among other matters, governs all CERCLA efforts at the Hanford Site. In June 1990, a remedial investigation/feasibility study (RI/FS) workplan for the 300-FF-5 operable unit was issued pursuant to the Tri-Party Agreement.

1918 (DOE/RL-93-21-Vol.2) Phase 1, Remedial investigation report for the 300-FF-5 operable unit: Volume 2. USDOE Richland Operations Office, WA (United States). Jan 1994. 1145p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94008646. Source: OSTI; NTIS; INIS; GPO Dep.

Volume two contains the following appendices: 300-FF-5 spring, sediment, Columbia River - water and spring groundwater well analytical data; 300-FF-5 borehole soil analytical data; 300-FF-5 groundwater analytical data for 1st, 2nd, 3rd, and 4th sampling rounds; numerical groundwater flow and transport modeling; pertinent correspondence; data quality summary; monthly potentiometric surface contour maps of the unconfined aquifer in the 300-FF-5 operable unit; applicable or relevant and appropriate requirements; calculations of estimated future groundwater concentrations resulting from 300-FF-1 soil contamination; risk assessment example calculations; plume maps for 300-FF-5 operable unit contaminants of potential concern; analytical model input; and toxicity profiles for contaminants of potential concern at the 300-FF-5 operable unit.

1919 (DOE/RL-93-35-Rev.1) Feasibility study report for the 200-BP-1 operable unit: Revision 1. USDOE Richland Field Office, WA (United States). Jan 1994. 305p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94006332. Source: OSTI; NTIS; INIS; GPO Dep.

This feasibility study (FS) examines a range of alternatives and provides recommendations for selecting a preferred alternative for remediating contamination at the 200-BP-1 operable unit. The 200-BP-1 operable unit is located in the center of the Hanford Site along the northern boundary of the 200 East Area. The 241-BY Tank Farm is located immediately to the south of the operable unit. 200-BP-1 is a source operable unit with contaminated soils associated primarily with nine inactive cribs (known as the 216-B cribs). These cribs were used for disposal of low-level radioactive liquid waste from U Plant uranium recovery operations, and waste storage tank condensate from the adjacent 241-BY Tank Farm. The cribs used for disposal of U Plant waste were in operation from 1955-1965, and the cribs used for disposal of tank condensate were in operation from 1965-1975. In addition to the cribs, four unplanned releases of radioactive materials have occurred within the operable unit. Contaminated surface soils associated with the unplanned releases have been consolidated over the cribs and covered with clean soil to reduce contaminant migration and exposure. Discharge of wastes to the cribs has resulted in soil and groundwater contamination. The groundwater is being addressed as part of the 200 East Aggregate Area groundwater operable unit. Contaminated soils at the site can be categorized by the types of contaminants, their distribution in the soil column, and the risk posed by the various potential exposure pathways. Below the clean soil cover, the near surface soils contain low-levels of contamination with

cesium-137, radium-226, strontium-90, thorium-228 and uranium. The lifetime incremental cancer risk associated with these soils if they were exposed at the surface is 9×10^5 .

1920 (DOE/RL-93-38) Hanford Integrated Planning Process: 1993 Hanford Site-specific science and technology plan. Pacific Northwest Lab., Richland, WA (United States). Dec 1993. 470p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (PNL-8951). Order Number DE94007992. Source: OSTI; NTIS; INIS; GPO Dep.

This document is the FY 1993 report on Hanford Site-specific science and technology (S&T) needs for cleanup of the Site as developed via the Hanford Integrated Planning Process (HIPP). It identifies cleanup problems that lack demonstrated technology solutions and technologies that require additional development. Recommendations are provided regarding allocation of funding to address Hanford's highest-priority technology improvement needs, technology development needs, and scientific research needs, all compiled from a Sitewide perspective. In the past, the S&T agenda for Hanford Site cleanup was sometimes driven by scientists and technologists, with minimal input from the "problem owners" (i.e., Westinghouse Hanford Company [WHC] staff who are responsible for cleanup activities). At other times, the problem-owners made decisions to proceed with cleanup without adequate scientific and technological inputs. Under both of these scenarios, there was no significant stakeholder involvement in the decision-making process. One of the key objectives of HIPP is to develop an understanding of the integrated S&T requirements to support the cleanup mission, (a) as defined by the needs of the problem owners, the values of the stakeholders, and the technology development expertise that exists at Hanford and elsewhere. This requires a periodic, systematic assessment of these needs and values to appropriately define a comprehensive technology development program and a complementary scientific research program. Basic to our success is a methodology that is defensible from a technical perspective and acceptable to the stakeholders.

1921 (DOE/RL-93-38-Exec.Summ.) 1993 Hanford Site-Specific Science and Technology Plan: Hanford Integrated planning process, Executive summary. Pacific Northwest Lab., Richland, WA (United States). Dec 1993. 45p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (PNL-8960). Order Number DE94004713. Source: OSTI; NTIS; GPO Dep.

The Hanford Site-Specific Science and Technology Plan (HSSSTP) documents the integrated science and technology (S&T) needs for cleanup of the Hanford Site as developed via Hanford integrated planning. This summary of the HSSSTP includes background information; an explanation of the purpose of the plan; a description of the integrated S&T needs assessment methodology; and principal results, conclusions, and recommendations.

1922 (DOE/RL-93-57) Public comments and responses to the 1993 Hanford cleanup five-year plan. USDOE Richland Operations Office, WA (United States). Aug 1993. 99p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94011332. Source: OSTI; NTIS; INIS; GPO Dep.

In March 1993, the US Department of Energy, Richland Operations Office (DOE-RL) published its annual Site-Specific Five-Year Plan. The Site-Specific Plan is published to inform the public about the background, status, and plans

for Environmental Restoration (ER) and Waste Management (WM) activities at the Hanford site. It is the only document that seeks to bring all ER and WM elements together in one document. The Site-Specific Plan is a companion document to the National Five-Year Plan that deals with all the sites within the DOE complex on a summary level. This Response to Comments document does not try to address every question or concern raised during the public comment period. Some questions were outside the scope of the Five-Year Plan, some we could not decipher, others were variations of the same question. The initial round of public meetings was held in Portland, Oregon, and Seattle, Pasco, and Olympia, Washington. At the request of the Oregon Department of Energy (ODOE) and the Washington State Department of Ecology (Ecology), a second round of meetings was held in Portland and Olympia. Both agencies felt that the first two meetings were held with too little advance notice, and before the Plan could be distributed. Once the public meetings were over and the comment period closed, we then compiled the public comments, largely from audio tapes of the meetings. Individual functions within Hanford were asked to consider and respond to the comments.

1923 (DOE/RL-93-68) Interim remedial measures proposed plan for the 200-ZP-1 Operable Unit, Hanford Site, Washington. Parker, D.L. USDOE Richland Operations Office, WA (United States). Dec 1993. 20p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94005486. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this interim remedial measures (IRM) proposed plan is to present and solicit public comments on the IRM planned for the 200-ZP-1 Operable Unit at the Hanford Site in Washington state. The 200-ZP-1 is one of two operable units that envelop the groundwater beneath the 200 West Area of the Hanford Site.

1924 (DOE/RL-93-90) Security Transition Program Office 1994 fiscal year work plan WBS 6.11. Brogdon, R.C. Jr. USDOE Richland Operations Office, WA (United States). Oct 1993. 103p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94004896. Source: OSTI; NTIS; INIS; GPO Dep.

The Security Transition Program Office (STPO) will change the Hanford Safeguards and Security Protection Program from one that supported the national defense program to one that supports environmental restoration and waste management. A Successful Safeguards and Security Protection Program transition will have an industrial security foundation supplemented to protect material interests and information resources. The transition will change the current approaches to protection philosophy to ones that will provide the Hanford Site with the following: consolidation, reduction, and elimination of safeguards and security interests and targets; greater open Site access; maximum application of technology and automation; interpretation of security policies and procedures in light of the Hanford Site's environmental mission; coexistence with other emergency services; streamlined operations; and protection of employees and the public from health, safety, fire, security, and safeguards risks. This report describes the 1994 program objectives, the technical base, schedule baseline, cost, funding, manpower, and the 1993 program workscope.

1925 (DOE/RL-93-101) Expanded public notice: Washington State notice of intent for corrective action management unit, Hanford Environmental Restoration Disposal. USDOE Richland Field Office, WA (United

States). Jan 1994. 254p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94006346. Source: OSTI; NTIS; INIS; GPO Dep.

This document is to serve notice of the intent to operate an Environmental Restoration Disposal Facility (ERDF), adjacent to the 200 West Area of the Hanford Facility, Richland, Washington, as a Corrective Action Management Unit (CAMU), in accordance with 40 Code of Federal Regulation (CFR) 264.552. The ERDF CAMU will serve as a management unit for the majority of waste (primarily soil) excavated during remediation of waste management sites on the Hanford Facility. Only waste that originates from the Hanford Facility can be accepted in this ERDF CAMU. The waste is expected to consist of dangerous waste, radioactive waste, and mixed waste. Mixed waste contains radioactive and dangerous components. The primary features of the ERDF could include the following: one or more trenches, rail and tractor/trailer container handling capability, railroads, an inventory control system, a decontamination building, and operational offices.

1926 (DOE/RL-93-104) Decontamination and decommissioning assessment for the Waste Incineration Facility (Building 232-Z) Hanford Site, [Hanford], WA. Dean, L.N. (Advanced Sciences, Inc., (United States)). USDOE Richland Operations Office, WA (United States). Feb 1994. 108p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94007983. Source: OSTI; NTIS; INIS; GPO Dep.

Building 232-Z is an element of the Plutonium Finishing Plant (PFP) located in the 200 West Area of the Hanford Site. From 1961 until 1972, plutonium-bearing combustible materials were incinerated in the building. Between 1972 and 1983, following shutdown of the incinerator, the facility was used for waste segregation activities. The facility was placed in retired inactive status in 1984 and classified as a Limited Control Facility pursuant to DOE Order 5480.5, Safety of Nuclear Facilities, and 6430.1A, General Design Criteria. The current plutonium inventory within the building is estimated to be approximately 848 grams, the majority of which is retained within the process hood ventilation system. As a contaminated retired facility, Building 232-Z is included in the DOE Surplus Facility Management Program. The objective of this Decontamination and Decommissioning (D&D) assessment is to remove Building 232-Z, thereby eliminating the radiological and environmental hazards associated with the plutonium inventory within the structure. The steps to accomplish the plan objectives are: (1) identifying the locations of the most significant amounts of plutonium, (2) removing residual plutonium, (3) removing and decontaminating remaining building equipment, (4) dismantling the remaining structure, and (5) closing out the project.

1927 (DOE/RL-94-37) The Hanford Site focus, 1994. Peterson, J.M. USDOE Richland Field Office, WA (United States). Mar 1994. 62p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94011443. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes what the Hanford Site will look like in the next two years. We offer thumbnail sketches of Hanford Site programs and the needs we are meeting through our efforts. We describe our goals, some recent accomplishments, the work we will do in fiscal year (FY) 1994, the major activities the FY 1995 budget request covers, and the economic picture in the next few years. The Hanford Site budget shows the type of work being planned. US Department of Energy (DOE) sites like the Hanford Site use

documents called Activity Data Sheets to meet this need. These are building blocks that are included in the budget. Each Activity Data Sheet is a concise (usually 4 or 5 pages) summary of a piece of work funded by the DOE's Environmental Restoration and Waste Management budget. Each sheet describes a waste management or environmental restoration need over a 5-year period; related regulatory requirements and agreements; and the cost, milestones, and steps proposed to meet the need. The Hanford Site is complex and has a huge budget, and its Activity Data Sheets run to literally thousands of pages. This report summarizes the Activity Data Sheets in a less detailed and much more reader-friendly fashion.

1928 (DOE/RL/12175-T1) Subproject L-045H 300 Area Treated Effluent Disposal Facility: Hanford Environmental Compliance Project, Hanford Site, Richland, Washington. Corps of Engineers, Walla Walla, WA (United States). Walla Walla District. Jun 1991. 100p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AT06-91RL12175. Order Number DE92003440. Source: OSTI; NTIS; INIS; GPO Dep.

The study focuses on the project schedule for Project L-045H, 300 Area Treated Effluent Disposal Facility. The 300 Area Treated Effluent Disposal Facility is a Department of Energy subproject of the Hanford Environmental Compliance Project. The study scope is limited to validation of the project schedule only. The primary purpose of the study is to find ways and means to accelerate the completion of the project, thereby hastening environmental compliance of the 300 Area of the Hanford site. The "300 Area" has been utilized extensively as a laboratory area, with a diverse array of laboratory facilities installed and operational. The 300 Area Process Sewer, located in the 300 Area on the Hanford Site, collects waste water from approximately 62 sources. This waste water is discharged into two 1500 feet long percolation trenches. Current environmental statutes and policies dictate that this practice be discontinued at the earliest possible date in favor of treatment and disposal practices that satisfy applicable regulations.

1929 (DOE/UMTRA-3050-93-1235-Vol.1) Uranium Mill Tailings Remedial Action Project Annual Environmental Monitoring Report calendar year 1992: Volume 1. MK-Ferguson Co., Albuquerque, NM (United States); Jacobs Engineering Group, Inc., Albuquerque, NM (United States); Chem Waste Management (CWM) Federal Environmental Services, Inc. (United States). [1993]. 452p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94007205. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes environmental monitoring and compliance at eight UMTRA sites where remedial action was underway during 1992 and at the ten sites that were complete at the end of 1992. Volume 1 contains information for Ambrosia Lake, NM; Cannonsburg/Burrell, PA; Durango, CO; Falls City, TX; Grand Junction, CO; Green River, UT; and Gunnison, CO. Each site report contains a site description, compliance summary, environmental program information, environmental radiological and non-radiological program information, water resources protection, and quality assurance information.

1930 (DOE/UMTRA-150128-0000) Uranium Mill Tailings Remedial Action Project Environmental Protection Implementation Plan. USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Remedial

Action Project Office. Oct 1992. 39p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE93008958. Source: OSTI; NTIS; INIS; GPO Dep.

The Uranium Mill Tailings Remedial Action (UMTRA) Project Environmental Protection Implementation Plan (EPIP) has been prepared in accordance with the requirements of the US Department of Energy (DOE) Order 5400.1 (Chapter 3, paragraph 2). The UMTRA EPIP covers the time period of November 9, 1992, through November 8, 1993. It will be updated annually. Its purpose is to provide management direction to ensure that the UMTRA Project is operated and managed in a manner that will protect, maintain, and where necessary, restore environmental quality, minimize potential threats to public health and the environment, and comply with environmental regulations and DOE policies.

1931 (DOE/UMTRA-150129-0000) Uranium Mill Tailings Remedial Action Project Environmental Monitoring Plan. USDOE Albuquerque Field Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office; MK-Ferguson Co., Albuquerque, NM (United States); Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Nov 1992. 382p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE93008951. Source: OSTI; NTIS; INIS; GPO Dep.

The Department of Energy (DOE) has issued requirements for complying with DOE and other Federal agency environmental regulations. DOE Order 5400.1 requires environmental monitoring plans for each DOE operation that uses, generates, releases, or manages pollutants of radioactive and hazardous materials.

1932 (DOE/UMTRA-150306-MITI) Mitigation action plan for remedial action at the uranium mill tailings sites and disposal site, Rifle, Colorado. USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Dec 1992. 31p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE93008956. Source: OSTI; NTIS; INIS; GPO Dep.

The Old and New Rifle sites cover 66 hectares (164 acres) of private land just outside the town of Rifle, in northwestern Colorado. Approximately 3,161,620 cubic meters (4,135,000 cubic yards) of Residual Radioactive Materials (RRM) contaminates the sites and the adjacent land. The tailings piles at both sites have been partially stabilized, seeded, and irrigated to promote a native vegetation cover. In May 1987, the DOE released its draft EIS on remedial actions at the Rifle sites (DOE, 1987) for public comment. The draft EIS analyzed four alternatives, including: No action; Stabilizing all of the RRM at the New Rifle site; Disposal of all of the RRM at the Estes Guich site, which was the preferred alternative; Disposal of all of the RRM at the Lucas Mesa site.

1933 (DOE/UMTRA-150308-GAME) Report on game species of concern associated with the Gunnison Remedial Action Project, Gunnison, Colorado. USDOE Albuquerque Field Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Sep 1991. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE93010390. Source: OSTI; NTIS; INIS; GPO Dep.

This report provides background information and data used in the analysis of potential impacts to game species reported in the Environmental Assessment of the Proposed Remedial Action at the Gunnison Uranium Mill Tailings Site,

Gunnison, Colorado. That environmental assessment provides details regarding proposed remedial action at the Gunnison site along with a description of existing conditions and projected environmental impacts. A summary of the proposed action is provided. The uranium mill tailings and other contaminated materials at the Gunnison processing site would be transported to the Landfill disposal site via the Tenderfoot Mountain (TM) haul route. The remedial action would take place over a three-year period with two six-month winter shutdowns. The first year would consist of site preparation and haul road construction. The second year would consist of moving the tailings. Movement of the radon/infiltration barrier cover material and erosion protection material would take place during the third construction year. The material used to cover the pile is fine-grained material for the radon/infiltration barrier (Sixmile Lane borrow site) and rock for erosion protection from the Chance Gulch borrow site. The location of the borrow sites used to obtain these materials and the associated haul roads is shown.

1934 (DOE/UMTRA-150308-MITI) Mitigation and monitoring plan for impacted wetlands at the Gunnison UMTRA Project site, Gunnison, Colorado. USDOE Albuquerque Field Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Jun 1992. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE93010391. Source: OSTI; NTIS; INIS; GPO Dep.

The U.S Department of Energy (DOE) administers the Uranium Mill Tailings Remedial Action (UMTRA) Project. The UMTRA Project is the result of the Uranium Mill Tailings Radiation Control Act(UMTRA) which was passed in response to the public's concern over the potential public health hazards related to uranium mill tailings and associated contaminated material at abandoned or otherwise uncontrolled inactive processing sites throughout the United States. The Gunnison, Colorado abandoned uranium mill site is one of the sites slated for cleanup by the DOE under authority of UMTRA. The contaminated material at this site will be transported to a disposal site on US Bureau of Land Management (BLM) land east of Gunnison. Remedial action activities will temporarily disturb 0.8 acre and permanently eliminate 5.1 acres of wetlands. This report describes the proposed mitigation plan for the 5.9 acres of impacted wetlands. In conjunction with the mitigation of the permanently impacted wetlands through the enhancement of wetland and adjacent riparian areas, impacts to wildlife as a result of this project will also be mitigated. However, wildlife mitigation is not the focus of this document and is covered in relevant BLM permits for this project. This plan proposes the enhancement of a 3:1 ratio of impacted wetlands in accordance with US Environmental Protection Agency guidelines, plus the enhancement of riparian areas for wildlife mitigation. Included in this mitigation plan is a monitoring plan to ensure that the proposed measures are working and being maintained.

1935 (DOE/UMTRA-150312-0000) Environmental analysis and data report prepared for the environmental assessment of remedial action at the Lowman uranium mill tailings site near Lowman, Idaho: Final report. USDOE Albuquerque Field Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Jan 1991. 248p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-82AL14086. Order Number DE93008952. Source: OSTI; NTIS; INIS; GPO Dep.

This document contains information and data gathered in support of the preparation of the environmental assessment

(EA) of the proposed remedial action at the Uranium Mill Tailings Remedial Action (UMTRA) Project site near Lowman, Idaho. The Lowman EA was prepared pursuant to the National Environmental Policy Act (NEPA), which requires Federal agencies to assess the effects of their actions on the environment. It examines the short-term and the long-term effects of the US Department of Energy's (DOE) proposed remedial action for the Lowman site as well as the no action alternative. The DOE will use the information and analyses presented in the EA to determine whether the proposed action would have a significant impact on the environment. If the impacts are determined to be significant, an environmental impact statement will be prepared. If the impacts are not judged to be significant, the DOE may issue a Finding of No Significant Impact and implement the proposed action. The information and data presented in this environmental analyses and data report are for background purposes only and are not required as part of the NEPA decision-making process.

1936 (DOE/UMTRA-150320-EADR) Environmental analysis and data report prepared for the environmental assessment of remedial action at the inactive uranium mill tailings site near Falls City, Texas. USDOE Albuquerque Field Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Dec 1991. 197p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE93010324. Source: OSTI; NTIS; INIS; GPO Dep.

This document contains information and data gathered in support of the preparation of the environmental assessment (EA) of the proposed remedial action at the Uranium Mill Tailings Remedial Action (UMTRA) Project site near Falls City, Texas. The Falls City EA was prepared pursuant to the National Environmental Policy Act (NEPA), which requires Federal agencies to assess the impacts of their actions on the environment. It examines the short- and long-term effects of the US Department of Energy's (DOE) remedial action for the Falls City site as well as the no action alternative. The DOE will use the information and analyses presented in the EA to determine whether the proposed action would have a significant impact on the environment. If the impacts are determined to be significant, an environmental impact statement (EIS) will be prepared. If the impacts are not determined to be significant, the DOE may issue a Finding of No Significant Impact (FONSI) and implement the proposed action. The information and data presented in this report are for background purposes only and are not required as part of the NEPA decision-making process.

1937 (DOE/UMTRA-350125-0000-Rev.1) Guidance for implementing the UMTRA Project long-term surveillance program: Final report, Revision 1. Jacobs Engineering Group, Inc., Pasadena, CA (United States); USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Sep 1992. 129p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE93005955. Source: OSTI; NTIS; INIS; GPO Dep.

The US Nuclear Regulatory Commission (NRC) has issued a general license for the custody and long-term care of US Department of Energy (DOE) Uranium Mill Tailings Remedial Action (UMTRA) Project permanent disposal sites. The purpose of this general license is to ensure that the UMTRA disposal sites will be cared for in such a manner as to protect the public health and safety and the environment upon completion of remedial actions. The general license

will be in effect for a disposal site when NRC accepts the disposal site long-term surveillance plan (LTSP) that meets the requirements of 10 CFR 40.27. The site LTSP describes in detail the long-term surveillance program, including any monitoring, maintenance, and emergency measures necessary to fulfill the conditions of the general license. This guidance document provides (1) instructions for preparing the disposal site LTSPs and (2) instructions for carrying out the UMTRA Project long-term surveillance program, including any monitoring that may be required. The information provided in this document also is in accordance with the regulatory requirements set forth in 40 CFR 192. On January 5, 1985, the US Tenth Circuit Court of Appeals remanded the groundwater standards, 40 CFR 192.02. Proposed groundwater standards were issued for comment on September 24, 1987 (52 FR 3600). When the groundwater standards become final, this document will be revised, as appropriate. This document also will be updated in response to any changes to 10 CFR 40, or in response to changes in the manner in which the long-term care of the licensed disposal sites is carried out.

1938 (DOE/UMTRA-400134-0000) Uranium Mill Tailings Remedial Action Project: Cost Reduction and Productivity Improvement Program Project Plan: Revised. USDOE Albuquerque Field Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Nov 1991. 53p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE93010588. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of the Cost Reduction/Productivity Improvement Program Plan is to formalize and improve upon existing efforts to control costs which have been underway since project inception. This program plan has been coordinated with the Department of Energy (DOE) Office of Environmental Management (EM) and the DOE Field Office, Albuquerque (AL). It incorporates prior Uranium Mill Tailings Remedial Action (UMTRA) Project Office guidance issued on the subject. The opportunities for reducing cost and improving productivity are endless. The CR/PIP has these primary objectives: Improve productivity and quality; heighten the general cost consciousness of project participants, at all levels of their organizations; identify and implement specific innovative employee ideas that extend beyond what is required through existing processes and procedures; emphasize efforts that create additional value for the money spent by maintaining the project Total Estimated Cost (TEC) at the lowest possible level.

1939 (DOE/UMTRA-400135-0000) Uranium Mill Tailings Remedial Action fiscal year 1992 roadmap. USDOE Albuquerque Field Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Feb 1993. 87p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE93011699. Source: OSTI; NTIS; INIS; GPO Dep.

The Uranium Mill Tailings Remedial Action (UMTRA) Project is funded and managed as two separate projects: Surface remediation (UMTRA-S) and Groundwater compliance (UMTRA-G). Surface remediation is a Major System Acquisition and has been completed at 10 sites, 7 sites are under construction, and 7 sites are in the planning stage. The planning stages of the UMTRA-G Project, a major project, began in April 1991. A programmatic environmental impact statement (PEIS) has been started. Site characterization work and baseline risk assessment will begin FY 1993. Thus, the UMTRA-S Project is a mature and ongoing

program with the roles of various organizations well defined, while the UMTRA-G Project is still being formulated and the interfaces between the DOE, states and tribes, and the EPA are being established. The Office of Environmental Restoration and Waste Management (EM) directed that all projects under its authority develop roadmaps for their activities. The UMTRA Project Roadmap was developed by the UMTRA Project Office with input from the TAC, RAC, the GJPO, and assistance from SAIC. A single roadmap has been prepared for both the UMTRA-S and UMTRA-G Projects. This was deemed appropriate due to the close relationship between the projects and to the fact that the same Government and contractor personnel are preparing the roadmaps. Roadmap development is a planning process that focuses on issue identification, root-cause analysis, and issues resolution. The methodology is divided into three phases: assessment, analysis, and issues resolution.

1940 (DOE/UMTRA-400655-0000) DECHEM: A remedial planning tool for metallic contaminants in soil at UMTRA Project sites: Final report and users' guide. USDOE Albuquerque Field Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Mar 1989. 90p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-82AL14086. Order Number DE93009466. Source: OSTI; NTIS; INIS; GPO Dep.

The DECHEM (DEcontamination of CHEMicals) method was developed for the Uranium Mill Tailings Remedial Action (UMTRA) Project to guide characterization and remedial planning for metals contamination in soils. This is necessary because non-radiological hazardous constituents may be more mobile than radium-226 (Ra-226), and hence may migrate more deeply into subpile soils (beneath tailings that are to be relocated) or into adjacent contaminated soils at UMTRA Project sites. The result is that remedial action to the Ra-226 excavation limit, as specified in the US Environmental Protection Agency (EPA) standards, may not adequately remove hazardous non-radiological contamination. Unmitigated, these contaminants in soil may cause health risks because of their presence in resuspended particles, their uptake by crops or fodder their seepage into aquifers used for drinking water or other possible exposure pathways. The DECHEM method was developed in response to the need for advanced planning for the remediation of chemical contaminants at UMTRA Project sites, and includes the following elements: Establishment of acceptable exposure rates for humans to chemicals, based on EPA guidelines or other toxicological literature. Modeling of chemical migration through environmental pathways from a remediated UMTRA Project site to humans. Determination of allowable residual concentrations (i.e., cleanup guidelines) for chemicals in soils that results in doses to humans that are below established acceptable exposure rates. The initial development and application of the DECHEM method has focused upon hazardous metallic contaminants such as arsenic, lead, molybdenum, and selenium, which are known to occur in elevated concentrations at some UMTRA Project sites.

1941 (DOE/UMTRA-400661-0000) Data for surface ionization and complexation modeling. USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Oct 1990. 45p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-82AL14086. Order Number DE93008955. Source: OSTI; NTIS; INIS; GPO Dep.

Objective is to compile the thermodynamic data for using the adsorption subroutines in the MINTEQA2 geochemical

simulator. As a test of the applicability of the sorption subroutines to UMTRA (Uranium Mill Tailings Remedial Action) project sites, a test case was run using data from Falls City site. Results suggest that adsorption of uranyl ion onto a mixture of silica (quartz) and goethite has limited the mobility of uranium in the groundwater at Falls City. Given the limited analytical data, variability in pH and alkalinity in groundwater, and variation in sorbent phases, the simulations are reasonable (agree within an order of magnitude). Because thermodynamic data exist for relatively few dissolved constituents and their interactions with even fewer mineral phases, the importance of adsorption for hazardous constituent attenuation is difficult to assess. However, the test case indicates that sorption on even two minerals can contribute to U distribution.

1942 (DOE/UMTRA-400662-0000) An assessment of plant bioinvasion at the Uranium Mill Tailings Remedial Action Project rock-covered disposal cells. USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Oct 1990. 36p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-82AL14086. Order Number DE93009467. Source: OSTI; NTIS; INIS; GPO Dep.

This study is one of a number of special studies that have been conducted regarding various aspects of the Uranium Mill Tailings Remedial Action (UMTRA) Project. This special study was proposed following routine surveillance and maintenance surveys and observations reported in a special study of vegetative covers (DOE, 1988), in which plants were observed growing up through the rock erosion layer at recently completed disposal cells. Some of the plants observed were deep-rooted woody species, and questions concerning root intrusion into disposal cells and the need to control plant growth were raised. The special study discussed in this report was designed to address some of the ramifications of plant growth on disposal cells that have rock covers. The NRC has chosen rock covers over vegetative covers in the arid western United States because licenses cannot substantiate that the vegetative covers "will be significantly greater than 30 percent and preferably 70 percent," which is the amount of "vegetation required to reduce flow to a point of stability." The potential impacts of vegetation growing in rock covers are not addressed by the NRC (1990). The objectives, then, of this study were to determine the species of plants growing on two rock-covered disposal cells, study the rooting pattern of plants on these cells, and identify possible impacts of plant root penetration on these and other UMTRA Project rock-covered cells.

1943 (DOE/UMTRA-400663-0000) The effect of desiccation on UMTRA Project radon barrier materials. USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Nov 1990. 34p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-82AL14086. Order Number DE93009469. Source: OSTI; NTIS; INIS; GPO Dep.

The proposed US Environmental Protection Agency (EPA) groundwater standards (40 CFR 192) require that Uranium Mill Tailings Remedial Action (UMTRA) Project remedial action designs meet low numerical limits for contaminants contained in water or vapors exiting the disposal cell embankments. To meet the standards, a cover of compacted, fine-grained soil is placed over UMTRA Project embankments. One of the functions of this cover is to limit infiltration into the disposal cell. The hydraulic conductivity of this infiltration barrier must be low in order to reduce the resultant

seepage from the base of the cell to the extent necessary to comply with the proposed EPA groundwater standards. Another function of this cover is to limit the emission of radon gas. The air permeability of the cover must be low in order to reduce radon emissions to comply with EPA standards. Fine-grained soils exposed to evaporation will dry. Continued exposure will cause shrinking that, if allowed to continue, will eventually result in the development of cracks. The results of the cracking could be an increase in the hydraulic conductivity and an increase in the air permeability. This could then allow additional infiltration and increased radon emissions. Cracking of the radon barrier has been noted at one UMTRA Project location. The potential for cracking of the radon barrier during construction has been addressed by requiring moistening of previously compacted surfaces prior to placing additional lifts. The efficacy of these treatments has not been verified. The potential for cracking after construction of the cover is completed has also not been examined. The purpose of this study is to evaluate the potential for cracking of the radon barrier both during construction and after completion of the cover. The effect of shrinkage cracking on the performance of the radon barrier will also be examined.

1944 (DOE/UMTRA-400665-0000) **Bentonite-amended soils special study: Phase 2 evaluation report.** USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Oct 1990. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE93008964. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents the results of a two-phased special study to evaluate the viability of soil amended with a high percentage of bentonite as an infiltration barrier in the cover of Uranium Mill Tailings Remedial Action (UMTRA) Project disposal cells. Phase I of the study was initiated in order to examine the feasibility of using bentonite-amended soils as a cover component on sideslopes and topslopes. The Phase I objectives were to test a variety of materials to determine if low hydraulic conductivities were achievable in materials exhibiting sufficient strength and to select suitable materials for further testing. Phase II objectives were to (1) optimize designs – test materials with various percentages of bentonite added; (2) provide design recommendations; (3) address constructibility concerns; and (4) evaluate long-term performance with respect to desiccation effects on the amended materials.

1945 (DOE/UMTRA-400668-0000) **Lessons learned on the UMTRA Project: Special study.** USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Feb 1991. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-82AL14086. Order Number DE93008960. Source: OSTI; NTIS; INIS; GPO Dep.

This report has been compiled as part of the Technical Assistance Contractor's (TAC's) continuing efforts to improve the quality of its product to the US Department of Energy (DOE), and to reduce the costs while maintaining a standard of excellence on the Uranium Mill Tailings Remedial Action (UMTRA) Project. The report documents the lessons learned and the steps taken to benefit the project as a result. This study has multiple objectives, which fall under the following hierarchy: To examine and evaluate past successes and mistakes. To provide a record of lessons learned for the benefit and orientation of future staffmembers. To identify

shortcomings of, and desired improvements to, current UMTRA Project practices and procedures. To establish a means for the future review and dissemination of lessons learned.

1946 (DOE/UMTRA-400677-0000) **Vegetation growth patterns on six rock-covered UMTRA Project disposal cells.** USDOE Albuquerque Field Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Feb 1992. 109p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE93010096. Source: OSTI; NTIS; INIS; GPO Dep.

This study assessed vegetation growth patterns, the potential impacts of vegetation growth on disposal cell cover integrity, and possible measures that could be taken to monitor and/or control plant growth, where necessary, on six Uranium Mill Tailings Remedial Action (UMTRA) Project rock-covered disposal cells. A large-scale invasion of volunteer plants was observed on the Shiprock and Burrell disposal cells. Plant growth at the South Clive, Green River, and Tuba City disposal cells was sparse except for the south rock apron and south slope of the Tuba City disposal cell, where windblown sand had filled up part of the rock cover and plant growth was observed. The rock-covered topslope of the Collins Ranch disposal cell was intentionally covered with topsoil and vegetated. Plant roots growing on the disposal cells are changing the characteristics of the cover by drying out the radon barrier, encouraging the establishment of soil-building processes in the bedding and radon barrier layers, creating channels in the radon barrier, and facilitating ecological succession, which could lead to the establishment of additional deep-rooted plants on the disposal cells. If left unchecked, plant roots would reach the tailings at the Burrell and Collins Ranch disposal cells within a few years, likely resulting in the transport of contaminants out of the cells.

1947 (DOE/UMTRA-400690-0000) **Passive environmental radon detector study.** USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Mar 1992. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE93008962. Source: OSTI; NTIS; INIS; GPO Dep.

There are three stages at which the ambient air concentrations of radon-222 are monitored around the Uranium Mill Tailings Remedial Action (UMTRA) Project sites: before, during, and after construction. Pre-remedial-action measurements are taken for approximately 1 year. Monitoring is conducted during the entire duration of construction, and post-remedial-action monitoring is performed for approximately 1 year. Currently, the UMTRA Project uses Radtrak® brand alpha-track radon detectors for these environmental measurements. The purposes of radon monitoring around the UMTRA sites are (1) to determine background values around the site and pre-remedial-action conditions, (2) to control construction activities and monitor off-site releases, and (3) to compare post-remedial-action concentrations with pre-remedial-action values to demonstrate that radon concentrations have been reduced to approximately background levels. The Technical Assistance Contractor to the DOE for the UMTRA Project evaluated the performance of four different types of passive environmental radon detectors under both controlled laboratory conditions and field conditions at an unremediated UMTRA site. This study was undertaken to evaluate the accuracy and precision of four different passive, timeintegrating, environmental radon detectors in an effort to determine which brand of detector is best suited to measure environmental outdoor radon concentrations for the UMTRA

Project. Voluntary manufacturer participation in the study was solicited by placing an advertisement in the Commerce Business Daily. All manufacturers participating in the study supplied the detectors and analysis free of charge.

1948 (DOE/UMTRA-400730-0000) Implementation of UMTRA Project Environmental Audit Action Plan status report for period ending September 30, 1992. USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Sep 1992. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE93009468. Source: OSTI; NTIS; INIS; GPO Dep.

This report provides the status of implementation of corrective actions for findings made in an Environmental Audit conducted by DOE Headquarters, Office of Environmental Audit, in June 1991. An Action Plan, dated December 1991, was developed to address the findings. The Action Plan was approved by DOE Headquarters, Office of Environment, Safety and Health, in July 1992. This report provides status for each activity listed in the approved Action Plan. Of 48 findings identified in the August 1991 Environmental Audit Report, 4 required no action, 5 were combined with others and actions to correct 19 are complete. Although it appears no progress has been made since the last status report was issued, UMTRA has completed 89% of the findings identified, compared to 72% identified in the last status report. The table below lists the 20 findings where actions are still underway, the current projected completion date, the organization(s) responsible for taking action on the finding, and the UMTRA Project Office staff member assigned responsibility for the finding.

1949 (DOE/UMTRA-0505125-0000) Technical summary of geological, hydrological, and engineering studies at the Slick Rock Uranium Mill Tailings sites, Slick Rock, Colorado. USDOE Albuquerque Field Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office. Dec 1990. 71p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-82AL14086. Order Number DE93009141. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this document is to provide the Colorado Department of Health (CDH) with a summary of the technical aspects of the proposed remedial action for the Slick Rock tailings near Slick Rock, Colorado. The technical issues summarized in this document are the geology and groundwater at the Burro Canyon disposal site and preliminary engineering considerations for the disposal cell.

1950 (EGG-2679(92)) Annual report - 1992: Environmental surveillance for EG & G Idaho: Waste Management Facilities at the Idaho National Engineering Laboratory. Wilhelmsen, R.N.; Wright, K.C.; McBride, D.W. EG and G Idaho, Inc., Idaho Falls, ID (United States). Aug 1993. 107p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94002898. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes the 1992 environmental surveillance activities of the Environmental Monitoring Unit of EG&G Idaho, Inc., at EG&G Idaho-operated Waste Management facilities at the Idaho National Engineering Laboratory (INEL). The major facilities monitored include the Radioactive Waste Management Complex, the Waste Experimental Reduction Facility, the Mixed Waste Storage Facility, and two surplus facilities. Included are some results of the sampling performed by the Radiological and Environmental

Sciences Laboratory and the United States Geological Survey. The primary purposes of monitoring are to evaluate environmental conditions, to provide and interpret data, to ensure compliance with applicable regulations or standards, and to ensure protection of human health and the environment. This report compares 1992 environmental surveillance data with DOE derived concentration guides, and with data from previous years.

1951 (EGG-2683) Final report of the decontamination and decommissioning of the BORAX-V facility turbine building. Arave, A.E.; Rodman, G.R. EG and G Idaho, Inc., Idaho Falls, ID (United States). Dec 1992. 45p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93012142. Source: OSTI; NTIS; INIS; GPO Dep.

The Boiling Water Reactor Experiment (BORAX)-V Facility Turbine Building Decontamination and Decommissioning (D&D) Project is described in this report. The BORAX series of five National Reactor Testing Station (NRTS) reactors pioneered intensive work on boiling water reactor (BWR) experiments conducted between 1953 and 1964. Facility characterization, decision analyses, and D&D plans for the turbine building were prepared from 1979 through 1990. D&D activities of the turbine building systems were initiated in November of 1988 and completed with the demolition and backfill of the concrete foundation in March 1992. Due to the low levels of radioactivity and the absence of loose contamination, the D&D activities were completed with no radiation exposure to the workers. The D&D activities were performed in a manner that no radiological health or safety hazard to the public or to personnel at the Idaho National Engineering Laboratory (INEL) remain.

1952 (EGG-ERD-10422) Evaluation of historical and analytical data on the TAN TSF-07 Disposal Pond. Medina, S.M. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jul 1993. 285p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94002834. Source: OSTI; NTIS; INIS; GPO Dep.

The Technical Support Facility (TSF)-07 Disposal Pond, located at Test Area North at the Idaho National Engineering Laboratory, has been identified as part of Operable Unit 1-06 under the Comprehensive Environmental Response, Compensation, and Liability Act. The Environmental Restoration and Waste Management Department is conducting an evaluation of existing site characterization data for the TSF-07 Disposal Pond Track 1 investigation. The results from the site characterization data will be used to determine whether the operable unit will undergo a Track 2 investigation, an interim action, a remedial investigation/feasibility study, or result in a no-action decision. This report summarizes activities relevant to wastewaters discharged to the pond and characterization efforts conducted from 1982 through 1991. Plan view and vertical distribution maps of the significant contaminants contained in the pond are included. From this evaluation it was determined that cobalt-60, cesium-137, americium-241, mercury, chromium, and thallium are significant contaminants for soils. This report also evaluates the migration tendencies of the significant contaminants into the perched water zone under the pond and the surrounding terrain to support the investigation.

1953 (EGG-ERD-10453) Remedial Investigation/feasibility study Work Plan and addenda for Operable Unit 4-12: Central Facilities Area Landfills II and III at the Idaho National Engineering Laboratory. Keck, K.N.;

Stormberg, G.J.; Porro, I.; Sondrup, A.J.; McCormick, S.H. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jul 1993. 1148p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94002883. Source: OSTI; NTIS; INIS; GPO Dep.

This document is divided into two main sections – the Work Plan and the addenda. The Work Plan describes the regulatory history and physical setting of Operable Unit 4-12, previous sampling activities, and data. It also identifies a preliminary conceptual model, preliminary remedial action alternatives, and preliminary applicable or relevant and appropriate requirements. In addition, the Work Plan discusses data gaps and data quality objectives for proposed remedial investigation activities. Also included are tasks identified for the remedial investigation/feasibility study (RI/FS) and a schedule of RI/FS activities. The addenda include details of the proposed field activities (Field Sampling Plan), anticipated quality assurance activities (Quality Assurance Project Plan), policies and procedures to protect RI/FS workers and the environment during field investigations (Health and Safety Plan), and policies, procedures, and activities that the Department of Energy will use to involve the public in the decision-making process concerning CFA Landfills II and III RI/FS activities (Community Relations Plan).

1954 (ES/ER/TM-20) Nuclear facility decommissioning and site remedial actions: A selected bibliography, Volume 12: Environmental Restoration Program. Martin Marietta Energy Systems, Inc., Oak Ridge, TN (United States). Sep 1991. 545p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92007776. Source: OSTI; NTIS; INIS; GPO Dep.

The 664 abstracted references on environmental restoration, nuclear facility decommissioning, uranium mill tailings management, and site remedial actions constitute the twelfth in a series of reports prepared annually for the US Department of Energy Remedial Action Programs. Citations to foreign and domestic literature of all types – technical reports, progress reports, journal articles, symposia proceedings, theses, books, patents, legislation, and research project descriptions – have been included. The bibliography contains scientific, technical, economic, regulatory, and legal information pertinent to the US Department of Energy Remedial Action Programs. Major sections are (1) Decontamination and Decommissioning Program, (2) Nuclear Facilities Decommissioning, (3) Formerly Utilized Sites Remedial Action Program, (4) Facilities Contaminated with Naturally Occurring Radionuclides, (5) Uranium Mill Tailings Remedial Action Program, (6) Uranium Mill Tailings Management, (7) Technical Measurements Center, and (8) Environmental Restoration Program. Within these categories, references are arranged alphabetically by first author. Those references having no individual author are listed by corporate affiliation or by publication title. Indexes are provided for author, corporate affiliation, title word, publication description, geographic location, subject category, and key word. This report is a product of the Remedial Action Program Information Center (RAPIC), which selects, analyzes, and disseminates information on environmental restoration and remedial actions. RAPIC staff and resources are available to meet a variety of information needs. Contact the center at FTS 624-7764 or (615) 574-7764.

1955 (ES/ER/TM-25) Decontamination and decommissioning surveillance and maintenance report for FY

1991: Environmental Restoration Program. Martin Marietta Energy Systems, Inc., Oak Ridge, TN (United States). Dec 1991. 57p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92005308. Source: OSTI; NTIS; GPO Dep.

The Decontamination and Decommissioning (D&D) Program has three distinct phases: (1) surveillance and maintenance (S&M); (2) decontamination and removal of hazardous materials and equipment (which DOE Headquarters in Washington, D.C., calls Phase I of remediation); and (3) decommissioning and ultimate disposal, regulatory compliance monitoring, and property transfer (which DOE Headquarters calls Phase II of remediation). A large part of D&D is devoted to S&M at each of the sites. Our S&M activities, which are performed on facilities awaiting decommissioning, are designed to minimize potential hazards to human health and the environment by: ensuring adequate containment of residual radioactive and hazardous materials; and, providing physical safety and security controls to minimize potential hazards to on-site personnel and the general public. Typically, we classify maintenance activities as either routine or special (major repairs). Routine maintenance includes such activities as painting, cleaning, vegetation control, minor structural repairs, filter changes, and building system(s) checks. Special maintenance includes Occupational Safety and Health Act facility upgrades, roof repairs, and equipment overhaul. Surveillance activities include inspections, radiological measurements, reporting, records maintenance, and security (as required) for controlling and monitoring access to facilities. This report summarizes out FY 1991 S&M activities for the Tennessee plant sites, which include the K-25 Site, the Gas Centrifuge facilities, ORNL, and the Y-12 Plant.

1956 (ES/ER/TM-48/Pt.1) Nuclear facility decommissioning and site remedial actions: A selected bibliography, Volume 13: Part 1, Main text: Environmental Restoration Program. Goins, L.F.; Webb, J.R.; Cravens, C.D.; Mallory, P.K. Martin Marietta Energy Systems, Inc., Oak Ridge, TN (United States). Sep 1992. 468p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93007801. Source: OSTI; NTIS; INIS; GPO Dep.

This publication contains 1035 abstracted references on environmental restoration, nuclear facility decommissioning, uranium mill tailings management, and site remedial actions. These citations constitute the thirteenth in a series of reports prepared annually for the US Department of Energy (DOE) Environmental Restoration programs. Citations to foreign and domestic literature of all types. There are 13 major sections of the publication, including: (1) DOE Decontamination and Decommissioning Program; (2) Nuclear Facilities Decommissioning; (3) DOE Formerly Utilized Sites Remedial Action Program; (4) DOE Uranium Mill Tailings Remedial Action Project; (5) Uranium Mill Tailings Management; (6) DOE Environmental Restoration Program; (7) DOE Site-Specific Remedial Actions; (8) Contaminated Site Restoration; (9) Remediation of Contaminated Soil and Groundwater; (10) Environmental Data Measurements, Management, and Evaluation; (11) Remedial Action Assessment and Decision-Making; (12) Technology Development and Evaluation; and (13) Environmental and Waste Management Issues. Bibliographic references are arranged in nine subject categories by geographic location and then alphabetically by first author, corporate affiliation, or publication title. Indexes are provided for author, corporate

affiliation, title word, publication description, geographic location, subject category, and key word.

1957 (ES/ER/TM-48/Pt.2) Nuclear facility decommissioning and site remedial actions: A selected bibliography, Volume 13: Part 2, Indexes: Environmental Restoration Program. Goins, L.F.; Webb, J.R.; Cravens, C.D.; Mallory, P.K. Martin Marietta Energy Systems, Inc., Oak Ridge, TN (United States). Sep 1992. 428p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93007802. Source: OSTI; NTIS; INIS; GPO Dep.

This is part 2 of a bibliography on nuclear facility decommissioning and site remedial action. This report contains indexes on the following: authors, corporate affiliation, title words, publication description, geographic location, subject category, and key word.

1958 (ES/ER/TM-87/Pt.1) Nuclear Facility Decommissioning and Site Remedial Actions: A selected bibliography, Volume 14: Environmental Restoration Program: Part 1, Citations with abstracts. Goins, L.F.; Webb, J.R.; Cravens, C.D.; Mallory, P.K. Martin Marietta Energy Systems, Inc., Oak Ridge, TN (United States). Sep 1993. 563p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94006305. Source: OSTI; NTIS; INIS; GPO Dep.

This bibliography contains 1820 citations with abstracts of documents relevant to environmental restoration, nuclear facility decontamination and decommissioning (D&D), uranium mill tailings management, and site remedial actions. This report is the fourteenth in a series of bibliographies prepared annually for the US Department of Energy (DOE) Office of Environmental Restoration. Citations to foreign and domestic literature of all types-technical reports, progress reports, journal articles, symposia proceedings, theses, books, patents, legislation, and research project descriptions-have been included in Part I of the report. The bibliography contains scientific, technical, economic, and regulatory information that pertains to DOE environmental restoration programs. The citations are separated by topic into 14 sections, including: DOE Environmental Restoration Program Planning and Management; DOE D&D Program; Nuclear Facilities Decommissioning; DOE Formerly Utilized Sites Remedial Action Program; Contaminated Site Restoration; DOE Uranium Mill Tailings Remedial Action Project; Uranium Mill Tailings Management; DOE Site-Specific Remedial Actions; DOE Underground Storage Tank Remediation; DOE Technology Development, Demonstration, and Evaluation; Soil/Groundwater Remediation Technologies; Environmental Data Measurement, Management, and Analysis; Remedial Action Assessment and Decision-Making; and Environmental and Waste Management Issues. Within the 14 sections, the citations are sorted into 9 subsections; within each subsection, the citations are grouped according to geographic location. This bibliography is published annually by the Remedial Action Program Information Center (RAPIC), which selects, analyzes, and disseminates information on environmental restoration, D&D and remedial actions. RAPIC staff and resources are available to meet a variety of information needs. Contact the center at (615) 576-0658.

1959 (ES/ER/TM-87/Pt.2) Nuclear Facility Decommissioning and Site Remedial Actions: A selected bibliography, Volume 14: Environmental Restoration Program: Part 2, Indexes. Goins, L.F.; Webb, J.R.;

Cravens, C.D.; Mallory, P.K. Martin Marietta Energy Systems, Inc., Oak Ridge, TN (United States). Sep 1993. 493p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94006306. Source: OSTI; NTIS; INIS; GPO Dep.

This Part 2 of this report provides indexes of: Author, Corporate Affiliation, Title Word, Publication Description, Geographic Location, Subject Category, and Key Words.

1960 (FEMP-2310) Streamlining the OU3 RI/FS process to accommodate decontamination and dismantlement at Fernald. Hampshire, L.H. (Fernald Environmental Restoration Management Corp., Cincinnati, OH (United States)); Dalg, D.G.; Clark, T.R.; Throckmorton, J.D.; Janke, R.J. Fernald Environmental Restoration Management Corp., Cincinnati, OH (United States). [1993]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-92OR21972. (CONF-931095-59: Department of Energy environmental remediation conference, Augusta, GA (United States), 24-28 Oct 1993). Order Number DE94003187. Source: OSTI; NTIS; GPO Dep.

The importance of a proper and complete assessment of data needs, relative to the characterization of a site, can never be understated. Not only will this assessment assure that the appropriate types, levels, and numbers of samples are taken, but as evidenced by the subject project, can lead to significant time and cost savings. The Fernald Environmental Management Project (FEMP), formerly known as the Feed Materials Production Center (FMPC), covers an area measuring 4.25 square kilometers (1,050 acres) and is located in a rural agricultural area about 28 kilometers (17 miles) northwest of downtown Cincinnati, Ohio. The site is near the villages of Fernald, New Haven, Ross, and Shandon, Ohio. After providing some general background information on the site, and the subject RI/FS, the remainder of this presentation will focus on how the sampling approach was changed to reflect a reassessment of data needs, and the resultant benefits of that change. Specifically, discussion will be provided relative to the initial approach proposed for characterizing the contamination at the site, the revised, improved sampling approach contained in the approved RI/FS Work Plan Addendum, and the benefits derived from this change in the sampling approach.

1961 (K/TCD-1076) Preconceptual design of the gas-phase decontamination demonstration cart. Munday, E.B. Oak Ridge K-25 Site, TN (United States). Dec 1993. 47p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OT21400. Order Number DE94004841. Source: OSTI; NTIS; INIS; GPO Dep.

Removal of uranium deposits from the interior surfaces of gaseous diffusion equipment will be a major portion of the overall multibillion dollar effort to decontaminate and decommission the gaseous diffusion plants. Long-term low-temperature (LTLT) gas-phase decontamination is being developed at the K-25 Site as an in situ decontamination process that is expected to significantly lower the decontamination costs, reduce worker exposure to radioactive materials, and reduce safeguard concerns. This report documents the preconceptual design of the process equipment that is necessary to conduct a full-scale demonstration of the LTLT method in accordance with the process steps listed above. The process equipment and method proposed in this report are not intended to represent a full-scale production campaign design and operation, since the gas evacuation, gas charging, and off-gas handling systems that would be cost effective in a production campaign are not cost effective

for a first-time demonstration. However, the design presented here is expected to be applicable to special decontamination projects beyond the demonstration, which could include the Deposit Recovery Program. The equipment will therefore be sized to a 200 ft size 1 converter (plus a substantial conservative design margin), which is the largest item of interest for gas phase decontamination in the Deposit Recovery Program. The decontamination equipment will allow recovery of the UF_6 , which is generated from the reaction of ClF_3 with the uranium deposits, by use of NaF traps.

1962 (K/TCD-1089) Technology needs for decommissioning and decontamination. Bundy, R.D.; Kennerly, J.M. Oak Ridge K-25 Site, TN (United States). Dec 1993. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OT21400. Order Number DE94004931. Source: OSTI; NTIS; INIS; GPO Dep.

This report summarizes the current view of the most important decontamination and decommissioning (D & D) technology needs for the US Department of Energy facilities for which the D & D programs are the responsibility of Martin Marietta Energy Systems, Inc. The source of information used in this assessment was a survey of the D & D program managers at each facility. A summary of needs presented in earlier surveys of site needs in approximate priority order was supplied to each site as a starting point to stimulate thinking. This document reflects a brief initial assessment of ongoing needs; these needs will change as plans for D & D are finalized, some of the technical problems are solved through successful development programs, and new ideas for D and D technologies appear. Thus, this assessment should be updated and upgraded periodically, perhaps, annually. This assessment differs from others that have been made in that it directly and solely reflects the perceived need for new technology by key personnel in the D & D programs at the various facilities and does not attempt to consider the likelihood that these technologies can be successfully developed. Thus, this list of technology needs also does not consider the cost, time, and effort required to develop the desired technologies. An R & D program must include studies that have a reasonable chance for success as well as those for which there is a high need. Other studies that considered the cost and probability of successful development as well as the need for new technology are documented. However, the need for new technology may be diluted in such studies; this document focuses only on the need for new technology as currently perceived by those actually charged with accomplishing D & D.

1963 (K/TCD-1090) Characterization of the internal surfaces of two emptied 30A UF_6 storage cylinders. Rao, M.; Ellis, A.; Freels, D. Oak Ridge K-25 Site, TN (United States). [1993]. 74p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OT21400. Order Number DE94005426. Source: OSTI; NTIS; GPO Dep.

Before any cylinders used for storage of uranium hexafluoride (UF_6) can be decommissioned, all chemical and metallurgical changes in the cylinder walls during storage need to be known. This study was conducted to obtain initial data on changes that may have occurred in cylinders because of long-term contact with UF_6 . Two 2.5-ton cylinders, emptied of UF_6 and rinsed, were selected based on the extent of residual radioactivity, as judged from sweeps of a field survey meter over the outside surfaces of a batch of cylinders. A videoprobe was used to record the appearance of the internal surface of the selected cylinder. Sections of

the cylinders representing various levels of residual radioactivity were cut out using a 6 in. diameter hole saw. These sections were further characterized by nuclear spectroscopy to identify the radionuclides present. Pieces were cut from the sections, mounted in taper section, and metallographically examined to characterize near-surface changes, including those resulting from surface corrosion from the moisture present in the washed cylinders. X-ray diffraction was used to further identify the various phases present, both in the corroded surface layers and in the immediate subsurface areas. Samples were examined using scanning electron microscopy and energy dispersive x-ray analysis to examine the morphology and chemical nature of surface residues relative to the various levels of residual radioactivity measured. X-ray photoelectron spectroscopy was used to examine the very-near surface layers. Results from the various techniques are discussed and compared and are interpreted in terms of overall impact on decommissioning.

1964 (KY/ER-8) Applicable or relevant and appropriate requirements (ARARs) for remedial actions at the Paducah Gaseous Diffusion Plant: A compendium of environmental laws and guidance: Environmental Restoration Program. Etner, E.L. (Oak Ridge National Lab., TN (United States)); Eaton, L.A. Paducah Gaseous Diffusion Plant, KY (United States); Oak Ridge National Lab., TN (United States). Mar 1992. 94p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (ORNL/M-2131). Order Number DE92018415. Source: OSTI; NTIS; INIS; GPO Dep.

Section 121 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 specifies that remedial actions for cleanup of hazardous substances found at sites placed on the National Priorities List (NPL) by the US Environmental Protection Agency (EPA) must comply with applicable or relevant and appropriate requirements (ARARs) or standards under federal and state environmental laws. To date, the US Department of Energy (DOE) Paducah Gaseous Diffusion Plant (PGDP) has not been on the NPL. Although DOE and EPA have entered into an Administrative Consent Order (ACO), the prime regulatory authority for cleanup at PGDP will be the Resource Conservation and Recovery Act (RCRA). This report supplies a preliminary list of available federal and state ARARs that might be considered for remedial response at PGDP in the event that the plant becomes included on the NPL or the ACO is modified to include CERCLA cleanup. A description of the terms "applicable" and "relevant and appropriate" is provided, as well as definitions of chemical-, location-, and action-specific ARARs. ARARs promulgated by the federal government and by the state of Kentucky are listed in tables. In addition, the major provisions of RCRA, the Safe Drinking Water Act, the Clean Water Act, the Clean Air Act, and other acts, as they apply to hazardous and radioactive waste cleanup, are discussed.

1965 (KY/ER-11) Environmental Restoration Site-Specific Plan for the Paducah Gaseous Diffusion Plant, FY 93. Oak Ridge National Lab., TN (United States); Paducah Gaseous Diffusion Plant, KY (United States); Portsmouth Gaseous Diffusion Plant, OH (United States). 15 Jan 1993. 77p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-76OR00001; AC05-84OR21400. Order Number DE94000599. Source: OSTI; NTIS; INIS; GPO Dep.

This report provides an overview of the major Environmental Restoration (ER) concerns at Paducah Gaseous

Diffusion Plant (PGDP). The identified solid waste management units at PGDP are listed. In the Department of Energy (DOE) Five Year Plan development process, one or more waste management units are addressed in a series of activity data sheets (ADSs) which identify planned scope, schedule, and cost objectives that are representative of the current state of planned technical development for individual or multiple sites.

1966 (LA-12356) Decommissioning the UHTREX Reactor Facility at Los Alamos, New Mexico. Salazar, M.; Elder, J. Los Alamos National Lab., NM (United States). Aug 1992. 117p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93002708. Source: OSTI; NTIS; INIS; GPO Dep.

The Ultra-High Temperature Reactor Experiment (UHTREX) facility was constructed in the late 1960s to advance high-temperature and gas-cooled reactor technology. The 3-MW reactor was graphite moderated and helium cooled and used 93% enriched uranium as its fuel. The reactor was run for approximately one year and was shut down in February 1970. The decommissioning of the facility involved removing the reactor and its associated components. This document details planning for the decommissioning operations which included characterizing the facility, estimating the costs of decommissioning, preparing environmental documentation, establishing a system to track costs and work progress, and preplanning to correct health and safety concerns in the facility. Work to decommission the facility began in 1988 and was completed in September 1990 at a cost of \$2.9 million. The facility was released to Department of Energy for other uses in its Los Alamos program.

1967 (LA-12464) Final project report: TA-35 Los Alamos Power Reactor Experiment No. II (LAPRE II) decommissioning project. Montoya, G.M. Los Alamos National Lab., NM (United States). Feb 1993. 45p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93012258. Source: OSTI; NTIS; INIS; GPO Dep.

This final report addresses the decommissioning of the LAPRE II Reactor, safety enclosure, fuel reservoir tanks, emergency fuel recovery system, primary pump pit, secondary loop, associated piping, and the post-remediation activities. Post-remedial action measurements are also included. The cost of the project including, Phase I assessment and Phase II remediation was approximately \$496K. The decommissioning operation produced 533 M³ of mixed waste.

1968 (LA-UR-91-2874) Decommissioning a nuclear reactor. Montoya, G.M. Los Alamos National Lab., NM (United States). [1991]. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-910981-18: Environmental remediation '91 conference, Pasco, WA (United States), 8-11 Sep 1991). Order Number DE92000311. Source: OSTI; NTIS; INIS; GPO Dep.

The process of decommissioning a facility such as a nuclear reactor or reprocessing plant presents many waste management options and concerns. Waste minimization is a primary consideration, along with protecting a personnel and the environment. Waste management is complicated in that both radioactive and chemical hazardous wastes must be dealt with. This paper presents the general decommissioning approach of a recent project at Los Alamos. Included are the following technical objectives: site characterization

work that provided a thorough physical, chemical, and radiological assessment of the contamination at the site; demonstration of the safe and cost-effective dismantlement of a highly contaminated and activated nuclear-fueled reactor; and techniques used in minimizing radioactive and hazardous waste. 12 figs.

1969 (ORNL/ER-17) Treatability study for WAG 6 (SWSA 6) trench water. Taylor, P.A. Oak Ridge National Lab., TN (United States). Aug 1991. 61p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92000418. Source: OSTI; NTIS; INIS; GPO Dep.

The Environmental Restoration Program at Oak Ridge National Laboratory (ORNL) is examining methods for remediation and final closure of Waste Area Grouping 6 (WAG 6) under a Resource Conservation and Recovery Act (RCRA) closure plan. WAG 6 consists primarily of Solid Waste Storage Area 6 (SWSA 6), where solid low-level radioactive waste (and some hazardous waste) was buried from 1968 to 1985 in shallow trenches. To support the feasibility study that is being prepared for closure of WAG 6, lab-scale treatability tests were performed on the water from selected trenches in SWSA 6 to determine if the trench water could be treated at the existing wastewater treatment plants at ORNL. Water from 23 of the 500 trenches in SWSA 6 has been sampled and analyzed to date, and the 4 most highly contaminated trenches identified thus far supplied the water used in the treatability tests. The softening and ion-exchange processes used in the Process Wastewater Treatment Plant (PWTP) reduced the ⁹⁰Sr concentration, which was the only radionuclide present in the trench water at above the discharge limits, from 260 to 0.2 Bq/L. The air stripping and activated carbon adsorption processes used in the Nonradiological Wastewater Treatment Plant (NRWTP) removed volatile and semivolatile organics (mostly toluene, xylene, and naphthalene), which were the main contaminants in the trench water, to below detection limits. The trench water treated in the lab-scale equipment easily met all discharge limits for the PWTP and the NRWTP. 6 refs., 2 figs., 9 tabs.

1970 (ORNL/ER-25) Task plan for TARA-II compaction and grouting demonstration: Environmental Restoration Program. Spalding, B.P. Oak Ridge National Lab., TN (United States). Nov 1991. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92012591. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental Sciences Division Publication No. 3808.

This task directly supports the corrective measures evaluation for the closure of Solid Waste Storage Area (SWSA) 6 but also supports technology development for the closure of other Oak Ridge National Laboratory (ORNL) WSAs and waste management units. Previous demonstrations have established the effectiveness of dynamic compaction and in situ grouting in stabilizing burial trenches against subsidence, which would otherwise compromise the support of infiltration barrier structures designed to protect buried waste from leaching. In situ grouting with polyacrylamide has also been demonstrated to improve the hydrologic isolation of buried waste. Both of these stabilization techniques have been demonstrated on burial trenches that are situated well above the water table and, hence, are in a chronic unsaturated moisture regime. Further demonstrations of these shallow-land burial trench stabilization techniques are necessary to establish their effectiveness and safety when

applied to burial trenches that are chronically inundated with groundwater.

1971 (ORNL/ER-39) Surveillance and maintenance plan for Waste Area Groupings at Oak Ridge National Laboratory, Oak Ridge, Tennessee, for FY 1993-2002: Environmental Restoration Program. Ford, M.K.; Holder, L. Jr.; Jones, R.G. Oak Ridge National Lab., TN (United States). Environmental Restoration Div. Dec 1992. 202p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93004613. Source: OSTI; NTIS; INIS; GPO Dep.

The Oak Ridge National Laboratory (ORNL) Waste Area Grouping (WAG) Surveillance and Maintenance (S&M) program was designed for the management of sites contaminated with radioactive materials and/or hazardous chemicals from the end of their operating life until final facility disposition or site stabilization in accordance with environmental regulations and good management practices. Program objectives include (1) S&M of sites/facilities awaiting final disposition; (2) planning for safe and orderly final closure at each site/facility; and (3) implementing a program to accomplish final disposition in a safe, cost-effective, and timely manner.

1972 (ORNL/ER-51) Health risk assessment for the Building 3001 Storage Canal at Oak Ridge National Laboratory, Oak Ridge, Tennessee. Chidambariah, V.; White, R.K. Oak Ridge National Lab., TN (United States). Dec 1991. 41p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92007197. Source: OSTI; NTIS; INIS; GPO Dep.

This human health risk assessment has been prepared for the Environmental Restoration (ER) Program at the Oak Ridge National Laboratory (ORNL), Oak Ridge, Tennessee. The objectives of this risk assessment are to evaluate the alternatives for interim closure of the Building 3001 Storage Canal and to identify the potential health risk from an existing leak in the canal. The Building 3001 Storage Canal connects Buildings 3001 and 3019. The volume of water in the canal is monitored and kept constant at about 62,000 gal. The primary contaminants of the canal water are the radionuclides ^{137}Cs , ^{60}Co , and ^{90}Sr ; a layer of sediment on the canal floor also contains radionuclides and metals. The prime medium of contaminant transport has been identified as groundwater. The primary route for occupational exposure at the canal is external exposure to gamma radiation from the canal water and the walls of the canal. Similarly, the primary exposure route at the 3042 sump is external exposure to gamma radiation from the groundwater and the walls of the sump. Based on the exposure rates in the radiation work permits (Appendix C) and assuming conservative occupational work periods, the annual radiation dose to workers is considerably less than the relevant dose limits. The potential risk to the public using the Clinch River was determined for three significant exposure pathways: ingestion of drinking water; ingestion of contaminated fish; and external exposure to contaminated sediments on the shoreline, the dominant exposure pathway.

1973 (ORNL/ER-60) Annual summary report on surveillance and maintenance activities of the surplus contaminated facilities program at Oak Ridge National Laboratory for period ending September 30, 1991. Cannon, T.R.; Ford, M.K.; Holder, L. Jr. Oak Ridge National Lab., TN (United States). Sep 1991. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract

AC05-84OR21400. Order Number DE92003745. Source: OSTI; NTIS; INIS; GPO Dep.

The Surplus Contaminated Facilities Program (SCFP) was established at the Oak Ridge National Laboratory (ORNL) in 1985 to provide support for inactive contaminated facilities that were largely abandoned by the programs which they formerly served. This support provides for routine surveillance and maintenance (S&M) and special projects beyond a routine nature when such actions are needed to ensure adequate protection of personnel or the environment. The facilities included in the program had been used for research, technology development, isotope production and processing, and waste management. Support for facilities in the SCFP has previously been provided by the Department of Energy's (DOE's) Office of Energy Research: Multiprogram Energy Laboratories - Facilities Support (ERKG) because of multiprogram use of the facilities or because of the landlord responsibility of Energy Research. Recently, an integrated Decontamination and Decommissioning (D&D) program within the DOE Office of Environmental Restoration and Waste Management has been established to collectively manage the former Surplus Facilities Management Program, Defense D&D Program, and the KG-funded, ORNL-originated SCFP. This report gives an overview of the S&M planning, routine S&M, and special maintenance project activities which have occurred at the SCFP facilities during the 1991 Fiscal Year.

1974 (ORNL/ER-61) Annual summary report of the decontamination and decommissioning surveillance and maintenance program at Oak Ridge National Laboratory for period ending September 30, 1991. Ford, M.K.; Holder, L. Jr. Oak Ridge National Lab., TN (United States). Sep 1991. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92003746. Source: OSTI; NTIS; INIS; GPO Dep.

The Surplus Facilities Management Program and Defense Facilities Decommissioning Program were established at Oak Ridge National Laboratory (ORNL) in 1976 in order to provide collective management of all surplus sites under ORNL control on the Oak Ridge Reservation. Some 34 facilities, classified into 3 civilian-related and 8 defense-related projects, are currently managed by the recently integrated Decontamination and Decommissioning Program. Support includes (1) surveillance and maintenance (S&M) planning, (2) routine S&M, and (3) special maintenance projects. This report documents routine S&M, special projects, and special maintenance performed on these facilities for the period of October 1990 through September 1991.

1975 (ORNL/ER-119) Plugging and abandonment plan for wells and coreholes at Oak Ridge National Laboratory, Oak Ridge, Tennessee: Environmental Restoration Program. Stansfield, R.G.; Bogle, M.A.; Wood, M.A. Oak Ridge National Lab., TN (United States). Jul 1992. 152p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92019216. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental Sciences Division Publication No. 3896.

Site environmental characterization and remediation require data obtained from the installation and sampling of wells and coreholes. When these wells and coreholes are no longer needed, are not producing reliable information, or are damaged and can act as conduits for contaminant migration, they should be identified and properly decommissioned. This is most important for wells of sufficient depth to create the potential for exchange of fluids between different

hydrologic units. This plan presents the strategy and detailed approach for the well and corehole P&A plan for most of the areas for which ORNL has responsibility. Although wells in Waste Area Grouping (WAG) 5 and WAG 10 are not specifically addressed in this plan, these wells will be incorporated into the decommissioning program in FY 1993.

1976 (ORNL/ER-130) Surveillance and Maintenance Plan for the ORNL Decontamination and Decommissioning Program FY 1993-2002. Ford, M.K.; Holder, L. Jr. Oak Ridge National Lab., TN (United States). Jul 1992. 115p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92019495. Source: OSTI; NTIS; INIS; GPO Dep.

The Decontamination and Decommissioning (D&D) Program at the Oak Ridge National Laboratory (ORNL) is part of the Department of Energy (DOE) Environmental Restoration D&D program. The purpose and objectives of this program include: (1) surveillance and maintenance (S&M) of facilities awaiting decommissioning; (2) planning for the orderly decommissioning of these facilities; and (3) implementation of a program to accomplish facility disposition in a safe, cost-effective, and timely manner. Participating D&D contractors are required to prepare formal plans that document the S&M programs established for each site. This report has been prepared to provide this documentation for those facilities included in the ORNL D&D Program.

1977 (ORNL/ER-141) Annual summary report of the Decontamination and Decommissioning surveillance and maintenance program at Oak Ridge National Laboratory for period ending September 30, 1992: Environmental Restoration Program. Ford, M.K.; Holder, L. Jr. Oak Ridge National Lab., TN (United States). Environmental Restoration Div. Sep 1992. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93001423. Source: OSTI; NTIS; INIS; GPO Dep.

The Oak Ridge National Laboratory (ORNL) Decontamination and Decommissioning (D&D) Program is part of the Department of Energy (DOE) Environmental Restoration D&D Program and has continued to provide surveillance and maintenance (S&M) support for 34 surplus facilities. The objectives are (1) to ensure adequate containment of residual radioactive materials remaining in the facilities, (2) to provide safety and security controls to minimize the potential hazards to on-site personnel and to the general public, and (3) to manage the facilities in the most cost-effective manner while awaiting decommissioning. This support has included work in three principal areas: (1) S&M planning, (2) routine S&M, and (3) special projects designed to correct serious facility deficiencies beyond the scope of routine maintenance.

1978 (ORNL/ER-208) Annual summary report of the Decontamination and Decommissioning Surveillance and Maintenance Program at Oak Ridge National Laboratory for period ending September 30, 1993: Environmental Restoration Program. Oak Ridge National Lab., TN (United States). Nov 1993. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94004745. Source: OSTI; NTIS; INIS; GPO Dep.

The Oak Ridge National Laboratory (ORNL) Decontamination and Decommissioning (D&D) Program has continued to provide surveillance and maintenance (S&M) support for 34 surplus facilities. The objectives are to (1) ensure

adequate containment of residual radioactive materials remaining in the facilities, (2) provide safety and security controls to minimize the potential hazards to on-site personnel and the general public, and (3) manage the facilities in the most cost-effective manner while awaiting decommissioning. This support has included work in three principal areas: (1) S&M planning, (2) routine S&M, and (3) special projects designed to correct serious facility deficiencies beyond the scope of routine maintenance.

1979 (ORNL/ER-219) Decontamination Project for Cell G of the Metal Recovery Facility at Oak Ridge National Laboratory, Oak Ridge, Tennessee. Mandry, G.J. (Oak Ridge National Lab., TN (United States)); Grisham, R.W. Oak Ridge National Lab., TN (United States); Allied Technology Group, Inc., Fremont, CA (United States). Feb 1994. 80p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94009501. Source: OSTI; NTIS; INIS; GPO Dep.

The goal of the decontamination effort in Cell G at the Metal Recovery Facility, Building 3505, located at the Oak Ridge National Laboratory, was two-fold: to determine the effectiveness of the dry decontamination technique employed and to provide data required to assess whether additional decontamination using this method would be beneficial in the eventual decommissioning of the facility. Allied Technology Group (ATG) was contracted to remove a portion of the concrete surface in Cell G by a technique known as scabbling. Some metallic cell components were also scabbled to remove paint and other surface debris. Generally, the scabbling operation was a success. Levels of contamination were greatly reduced. The depth of contaminant penetration into the concrete surfaces of certain areas was much greater than had been anticipated, necessitating the removal of additional concrete and extending ATG's period of performance. Scabbling and other related techniques will be extremely useful in the decontamination and decommissioning of other nuclear facilities with similar radiological profiles.

1980 (ORNL/ER/Sub-87-99053/49) Evaluation of closure alternatives for the Building 3001 Storage Canal at Oak Ridge National Laboratory, Oak Ridge, Tennessee: Environmental Restoration Program. Oak Ridge National Lab., TN (United States); Bechtel National, Inc., Oak Ridge, TN (United States). Feb 1992. 82p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92016615. Source: OSTI; NTIS; INIS; GPO Dep.

The Bldg. 3001 Storage Canal at ORNL is leaking approximately 400 gal of water per day. This report presents the Bechtel National Inc. (BNI) Team's evaluation of plans and presents recommendations for interim closure alternatives to stop the release of radionuclides and potential release of heavy metals into the environment. This is a conceptual evaluation and does not include detailed engineering of physical mitigation methods. The alternatives address only interim closure measures and not final decommissioning of the canal.

1981 (ORNL/M-1814) Functional requirements for the support facilities to plug and abandon wells at SWSA 6, Oak Ridge National Laboratory, Oak Ridge, Tennessee: Environmental Restoration Program. Tulay, M.P. (Gilbert/Commonwealth, Inc., Knoxville, TN (United States)). Oak Ridge National Lab., TN (United States); Gilbert/Commonwealth, Inc., Knoxville, TN (United States).

Jul 1991. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92004675. Source: OSTI; NTIS; GPO Dep.

Throughout the operational history of Solid Waste Storage Area 6 (SWSA 6) at Oak Ridge National Laboratory (ORNL), numerous wells have been drilled for a variety of research and monitoring purposes. The plugging and abandonment (P&A) of unneeded wells and boreholes is an integral part of the maintenance and closure process for waste area groupings at ORNL. Wells requiring abandonment in and near SWSA 6 are currently being identified by an ORNL inter-organizational group. The ORNL report Corrective Action Plan in Response to Tiger Team Assessment (report ORNL-6657, 1990) states that a number of wells will be plugged because they will be covered by the capping of the waste areas. Still more will be plugged to reduce the potential for surface water and groundwater communication, leaving only the wells necessary for detecting the presence or movement of contamination. There is a need for facilities to support the removal of unused wells and boreholes located in SWSA 6. The purpose of this project is to construct facilities that will support personnel and equipment employed to plug and abandon the inactive wells. Additionally, the purpose of this project is to upgrade selected roads and facilities in SWSA 6 necessary to commence closure activities.

1982 (ORNL/M-1851) Functional requirements for the Liquid Waste Transfer and Distribution Station at Waste Area Grouping 6 at Oak Ridge National Laboratory, Oak Ridge, Tennessee. Tulay, M.P. Oak Ridge National Lab., TN (United States). Aug 1991. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92005309. Source: OSTI; NTIS; GPO Dep.

A new facility will be constructed near the Bethel Valley storage tanks to receive process waste liquids generated by Oak Ridge National Laboratory during closure activities at Waste Area Grouping 6. The facility will unload trucks and distribute the liquid waste to other treatment facilities. It will be able to handle eight 5000-gal transfers per 8-h shift. No waste categorized as Resource Conservation and Recovery Act or liquid low-level is expected, but if such waste is encountered, it will cause transfer rate restrictions.

1983 (ORNL/M-2751/I) Oak Ridge National Laboratory Technology Logic Diagram: Indexes. Oak Ridge K-25 Site, TN (United States). Sep 1993. 142p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94009871. Source: OSTI; NTIS; GPO Dep.

The Decontamination and Decommissioning (D&D) Index provides a comprehensive list of site problems, problem area/constituents, remedial technologies, and regulatory terms discussed in the D&D sections of the Oak Ridge National Laboratory Technology Logic Diagram. All entries provide specific page numbers, or cross-reference entries that provide specific page numbers, in the D&D volumes (Vol. 1, Pt. A; Vol. 2, Pt. A; and appropriate parts of Vol. 3). The Oak Ridge National Laboratory Technology (TLD) was developed to provide a decision-support tool that relates environmental restoration (ER) and waste management (WM) problems at Oak Ridge National Laboratory (ORNL) to potential technologies that can remediate these problems. The TLD identifies the research, development, demonstration, testing, and evaluation needed to develop these technologies to a state that allows technology transfer and application to decontamination and decommissioning (D&D),

remedial action (RA) and WM activities. It is essential that follow-on engineering studies be conducted to build on the output of this project. These studies will begin by selecting the most promising technologies identified in the TLD and finding an optimum mix of technologies that will provide a socially acceptable balance between cost and risk.

1984 (ORNL/M-2751/V1/Pt.A) Oak Ridge National Laboratory Technology Logic Diagram: Volume 1, Technology Evaluation: Part A, Decontamination and Decommissioning. Oak Ridge K-25 Site, TN (United States). Sep 1993. 180p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93016144. Source: OSTI; NTIS; GPO Dep.

The Strategic Roadmap for the Oak Ridge Reservation is a generalized planning document that identifies broad categories of issues that keep ORNL outside full compliance with the law and other legally binding agreements. Possible generic paths to compliance, issues, and the schedule for resolution of the issues are identified. The role of the Oak Ridge National Laboratory Technology Logic Diagram (TLD) is then to identify specific site issues (problems), identify specific technologies that can be brought to bear on the issues, and assess the current status and readiness of these remediation technologies within the constraints of the schedule commitment. Regulatory requirements and commitments contained in the Strategic Roadmap for the Oak Ridge Reservation are also included in the TLD as constraints to the application of immature technological solutions. Some otherwise attractive technological solutions may not be employed because they may not be deployable on the schedule enumerated in the regulatory agreements. The roadmap for ORNL includes a list of 46 comprehensive logic diagrams for WM of low-level, radioactive-mixed, hazardous, sanitary and industrial, and TRU waste. The roadmap process gives comparisons of the installation as it exists to the way the installation should exist under full compliance. The identification of the issues is the goal of roadmapping. This allows accurate and timely formulation of activities.

1985 (ORNL/M-2751/V2/Pt.A) Oak Ridge National Laboratory Technology Logic Diagram: Volume 2, Technology Logic Diagram: Part A, Decontamination and Decommissioning. Oak Ridge K-25 Site, TN (United States). Sep 1993. 240p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93016147. Source: OSTI; NTIS; GPO Dep.

This report documents activities of decontamination and decommissioning at ORNL. Topics discussed include general problems, waste types, containment, robotics automation and decontamination processes.

1986 (PNL-7008-Vol.1) Resource book: Decommissioning of contaminated facilities at Hanford: Volume 1. Pacific Northwest Lab., Richland, WA (United States). Sep 1991. 339p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (PNL-MA-588-Vol.1). Order Number DE92001760. Source: OSTI; NTIS; INIS; GPO Dep.

Originally issued in August 1975 as PNL-MA-588.

In 1942 Hanford was commissioned as a site for the production of weapons-grade plutonium. The years since have seen the construction and operation of several generations of plutonium-producing reactors, plants for the chemical processing of irradiated fuel elements, plutonium and uranium

processing and fabrication plants, and other facilities. There has also been a diversification of the Hanford site with the building of new laboratories, a fission product encapsulation plant, improved high-level waste management facilities, the Fast Flux test facility, commercial power reactors and commercial solid waste disposal facilities. Obsolescence and changing requirements will result in the deactivation or retirement of buildings, waste storage tanks, waste burial grounds and liquid waste disposal sites which have become contaminated with varying levels of radionuclides. This manual was established as a written repository of information pertinent to decommissioning planning and operations at Hanford. The Resource Book contains, in several volumes, descriptive information of the Hanford Site and general discussions of several classes of contaminated facilities found at Hanford. Supplementing these discussions are appendices containing data sheets on individual contaminated facilities and sites at Hanford. Twelve appendices are provided, corresponding to the twelve classes into which the contaminated facilities at Hanford have been organized. Within each appendix are individual data sheets containing administrative, geographical, physical, radiological, functional and decommissioning information on each facility within the class. 68 refs., 54 figs., 18 tabs.

1987 (PNL-7008-Vol.2) Resource book: Decommissioning of contaminated facilities at Hanford: Volume 2. Pacific Northwest Lab., Richland, WA (United States). Sep 1991. 148p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (BNWL-MA-88-App.1; PNL-MA-588-Vol.2). Order Number DE92001759. Source: OSTI; NTIS; INIS; GPO Dep.

Originally issued in August 1975 as PNL-MA-588.

In 1942 Hanford was commissioned as a site for the production of weapons-grade plutonium. The years since have seen the construction and operation of several generations of plutonium-producing reactors, plants for the chemical processing of irradiated fuel elements, plutonium and uranium processing and fabrication plants, and other facilities. There has also been a diversification of the Hanford site with the building of new laboratories, a fission product encapsulation plant, improved high-level waste management facilities, the Fast Flux test facility, commercial power reactors and commercial solid waste disposal facilities. Obsolescence and changing requirements will result in the deactivation or retirement of buildings, waste storage tanks, waste burial grounds and liquid waste disposal sites which have become contaminated with varying levels of radionuclides. This manual was established as a written repository of information pertinent to decommissioning planning and operations at Hanford. The Resource Book contains, in several volumes, descriptive information of the Hanford Site and general discussions of several classes of contaminated facilities found at Hanford. Supplementing these discussions are appendices containing data sheets on individual contaminated facilities and sites at Hanford. Twelve appendices are provided, corresponding to the twelve classes into which the contaminated facilities at Hanford have been organized. Within each appendix are individual data sheets containing administrative, geographical, physical, radiological, functional and decommissioning information on each facility within the class. 49 refs., 44 figs., 14 tabs.

1988 (PNL-7008-Vol.3) Resource book: Decommissioning of contaminated facilities at Hanford: Volume 3. Pacific Northwest Lab., Richland, WA (United States). Sep 1991. 270p. Sponsored by USDOE, Washington, DC

(United States). DOE Contract AC06-76RL01830. (PNL-MA-588-Vol.3). Order Number DE92001761. Source: OSTI; NTIS; INIS; GPO Dep.

Originally issued in August 1975 as PNL-MA-588.

In 1942 Hanford was commissioned as a site for the production of weapons-grade plutonium. The years since have seen the construction and operation of several generations of plutonium-producing reactors, plants for the chemical processing of irradiated fuel elements, plutonium and uranium processing and fabrication plants, and other facilities. There has also been a diversification of the Hanford site with the building of new laboratories, a fission product encapsulation plant, improved high-level waste management facilities, the Fast Flux test facility, commercial power reactors and commercial solid waste disposal facilities. Obsolescence and changing requirements will result in the deactivation or retirement of buildings, waste storage tanks, waste burial grounds and liquid waste disposal sites which have become contaminated with varying levels of radionuclides. This manual was established as a written repository of information pertinent to decommissioning planning and operations at Hanford. The Resource Book contains, in several volumes, descriptive information of the Hanford Site and general discussions of several classes of contaminated facilities found at Hanford. Supplementing these discussions are appendices containing data sheets on individual contaminated facilities and sites at Hanford. Twelve appendices are provided, corresponding to the twelve classes into which the contaminated facilities at Hanford have been organized. Within each appendix are individual data sheets containing administrative, geographical, physical, radiological, functional and decommissioning information on each facility within the class. 68 refs., 54 figs., 18 tabs.

1989 (PNL-8008) Decontamination solution development studies. Allen, R.P.; Fetrow, L.K.; Kjarmo, H.E.; Pool, K.H. Pacific Northwest Lab., Richland, WA (United States). Sep 1993. 72p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94001554. Source: OSTI; NTIS; INIS; GPO Dep.

This study was conducted for the Westinghouse Hanford Company (WHC) by Pacific Northwest Laboratory (PNL) as part of the Hanford Grout Technology Program (HGTP). The objective of this study was to identify decontamination solutions capable of removing radioactive contaminants and grout from the Grout Treatment Facility (GTF) process equipment and to determine the impact of these solutions on equipment components and disposal options. The reference grout used in this study was prepared with simulated double-shell slurry feed (DSSF) and a dry blend consisting of 40 wt % limestone flour, 28 wt % blast furnace slag, 28 wt % fly ash, and 4 wt % type I/II Portland cement.

1990 (PNL-8918) Workforce estimates for environmental restoration at Pinellas Plant. April, J.G.; Stahlman, E.J. Pacific Northwest Lab., Richland, WA (United States). Oct 1993. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94002831. Source: OSTI; NTIS; GPO Dep.

The purpose of this study was to assist the Pinellas Plant, Largo, Florida, in estimating work-force requirements for the anticipated environmental restoration (ER) mission. Pacific Northwest Laboratory (PNL) has prepared workforce estimates required for ER and the decontamination and decommissioning (D&D) at Pinellas Plant. These estimates are presented in the report and were based on a comparison of

several ER projects of similar magnitude, including Elmendorf Air Force Base in Alaska; Hanford in Richland, Washington; and the Radium Chemical D&D project in Queens, New York. The characterization of the Pinellas Plant was based on the RCRA [Resource Conservation and Recovery Act] Facility Investigation Report: Pinellas Plant.

1991 (PNL-8920) Workforce Transition Model for DOE-AL non-nuclear reconfiguration. Stahlman, E.J.; Lewis, R.E. Pacific Northwest Lab., Richland, WA (United States). Oct 1993. 47p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94002832. Source: OSTI; NTIS; GPO Dep.

The Pacific Northwest Laboratory (PNL) was tasked by the US Department of Energy Albuquerque Field Office (DOE-AL) to develop a workforce assessment and transition planning tool to support integrated decision making at a single DOE installation. The planning tool permits coordinated, integrated workforce planning to manage growth, decline, or transition within a DOE installation. The tool enhances the links and provides commonality between strategic, programmatic, and operations planners and human resources. Successful development and subsequent complex-wide implementation of the model will also facilitate planning at the national level by enforcing a consistent format on data that are now collected by installations in corporate-specific formats that are not amenable to national-level analyses. The workforce assessment and transition planning tool consists of two components: the Workforce Transition Model and the Workforce Budget Constraint Model. The Workforce Transition Model, the preponderant of the two, assists decision makers to identify and evaluates alternatives for transitioning the current workforce to meet the skills required to support projected workforce requirements. The Workforce Budget Constraint Model helps estimate the number of personnel that will be affected given a workforce budget increase or decrease and assists in identifying how the corresponding hiring or layoffs should be distributed across the common occupational classification system (COCS) occupations. The conceptual models and the computer implementation are described.

1992 (PNL-SA-18817) The observational approach in environmental restoration. Smyth, J.D. (Pacific Northwest Lab., Richland, WA (USA)); Quinn, R.D. Pacific Northwest Lab., Richland, WA (United States). Jul 1991. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9107139-1: 1991 American Society of Civil Engineers (ASCE) national conference on environmental engineering, Reno, NV (United States), 8-10 Jul 1991). Order Number DE91015528. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy (DOE) has committed to completing environmental restoration of its facilities within the next 28 years (DOE 1990b). In order to achieve this, DOE must ensure that its restoration activities are both effective and efficient. A key aspect of fulfilling this commitment is the recognition and management of uncertainty that is inherent in waste-site clean-up actions. The DOE Office of Environmental Restoration (DOE-ER) requested Pacific Northwest Laboratory (PNL) to investigate the applicability and implementation of what is known as the "observational approach" to better address these needs. PNL's initial investigation resulted in the positive conclusion that the observational approach had potential benefit to DOE during environmental restoration. In a follow-on effort, PNL supported by CH2M HILL, has been providing guidance to DOE

field-offices on observational approach fundamentals, implementation, and application to waste-site remediation. This paper outlines the fundamentals of the observational approach and discusses the progress in integrating the observational approach in DOE's environmental restoration efforts. 9 refs., 2 figs.

1993 (PNL-SA-21775) Proceedings of the First Hanford Separation Science Workshop. Pacific Northwest Lab., Richland, WA (United States). May 1993. 221p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9107153-: 1. Hanford separations workshop, Richland, WA (United States), 23-25 Jul 1991). Order Number DE93016925. Source: OSTI; NTIS; INIS; GPO Dep.

The First Hanford Separation Science Workshop, sponsored by PNL had two main objectives: (1) assess the applicability of available separation methods for environmental restoration and for minimization, recovery, and recycle of mixed and radioactive wastes; and (2) identify research needs that must be addressed to create new or improved technologies. The information gathered at this workshop not only applies to Hanford but could be adapted to DOE facilities throughout the nation as well. These proceedings have been divided into three components: Background and Introduction to the Problem gives an overview of the history of the Site and the cleanup mission, including waste management operations, past disposal practices, current operations, and plans for the future. Also included in this section is a discussion of specific problems concerning the chemistry of the Hanford wastes. Separation Methodologies contains the papers given at the workshop by national experts in the field of separation science regarding the state-of-the-art of various methods and their applicability/adaptability to Hanford. Research Needs identifies further research areas developed in working group sessions. Individual papers are indexed separately.

1994 (PNL-SA-22047) Risk management in facility transition and management decision making: Needs and opportunities. Stillwell, W. (Pacific Northwest Lab., Richland, WA (United States)); Seaver, D.; Keller, J.; Smith, D.; Weaver, D.; Sanders, T.; Thullen, P. Pacific Northwest Lab., Richland, WA (United States). Feb 1993. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-930205-42: Waste management '93, Tucson, AZ (United States), 28 Feb - 4 Mar 1993). Order Number DE93009813. Source: OSTI; NTIS; INIS; GPO Dep.

An overall approach to risk management is described in this paper. Many of these concepts have been developed and applied as part of Hanford Mission Planning (HMP) (Hanford Mission Plan, 1992). At Hanford, HMP provides a mechanism for integrating planning across all the missions and programs of the site. This paper discusses the decision context within which EM must make and defend decisions, the types of decisions that are being and will need to be made in order to progress with the cleanup of the DOE complex, and the resulting need for risk management. Risk management, in turn, requires quality health and ecological risk information to make these decisions. Other types of information are also needed, but the risk information is typically the most important and the most difficult to obtain. The paper then describes a general technical approach to risk management, including particular methods for developing the high quality of human health and ecological risk information that will be needed to support risk management. We

next turn to several special issues that make risk management more complex than many other decisions. We discuss these issues and offer some practical suggestions with respect to addressing them in the risk management framework. Finally, we conclude with some discussion of other opportunities for applying risk management.

1995 (POEF/ER-4548) Annual summary report surveillance and maintenance program, FY 1992 activities: Environmental Restoration Decontamination and Decommissioning Program. Schloesslin, W. Portsmouth Gaseous Diffusion Plant, OH (United States). Nov 1992. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-76OR00001. Order Number DE93003320. Source: OSTI; NTIS; GPO Dep.

The D&D Program at the Portsmouth Gaseous Diffusion Plant (PORTS) is part of the Environmental Restoration and Waste Management Program (ERWM). This work is funded through the Office of Environmental Restoration and Waste Management (EW-20). Its objective is to provide PORTS the capability to meet applicable environmental regulations through facility decommissioning activities and site decontamination actions. In support of this objective, the D&D Program provides collective management of sites within PORTS which are in need of D&D action, prioritizes those areas in terms of health, safety, and environmental concerns; and implements the appropriate level of remedial action. The program provides support to facilities which formerly served one or more of the many PORTS functions. Program activities include surveillance and maintenance of facilities awaiting decommissioning; planning safe and orderly facility decommissioning; and implementing a program to accomplish facility dispositioning in a safe, cost effective, and timely manner. The S&M Program is part of the D&D Program and was established at PORTS in FY 1989 to accomplish the following objectives: Ensure adequate containment of residual radioactive and hazardous materials remaining in inactive facilities; Provide safety and security controls to minimize the potential hazards to on-site personnel and the general public; and, manage the facilities awaiting decommissioning in the most cost effective manner.

1996 (POEF/ER-4549) Portsmouth Gaseous Diffusion Plant Decontamination and Decommissioning Program surveillance and maintenance plan, FY 1993-2002. Schloesslin, W. Portsmouth Gaseous Diffusion Plant, OH (United States). Nov 1992. 35p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-76OR00001. Order Number DE93004428. Source: OSTI; NTIS; INIS; GPO Dep.

The Decontamination and Decommissioning (D&D) Program at the Portsmouth Gaseous Diffusion Plant (PORTS) is part of the Environmental Restoration (ER) and Waste Management (WM) Programs (ERWM). The objective of the ER Program is to provide PORTS the capability to meet applicable environmental regulations through facility development activities and site remedial actions. The WM Program supports the ER Program. The D&D Program provides collective management of the sites within the plant which require decontamination and decommissioning, prioritizes those areas in terms of health, safety and environmental concerns, and implements the appropriate level of remedial action. The D&D Program provides support to facilities which formerly served one or more of the many Plant functions. Program activities include (1) surveillance and maintenance of facilities awaiting decommissioning; (2)

planning safe and orderly facility decommissioning; and (3) implementing a program to accomplish facility disposition in a safe, cost effective, and timely manner. In order to achieve the first objective, a formal plan which documents the surveillance and maintenance needs for each inactive facility has been prepared. This report provides this documentation for the PORTS facilities currently included in the D&D Program and includes projected resource requirements for the planning period of FY 1993 through FY 2002.

1997 (SAND-90-3065C) Intelligent systems for remote decommissioning in hazardous environments. Drotning, W.D.; Bennett, P.C. Sandia National Labs., Albuquerque, NM (United States). [1991]. 13p. Sponsored by USDOE, Washington, DC (USA). DOE Contract AC04-76DP00789. (CONF-910602-12: 1991 American Society of Mechanical Engineers (ASME) pressure vessels and piping conference, San Diego, CA (United States), 23-28 Jun 1991). Order Number DE91008573. Source: OSTI; NTIS; INIS; GPO Dep.

Investigation of advanced technologies utilizing intelligent machines is being supported jointly by the US Department of Energy Offices of Civilian Radioactive Waste Management (DOE/RW) and Environmental Restoration and Waste Management (DOE/EM) for automation of transportation package handling operations at nuclear facilities and of nuclear waste site remediation efforts. Handling operation requirements include identification, location, and health physics operation, followed by bolting/unbolting operations and package disassembly. To accommodate these operations and the diversity of packages, fast model-based automated programming and force feedback control of a robotic cask handling system were developed. In addition, sensor-directed model-based robotic control has been demonstrated for application to hazardous material cleanup. In this application, a graphical interface is used to simulate and evaluate operator-controlled motions and provide telerobotic control of the system. Remote automated handling technologies developed through these programs have the potential to decrease worker exposure and increase efficiency during decommissioning activities in hazardous environments. 8 refs., 4 figs.

1998 (WHC-EP-0231-4) Surplus Facilities and Resource Conservation and Recovery Act Closure program plan, fiscal year 1992. Hughes, M.C.; Wahlen, R.K.; Winship, R.A. Westinghouse Hanford Co., Richland, WA (United States). Oct 1991. 148p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92004541. Source: OSTI; NTIS; INIS; GPO Dep.

The Surplus Facilities and Resource Conservation and Recovery Act Closure program is responsible to US Department of Energy Field Office, Richland for the safe, cost-effective surveillance, maintenance, and decommissioning of surplus facilities at the Hanford Site. The Surplus Facilities and Resource Conservation and Recovery Act Closure program is also responsible to US Department of Energy Field Office, Richland for the program management of specific Resource Conservation and Recovery Act closures at the Hanford Site. This program plan addresses only the surplus facilities. The criteria used to evaluate each factor relative to decommissioning are based on the guidelines presented by the US Department of Energy Field Office, Richland, Environmental Restoration Division. The guidelines are consistent with the Westinghouse Hanford Company commitment to decommission Hanford Site retired

facilities in the safest and most cost-effective way achievable. This document outlines the plan for managing these facilities until disposal.

1999 (WHC-EP-0478) Summary of the Hanford Site decontamination, decommissioning, and cleanup, FY 1974-FY 1990. Wahlen, R.K. Westinghouse Hanford Co., Richland, WA (United States). Aug 1991. 170p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92000890. Source: OSTI; NTIS; INIS; GPO Dep.

At the end of World War II, the demand for more production along with process and military surveillance changes at the Hanford Site caused a continuing cycle of building and obsolescence. This trend continued until 1964, when the cutback in plutonium production began. The cutback caused the shutdown of excess production facilities. The last of eight reactors was shut down in 1971. Since that time, N Reactor has been the only production reactor that has operated. In addition, changes in the method of separating plutonium caused a number of excess facilities in the 200 Areas. Before 1973, no structured program existed for the disposal of unusable facilities or for general cleanup. Following a plant-wide safety and housekeeping inspection in 1973, a program was developed for the disposal of all surplus facilities. Since the start of FY 1974, a total of 46 radioactively contaminated sites have been demolished and disposed of. In addition, 28 buildings have been decontaminated for in situ disposal or for reuse, 21 contaminated sites have been stabilized, 131 clean structures have been removed, and 93 clean sites have received special remedial action to eliminate potential safety and/or environmental hazards. This report summarizes these activities. 3 refs, 1 fig., 18 tabs.

2000 (WHC-EP-0535) Annual surveillance and maintenance report for the retired Hanford Site facilities. Egge, R.G. Westinghouse Hanford Co., Richland, WA (United States). Dec 1991. 66p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92008592. Source: OSTI; NTIS; INIS; GPO Dep.

Implementation, of the surveillance and maintenance activities in the contaminated inactive facilities, in accordance with applicable laws and regulations, is the responsibility of Inactive Facilities Surveillance and Maintenance. The fundamental goal is to ensure that risks to the environment and human health and safety posed by the inventory of contaminated inactive facilities and sites from past US Department of Energy operations are maintained at prescribes safe levels in timely and cost-effective manner until they can be fully decommissioned. The inventory of inactive facilities will continue to increase as additional programs are modified or phased out as part of the changing mission at the Hanford Site. Of the funding received for inactive facilities, a growing percentage is being used for maintaining the confinement structures to ensure contamination control. With equipment and structures approaching three times their original design life, the probability of contamination release to the environment will increase. Even with continued facility maintenance, the probability of contamination release to the environment will always exist.

2001 (WHC-EP-0535-1) Annual surveillance and maintenance report for the retired Hanford Site facilities: Fiscal year 1992. Egge, R.G. Westinghouse Hanford Co., Richland, WA (United States). Nov 1992. 156p. Sponsored by USDOE, Washington, DC (United States). DOE

Contract AC06-87RL10930. Order Number DE93005000. Source: OSTI; NTIS; INIS; GPO Dep.

This report fulfills the US Department of Energy, Richland Field Office, annual milestone requirement to provide a status of the surveillance and maintenance actions that were accomplished in fiscal year 1992 for the retired, surplus facilities at the Hanford Site. These actions comply with US Department of Energy Order 5820.2A, Chapter V.*, and Order 5480.1B**, which require these facilities to be kept in a safe-storage configuration until final decommissioning can be accomplished. The surplus facilities covered in this report are located in the 100 and 200 Areas of the 1,450-Km² (560-mi²) Hanford Site (Figure A-1), a semiarid tract of land in southeastern Washington State. The facilities are located 24 to 48 kilometers (15 to 30 miles) from Richland, Washington (population 31,000). The 100 Area facilities are all located directly adjacent to the Columbia River. Design life parameters and present age of buildings, surveillance interval and types, hazardous and radiological inventories, photographs and general descriptions of the buildings, routine and nonroutine maintenance accomplishments in fiscal year 1992, and outyear Forecast estimates for nonroutine maintenance actions are contained in this report.

2002 (WHC-EP-0619-Vol.1) Risk management study for the retired Hanford Site facilities: Risk management executive summary: Volume 1. Coles, G.A.; Shultz, M.V.; Taylor, W.E. Westinghouse Hanford Co., Richland, WA (United States). Feb 1994. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94009389. Source: OSTI; NTIS; INIS; GPO Dep.

This document provides a cost-comparison evaluation for implementing certain risk-reduction measures and their effect on the overall risk of the 100 and 200 Area retired, surplus facilities. The evaluation is based on conditions that existed at the time the risk evaluation team performed facility investigations, and does not acknowledge risk-reduction measures that occurred soon after risk identification. This evaluation is one part of an overall risk management study for these facilities. The retired facilities investigated for this evaluation are located in the 100 and 200 Areas of the 1450-km² Hanford Site. The Hanford Site is a semiarid tract of land in southeastern Washington State. The nearest population center is Richland, Washington, (population 32,000) 30 km southeast of the 200 Area. This document is the first in a four volume series that comprise the risk management study for the retired, surplus facilities. Volume 2 is the risk evaluation work procedure; volume 3 provides the results for the risk evaluation; and volume 4 is the risk-reduction cost comparison.

2003 (WHC-EP-0619-Vol.2) Risk management study for the retired Hanford Site facilities: Volume 2, Risk evaluation work procedure for the retired Hanford Site facilities. Coles, G.A.; Shultz, M.V.; Taylor, W.E. Westinghouse Hanford Co., Richland, WA (United States). Apr 1993. 47p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93013004. Source: OSTI; NTIS; INIS; GPO Dep.

Risk from retired surplus facilities has always been assumed to be low at the Hanford Site as the facilities are inactive and have few potentials for causing an offsite hazardous material release. However, the fatal accident that occurred in the spring of 1992 in which an employee fell through a deteriorated roof at the 105-F Reactor Building has raised the possibility that retired facilities represent a

greater risk than was originally assumed. Therefore, Westinghouse Hanford Company and the US Department of Energy management have determined that facility risk management strategies and programmatic plans should be reevaluated to assure risks are identified and appropriate corrective action plans are developed. To evaluate risk management strategies, accurate risk information about the current and projected condition of the facilities must be developed. This work procedure has been created to address the development of accurate and timely risk information. By using the evaluation results in this procedure, it will be possible to create a prioritized baseline for managing facility risk until all retired surplus facilities are demolished.

2004 (WHC-EP-0619-Vol.3) Risk management study for the retired Hanford Site facilities: Qualitative risk evaluation for the retired Hanford Site facilities: Volume 3. Coles, G.A.; Shultz, M.V.; Taylor, W.E. Westinghouse Hanford Co., Richland, WA (United States). Sep 1993. 751p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94001230. Source: OSTI; NTIS; INIS; GPO Dep.

This document provides a risk evaluation of the 100 and 200 Area retired, surplus facilities on the Hanford Site. Also included are the related data that were compiled by the risk evaluation team during investigations performed on the facilities. Results are the product of a major effort performed in fiscal year 1993 to produce qualitative information that characterizes certain risks associated with these facilities. The retired facilities investigated for this evaluation are located in the 100 and 200 Areas of the 1,450-km² (570-mi²) Hanford Site. The Hanford Site is a semiarid tract of land in southeastern Washington State. The nearest population center is Richland, Washington, (population 32,000) 30-km (20 mi) southeast of the 200 Area. During walkdown investigations of these facilities, data on real and potential hazards that threatened human health or safety or created potential environmental release issues were identified by the risk evaluation team. Using these findings, the team categorized the identified hazards by facility and evaluated the risk associated with each hazard. The factors contributing to each risk, and the consequence and likelihood of harm associated with each hazard also are included in this evaluation.

2005 (WHC-EP-0619-Vol.4) Risk management study for the Hanford Site facilities: Risk reduction cost comparison for the retired Hanford Site facilities: Volume 4. Coles, G.A.; Egge, R.G.; Senger, E.; Shultz, M.W.; Taylor, W.E. Westinghouse Hanford Co., Richland, WA (United States). Feb 1994. 145p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94009390. Source: OSTI; NTIS; INIS; GPO Dep.

This document provides a cost-comparison evaluation for implementing certain risk-reduction measures and their effect on the overall risk of the 100 and 200 Area retired, surplus facilities. The evaluation is based on conditions that existed at the time the risk evaluation team performed facility investigations, and does not acknowledge risk-reduction measures that occurred soon after risk identification. This evaluation is one part of an overall risk management study for these facilities. The retired facilities investigated for this evaluation are located in the 100 and 200 Areas of the 1450-km² Hanford Site. The Hanford Site is a semiarid tract of land in southeastern Washington State. The nearest population center is Richland, Washington, (population 32,000) 30 km southeast of the 200 Area. This cost-comparison

evaluation (1) determines relative costs for reducing risk to acceptable levels; (2) compares the cost of reducing risk using different risk-reduction options; and (3) compares the cost of reducing risks at different facilities. The result is an identification of the cost effective risk-reduction measures. Supporting information required to develop costs of the various risk-reduction options also is included.

2006 (WHC-EP-0693) Idaho Chemical Processing Plant and Plutonium-Uranium Extraction Plant phase-out/deactivation study. Patterson, M.W. (Westinghouse Idaho Nuclear Co., Idaho Falls, ID (United States)); Thompson, R.J. Westinghouse Hanford Co., Richland, WA (United States). Jan 1994. 55p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94005981. Source: OSTI; NTIS; INIS; GPO Dep.

The decision to cease all US Department of Energy (DOE) reprocessing of nuclear fuels was made on April 28, 1992. This study provides insight into and a comparison of the management, technical, compliance, and safety strategies for deactivating the Idaho Chemical Processing Plant (ICPP) at Westinghouse Idaho Nuclear Company (WINCO) and the Westinghouse Hanford Company (WHC) Plutonium-Uranium Extraction (PUREX) Plant. The purpose of this study is to ensure that lessons-learned and future plans are coordinated between the two facilities.

2007 (WHC-EP-0726) General safety basis development guidance for environmental restoration decontamination and decommissioning. Ellingson, D.R. (Westinghouse Hanford Co., Richland, WA (United States)); Kerr, N.; Bohlander, K.; Hansen, J.; Crowley, W. Westinghouse Hanford Co., Richland, WA (United States). Feb 1994. 68p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94008658. Source: OSTI; NTIS; INIS; GPO Dep.

Safety analyses have the objective of contributing to two essential ingredients of a successful operation. The first is promoting the safety of the operation through worker involvement in information development (safety basis). The second is obtaining approval to conduct the operation (authorization). Typically these ingredients are assembled under separate programs covered by separate DOE requirements. DOE authorization relies on successful development of a document containing up to 21 topics written in terms and language suited to reviewers and approvers. Safety relies on successful training and procedures that convert the technical documented information into terms and language understandable to the worker. This separation can lead to successful incorporation of one ingredient independent of the other. At best, this separation may result in a safe but unauthorized operation; at worst, the separation may result in an unsafe operation authorized to proceed. This guide is based on experiences gained by contractors who have integrated rather than separated the safety and authorization. The short duration of ER/D&D activities, the uncertainties of hazards, and the publicly expressed desire for demonstrable progress in cleanup activities add emphasis to the need to integrate rather than separate and develop new programs. Experience-based information has been useful to workers, safety analysis practitioners, and reviewers in the following ways: (1) Acquiring or developing the needed information in a useful form; (2) Managing the uncertainties during activity development and operation; (3) Identifying the subset of applicable requirements for an activity; (4) Developing the

appropriate level of documentation detail for a specific activity; and (5) Increasing the usefulness and use of safety analysis (ownership).

2008 (WHC-SA-1190) Safe storage of deactivated radiological chemical processing plants in the 200 West Area of the Hanford Site. Egge, R.G. Westinghouse Hanford Co., Richland, WA (United States). Sep 1991. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-910981-38: Environmental remediation '91 conference, Pasco, WA (United States), 8-11 Sep 1991). Order Number DE92002252. Source: OSTI; NTIS; INIS; GPO Dep.

This paper describes the surveillance and preventive maintenance actions that are implemented in the retired chemical processing plants (S Plant and U Plant) for the US Department of Energy Field Office, Richland (RL). These actions are intended to keep the facilities in a safe storage configuration until final decommissioning, scheduled to begin in 2007, can be accomplished. 4 figs., 2 tabs.

2009 (WHC-SA-1191) RCRA closure experience with radioactive mixed waste in the 183-H Solar Evaporation Basins at the Hanford Site. Morton, M.R. Westinghouse Hanford Co., Richland, WA (United States). Sep 1991. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-910981-69: Environmental remediation '91 conference, Pasco, WA (United States), 8-11 Sep 1991). Order Number DE93004981. Source: OSTI; NTIS; INIS; GPO Dep.

This paper provides an overview of the Resource Conservation and Recovery Act (RCRA) of 1976 closure work of the 183-H Solar Evaporation Basins, at the Hanford Site for the US Department of Energy Field Office, Richland, Washington. A description of how the hazardous wastes and radioactive wastes (mixed wastes) were treated and removed is provided, as well as presenting an overview of the sampling program used to demonstrate and document closure.

2010 (WHC-SA-1811) Cleanout and stabilization at B Plant. Gehrke, J.W.; Davis, W.E. Westinghouse Hanford Co., Richland, WA (United States). Jul 1993. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-9308137-5: 1993 summer national American Institute of Chemical Engineers (AIChE) conference, Seattle, WA (United States), 15-18 Aug 1993). Order Number DE93040313. Source: OSTI; NTIS; INIS; GPO Dep.

B Plant is a 48-year-old canyon facility operated by the US Department of Energy at the Hanford Site in Washington State. Its last process mission was completed in 1985. The new mission is to complete a transition to long-term surveillance and maintenance before decontamination and decommissioning. This paper is a status report on the new mission, with emphasis on key technical and programmatic decisions to be made regarding radioactive hazards, or source terms, in the plant. The B Plant structure is a design uniquely suited for radioactive chemical processing and remote maintenance. The structure provides heavy concrete shielding, separating clean working areas from highly contaminated process areas. To complicate the transition to shutdown for the B Plant facility, several operating systems must and will remain operational to support the adjacent Waste Encapsulation and Storage Facility and its radioactive strontium and cesium capsule inventory. This paper details progress made and tasks remaining for cleaning up B Plant.

The tasks include decontamination of the canyon work area, removal of radioactive liquids stored from previous process missions, deactivation of equipment, and characterizing/stabilizing source terms ranging from contaminated High-Efficiency Particulate Air filters to residual concrete and equipment contamination. Progress that has been made during the first year, since this new mission was defined (mid 1992 to mid 1993), is documented in this paper. The cleanup mission for B Plant is expected to be of special interest to other US Department of Energy canyon facilities.

2011 (WHC-SA-1812) Use of the USQ process with an operating SAR for the shutdown/terminal cleanout of the PUREX facility. Dodd, E.N. Westinghouse Hanford Co., Richland, WA (United States). Jun 1993. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-9306143-12: Energy Facility Contractors Group safety analysis meeting, Denver, CO (United States), 16-18 Jun 1993). Order Number DE93016223. Source: OSTI; NTIS; INIS; GPO Dep.

The Plutonium-Uranium Extraction (PUREX) facility at the Hanford Site is a remote canyon facility that began operations in 1956 to support the Atomic Energy Commission and later the Department of Energy in the recovery of plutonium, uranium, and neptunium from spent reactor fuel. This report follows the transition of the PUREX facility from standby mode in 1990 to shutdown/terminal cleanout. Preparation of the Final Safety Analysis Report (FSAR), evaluation of OSR requirements, and the use of the USQ to successfully complete the deactivation of the facility in a timely and cost effective manner are discussed. The major activities, both administrative and procedural, performed as part of the PUREX facility deactivation are described.

2012 (WHC-SA-1831) Preliminary standard review guide for Environmental Restoration/Decontamination and Decommissioning safety analyses. Ellingson, D.R. Westinghouse Hanford Co., Richland, WA (United States). Jun 1993. 36p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-9306143-13: Energy Facility Contractors Group safety analysis meeting, Denver, CO (United States), 16-18 Jun 1993). Order Number DE93016348. Source: OSTI; NTIS; INIS; GPO Dep.

The review guide is based on the shared experiences, approaches, and philosophies of the Environmental Restoration/Decontamination and Decommissioning (ER/D&D) subgroup members. It is presented in the form of a review guide to maximize the benefit to both the safety analyses practitioner and reviewer. The guide focuses on those challenges that tend to be unique to ER/D&D cleanup activities. Some of these experiences, approaches, and philosophies may find application or be beneficial to a broader spectrum of activities such as terminal cleanout or even new operations. Challenges unique to ER/D&D activities include (1) consent agreements requiring activity startup on designated dates; (2) the increased uncertainty of specific hazards; and (3) the highly variable activities covered under the broad category of ER/D&D. These unique challenges are in addition to the challenges encountered in all activities; e.g., new and changing requirements and multiple interpretations. The experiences in approaches, methods, and solutions to the challenges are documented from the practitioner and reviewer's perspective, thereby providing the viewpoints on why a direction was taken and the concerns expressed. Site cleanup consent agreements with predetermined dates for restoration activity startup add the dimension of imposed

punitive actions for failure to meet the date. Approval of the safety analysis is a prerequisite to startup. Actions that increase expediency are (1) assuring activity safety; (2) documenting that assurance; and (3) acquiring the necessary approvals. These actions increase the timeliness of startup and decrease the potential for punitive action. Improvement in expediency has been achieved by using safety analysis techniques to provide input to the line management decision process rather than as a review of line management decisions. Expediency is also improved by sharing the safety input and resultant decisions with reviewers and regulators.

2013 (WHC-SA-1933) Westinghouse Hanford Company risk management strategy for retired surplus facilities. Taylor, W.E.; Coles, G.A.; Shultz, M.V.; Egge, R.G. Westinghouse Hanford Co., Richland, WA (United States). Sep 1993. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-931095-66: Department of Energy environmental remediation conference, Augusta, GA (United States), 24-28 Oct 1993). Order Number DE94003471. Source: OSTI; NTIS; INIS; GPO Dep.

This paper describes an approach that facilitates management of personnel safety and environmental release risk from retired, surplus Westinghouse Hanford Company-managed facilities during the predemolition time frame. These facilities are located in the 100 and 200 Areas of the 1,450-km² (570-mi²) Hanford Site in Richland, Washington. The production reactors are located in the 100 Area and the chemical separation facilities are located in the 200 Area. This paper also includes a description of the risk evaluation process, shows applicable results, and includes a description of comparison costs for different risk reduction options.

2014 (WHC-SA-1941) Hanford Small Building Demolition Program. Diebel, J.A.; Douglas, L.M.; Shuck, R.G. Westinghouse Hanford Co., Richland, WA (United States). Sep 1993. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-931095-42: Department of Energy environmental remediation conference, Augusta, GA (United States), 24-28 Oct 1993). Order Number DE94002409. Source: OSTI; NTIS; INIS; GPO Dep.

Over 1,100 buildings currently exist on the Hanford Site. Many of these structures are outdated and no longer needed to support the environmental restoration mission. The Hanford Small Building Demolition Program is part of a combined effort of an Accelerated Decontamination and Decommissioning (D and D) Program and Landlord Site Preparation and Stabilization Program aimed at reducing the inventory of noncontaminated surplus facilities onsite. The reduction of surplus facilities results in reduced surveillance and maintenance (S and M) costs and eliminates the safety and environmental hazards associated with aging buildings. The project involves decommissioning up to 80 surplus facilities over the next five years.

2015 (WHC-SA-1979) Upgrading a 1944 plutonium-extraction plant to a modern decontamination facility. Wills, C.E.; Millikin, R.M.; Cruz, E.A. Westinghouse Hanford Co., Richland, WA (United States). Oct 1993. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-940406-1: International symposium on decontamination and decommissioning, Knoxville, TN (United States), 27-29 Apr 1994). Order Number DE94003849. Source: OSTI; NTIS; INIS; GPO Dep.

The Hanford Site, located in south-central Washington State, is currently undergoing extensive modifications as its mission changes from defense material production to one of waste management and environmental restoration. Starting in World War II, Hanford's mission for over four decades was the production of plutonium for defense needs. With the removal of such defense requirements over the last several years, the Hanford Site has refocused its efforts on the issues of cleanup and safety. The T Plant Complex is the first of the existing facilities to begin conversion from the old mission to the new. This conversion process and associated problems are described.

2016 (WHC-SA-1997) Hazard characterization and special considerations for environmental and decontamination and decommissioning activities. Kerr, N.R. Westinghouse Hanford Co., Richland, WA (United States). Aug 1993. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-9310163-1: Environmental restoration and decontamination and decommissioning activities and energy facility contractors workshop, Albuquerque, NM (United States), 5-6 Oct 1993). Order Number DE93040370. Source: OSTI; NTIS; INIS; GPO Dep.

The mission of the US Department of Energy (DOE) has changed from defense production of special nuclear materials to cleanup of production facilities at the Hanford Site. The DOE contractors have formed the Energy Facility Contractors Group to support this change in mission. In addition, the Safety Analysis Working Subgroup for Environmental Restoration and Decontamination and Decommissioning (ER/D&D) was formed to identify, develop, and share information that supports safety analyses and engineering of ER/D&D activities. Safety analysis is in part the process of identifying and understanding the hazards that could result in exposures to radiological or chemical hazardous substances. The following paragraphs address the special considerations given to hazard characterization for ER/D&D activities.

2017 (WHC-SA-2131) Accelerated Decontamination and Decommissioning at the Hanford Site. Hughes, M.C.; Douglas, L.M.; Marske, S.G. Westinghouse Hanford Co., Richland, WA (United States). Jan 1994. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-940225-11: Waste management '94, Tucson, AZ (United States), 27 Feb - 3 Mar 1994). Order Number DE94005967. Source: OSTI; NTIS; INIS; GPO Dep.

The Hanford Site has over 100 facilities that have been declared surplus and are scheduled to be decommissioned. In addition to these surplus facilities, there is a significant number of facilities that are currently being shut down, deactivated, and transferred to the Decontamination and Decommissioning (D&D) program. In the last year, Westinghouse Hanford Company and the US Department of Energy, Richland Operations Office, have developed and implemented an initiative to accelerate the D&D work at the Hanford Site. The strategy associated with accelerated D&D is to reduce the number of surplus facilities, eliminate potential safety hazards, demonstrate meaningful cleanup progress, and recycle materials for other uses. This initiative has been extremely successful and has resulted in the safe demolition of 13 facilities in fiscal year (FY) 1993. In addition, four facilities have been completed in FY 1994 and demolition of several other facilities is currently underway.

2018 (WHC-SA-2169) Engineering studies for the Surplus Production Reactor Decommissioning Project at the Hanford Site. Miller, R.L. (Westinghouse Hanford Co., Richland, WA (United States)); Powers, E.W.; Usher, J.M.; Yannitell, D.M. Westinghouse Hanford Co., Richland, WA (United States). Oct 1993. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-931095-84: Department of Energy environmental remediation conference, Augusta, GA (United States), 24-28 Oct 1993). Order Number DE94011338. Source: OSTI; NTIS; INIS; GPO Dep.

In 1942, the Hanford Site (near Richland, WA) was commissioned as a facility for the production of plutonium. On location there are nine water cooled, graphite-moderated plutonium production reactors, which are now retired from service. Because the reactors contain irradiated reactor components, and because the buildings that house the reactors are contaminated with low levels of reactivity, the DOE has determined that there is a need for action and that some form of decommissioning or continued surveillance and maintenance is necessary. This report discusses assessments of the alternatives which have determined that while continued surveillance and maintenance adequately isolates remaining radioactive materials from the environment and properly protects human health and safety; decontamination and decommissioning (D&D) will ultimately be necessary. The project is technically complex and will likely be designated as a Department of Energy (DOE) Major System Acquisition or Major Project.

2019 (WHC-SA-2269) NESHAPs compliance tasks for the PUREX plant. Lohrasbi, J.; Johnson, D.L. Westinghouse Hanford Co., Richland, WA (United States). Mar 1994. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-940499-7: Federal environmental restoration and waste minimization conference and exhibition, New Orleans, LA (United States), 25-29 Apr 1994). Order Number DE94010346. Source: OSTI; NTIS; INIS; GPO Dep.

The Plutonium-Uranium Extraction (PUREX) plant is in transition to shutdown, with decontamination and decommissioning to be completed in 1998. During this transition, implementation of some new regulations is continuing. Regulated stacks are required to be in compliance with the Clean Air Act National Emission Standards for Hazardous Air Pollutants (NESHAP) (40 CFR 61, Subpart H). Recent tasks included certification of the PUREX main stack flow measurement system, stack radionuclide particulate sampler line loss studies, and radionuclide source term calculations.

2020 (WHC-SA-2288) Fire protection for inactive contaminated structures. Wyatt, D.M. Westinghouse Hanford Co., Richland, WA (United States). Feb 1994. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-940225-88: Waste management '94, Tucson, AZ (United States), 27 Feb - 3 Mar 1994). Order Number DE94009433. Source: OSTI; NTIS; GPO Dep.

In general industry and construction, destruction of an inactive/surplus facility by fire may be considered a blessing. However, in a decommissioned contaminated structure, where radiological and other hazardous materials exist, such a fire could be a major catastrophe. The losses from this type of fire are not only property (i.e., structure and its contents) but also the resulting environmental damage, required cleanup, offsite releases, and public relations and reactions. The purpose of this presentation is to (1) promote

an awareness among the waste management community of fire protection engineering aspects that must be considered for inactive/surplus contaminated structures, and (2) present to the fire protection community an opportunity to become involved in the decommissioning process while promoting the DOE objectives to manage the risks associated with these structures.

2021 (WHC-SA-2336) Deactivation completed at historic Hanford Fuels Laboratory. Gerber, M.S. Westinghouse Hanford Co., Richland, WA (United States). Mar 1994. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94010376. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses deactivation work which was completed as of March 31, 1994 at the 308 Fuels Development Laboratory (FDL) at the Hanford Site near Richland, Washington. The decision to deactivate the structure, formerly known as the Plutonium Fabrication Pilot Plant (PFPP), was driven by a 1980s Department of Energy (DOE) decision that plutonium fuels should not be fabricated in areas near the Site's boundaries, as well as by changing facility structural requirements. Inventory transfer has been followed by the cleanout and stabilization of plutonium oxide (PuO_2) and enriched uranium oxide (UO_2) residues and powders in the facility's equipment and duct work. The Hanford Site, located in southeastern Washington state, was one of America's primary arsenals of nuclear defense production for nearly 50 years beginning in World War II. Approximately 53 metric tons of weapons grade plutonium, over half of the national supply and about one quarter of the world's supply, were produced at Hanford between 1944 and 1989. Today, many Site buildings are undergoing deactivation, a precursor phase to decontamination and decommissioning (D&D). The primary difference between the two activities is that equipment and structural items are not removed or torn down in deactivation. However, utilities are disconnected, and special nuclear materials (SNM) as well as hazardous and pyrophoric substances are removed from structures undergoing this process.

2022 (WHC-SA-2372) Redeployment as an alternative to decommissioning: Conversion of a US Department of Energy facility to fish rearing. Anderson, B.N.; Herborn, D.I. Westinghouse Hanford Co., Richland, WA (United States). Mar 1994. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-940406-8: International symposium on decontamination and decommissioning, Knoxville, TN (United States), 27-29 Apr 1994). Order Number DE94010350. Source: OSTI; NTIS; INIS; GPO Dep.

The Hanford Site and the Tri-Cities community have before them an unprecedented opportunity to create an economic renaissance based on the unparalleled environmental cleanup mission. The nation and the world await the emergence of the post-Cold War economy and conversion of the national defense complex into new national economic thrusts. The legacy of the Hanford Site national defense mission must not end up simply with the Site being cleaned up and land being restored to near-original conditions. There also needs to be a future economic legacy of a dynamic Tri-Cities community resulting from the cumulative current activities that will have a positive impact for years to come. In anticipation of the eventual completion of the Hanford Site cleanup mission, the US Department of Energy (DOE) has established the Office of Economic Transition to identify and implement policies and actions that will support

the cleanup mission of the Site and the long-term economic development of the Tri-Cities area. In the future, it is envisioned that one phase of a vibrant regional economy with a diversified economic job base will be the capability to compete in national and international environmental services markets. Recently, it was realized that the K Area water treatments facilities might be suitable for the rearing of fish. A 'marketing' effort was undertaken to match the facility with potential users. At this time, four fish-rearing projects have either been conducted or are in various stages of progress or implementation. These will be described to explain the participants, the purposes, and the scope of each project.

2023 (WHC-SD-EN-AP-122) Hanford well remediation and decommissioning plan. Ledgerwood, R.K. Westinghouse Hanford Co., Richland, WA (United States). 12 Feb 1993. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94007147. Source: OSTI; NTIS; INIS; GPO Dep.

Protection of Hanford Site groundwater resources and assessment of the effects of their use or contamination upon public safety are required by federal and state regulations and U.S. Department of Energy (DOE) policy, (DOE, 1989). Compliance with constraints applicable to the use of existing wells requires assessment as to the suitability for use and needs for rehabilitation, remediation or decommissioning of existing groundwater wells and other boreholes potentially affecting aquifers beneath the Hanford Site. Approximately 3,500 groundwater wells and vadose zone boreholes had been drilled on the Hanford Site prior to 1989, over 2,900 still exist. Most of these boreholes were drilled prior to 1987 and do not conform to presently accepted construction standards intended to protect groundwater resources. Approximately 260 wells have been installed since 1987. These wells were constructed to current standards for well construction which mandate seals between the permanent casing and the formation to prevent potential migration of contaminated liquid. Several programs presently construct and/or utilize existing and newly drilled wells to provide characterization and groundwater monitoring data. The programs are summarized.

2024 (WHC-SP-0615-Rev.3-Vol.1) N Reactor Shutdown Program Plan: Revision 3, Volume 1. Debban, H.L. Westinghouse Hanford Co., Richland, WA (United States). Nov 1992. 128p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93011299. Source: OSTI; NTIS; INIS; GPO Dep.

This N Reactor Shutdown Program Plan is structured to identify the activities required for permanent closure of N Reactor. It is designed to provide the basic methodology required to place N Reactor and supporting facilities in a radiologically and environmentally safe condition such that they can be transferred to the Decommissioning and RCRA Closure Program (DRCP) in FY 1999 for ultimate decommissioning. Custody transfer to DRCP will be in accordance with facility transfer criteria specified in Department of Energy (DOE) and Westinghouse Hanford Company (WHC) documentation.

2025 (WINCO-1132) Listed waste determination report: Environmental characterization. Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (United States). Jun 1993. 113p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-84ID12435. Order Number DE94000718. Source: OSTI; NTIS; INIS; GPO Dep.

On September 23, 1988, the US Environmental Protection Agency (EPA) published a notice clarifying interim status requirements for the management of radioactive mixed waste thereby subjecting the Idaho National Engineering Laboratory (INEL) and other applicable Department of Energy (DOE) sites to regulation under the Resource Conservation and Recovery Act (RCRA). Therefore, the DOE was required to submit a Part A Permit application for each treatment, storage, and disposal (TSD) unit within the INEL, defining the waste codes and processes to be regulated under RCRA. The September 1990 revised Part A Permit application, that was approved by the State of Idaho identified 101 potential acute and toxic hazardous waste codes (F-, P-, and U- listed wastes according to 40 CFR 261.31 and 40 CFR 261.33) for some TSD units at the Idaho Chemical Processing Plant. Most of these waste were assumed to have been introduced into the High-level Liquid Waste TSD units via laboratory drains connected to the Process Equipment Waste (PEW) evaporator (PEW system). At that time, a detailed and systematic evaluation of hazardous chemical use and disposal practices had not been conducted to determine if F-, P-, or Unlisted waste had been disposed to the PEW system. The purpose of this investigation was to perform a systematic and detailed evaluation of the use and disposal of the 101 F-, P-, and Unlisted chemicals found in the approved September 1990 Part A Permit application. This investigation was aimed at determining which listed wastes, as defined in 40 CFR 261.31 (F-listed) and 261.33 (P & Unlisted) were discharged to the PEW system. Results of this investigation will be used to support revisions to the RCRA Part A Permit application.

2026 (WINCO-1163) Liquid abrasive grit blasting literature search and decontamination scoping tests report. Ferguson, R.L. Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (United States). Oct 1993. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-84ID12435. Order Number DE94008810. Source: OSTI; NTIS; INIS; GPO Dep.

Past decontamination and solvent recovery activities at the Idaho Chemical Processing Plant (ICPP) have resulted in the accumulation of 1.5 million gallons of radioactively contaminated sodium-bearing liquid waste. Future decontamination activities at the ICPP could result in the production of 5 million gallons or more of sodium-bearing waste using the current decontamination techniques of chemical/water flushes and steam jet cleaning. With the curtailment of reprocessing at the ICPP, the focus of decontamination is shifting from maintenance for continued operation of the facilities to decommissioning. As decommissioning plans are developed, new decontamination methods must be used which result in higher decontamination factors and generate lower amounts of sodium-bearing secondary waste. The primary initiative of the WINCO Decontamination Development Program is the development of methods to eliminate/minimize the use of sodium-bearing decontamination chemicals. One method that was chosen for cold scoping studies during FY-93 was abrasive grit blasting. Abrasive grit blasting has been used in many industries and a vast amount of research and development has already been conducted. However, new grits, process improvements and ICPP applicability was investigated. This evaluation report is a summary of the research efforts and scoping tests using the liquid abrasive grit blasting decontamination technique. The purpose of these scoping tests was to determine the effectiveness of three different abrasive grits: plastic beads, glass beads and alumina oxide.

2027 (Y/ER-10) Analysis of proposed postclosure alternatives for the Bear Creek Burial Grounds at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee. Walter, K.A.; White, R.K.; Southworth, G.R.; O'Donnell, F.R.; Travis, C.C.; White, D.A. Oak Ridge Y-12 Plant, TN (United States). Dec 1990. 171p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OS21400. Order Number DE92019629. Source: OSTI; NTIS; INIS; GPO Dep.

The Bear Creek Burial Grounds are located in Bear Creek Valley about 2 miles southwest of the Y-12 Plant on the United States Department of Energy (DOE) Oak Ridge Reservation. From 1955 until recently solid and liquid wastes from the Y-12 plant were deposited in Burial Grounds waste disposal areas. The principal types of wastes disposed of were solvents, oils, coolants, uranium, and other heavy metals. Methods of disposal included filling excavated trenches with solid wastes and pouring liquid wastes onto the filled trenches or into standpipes embedded in the trenches. Since 1982 the Y-12 Plant has sampled groundwater, surface water, soils, and sediments in Bear Creek Valley for contamination. At the Burial Grounds site, groundwater is the most seriously contaminated medium: very high levels of several volatile organic compounds (VOCs) occur near the eastern trenches. In addition, elevated levels of VOCS, metals, and polychlorinated biphenyls (PCBS) have been found in soils in the immediate vicinity of the waste trenches and the Oil Retention Ponds and in sediments. This report the risks to human health and the environment posed by the Bear Creek Burial Grounds under three remedial alternatives proposed under the CAPCA project: take no action; place an impermeable cap over the Burial Grounds trenches, and construct subsurface drains to reduce leachate production; and in addition to capping the site, construct a network of recovery wells to extract contaminated groundwater for treatment in an air-stripping facility. Two recovery well options were evaluated: (a) recovery of contaminants in only the upper 200 ft of aquifer and (b) recovery of contaminants over 600 ft of aquifer.

2028 (Y/ER-17) Analysis of proposed postclosure alternatives for the Oil Landfarm Waste Management Area at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee. Walter, K.A.; White, R.K.; Southworth, G.R.; O'Donnell, F.R.; Travis, C.C.; White, D.A. Oak Ridge National Lab., TN (United States). Dec 1990. 145p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OS21400. Order Number DE92019630. Source: OSTI; NTIS; INIS; GPO Dep.

The Oil Landfarm Waste Management Area (WMA) is located in Bear Creek Valley about 1 mile southwest of the Y-12 Plant on the US Department of Energy (DOE) Oak Ridge Reservation. From 1943 until 1982 several types of solid and liquid wastes were deposited in the five disposal areas that constitute the Oil Landfarm WMA. The disposal areas are: the OH Landfarm disposal plots, the Boneyard, the Burnyard, the Chemical Storage Area, and the Sanitary Landfill. The Oil Landfarm disposal plots were used from 1973 until 1982 for the biological degradation of oily wastes. The Boneyard was active 1943 to 1970 and received a great variety of wastes for burning or burial including organics, metals, acids, and debris. The Burnyard operated from 1943 to 1968 and consisted of unlined trenches in which various wastes from plant operations were ignited with solvents or oils and burned. The Chemical Storage Area operated from 1975 to 1981 for the disposal of wastes that posed safety hazards; for example, reactive, corrosive, and explosive chemicals. The Sanitary Landfill was used

from 1968 to 1980 for the burial of solid wastes and may contain toxic chemicals and contaminated material. Since 1982 the Y-12 Plant has sampled groundwater, surface water, soils and sediments in Bear Creek Valley. Data from this sampling program show that at the Oil Landfarm WMA groundwater is the most seriously contaminated medium. The chief contaminants of groundwater are the volatile organic compounds (VOCs). This study assesses the risks to human health and the environment posed by the Oil Landfarm WMA under three remedial scenarios.

2029 (Y/ER-19) Revised RCRA Closure Plan for the Interim Drum Yard (S-030) at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee: Revision of Y/TS-347/1R3. Oak Ridge Y-12 Plant, TN (United States). Aug 1991. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OS21400. Order Number DE92003900. Source: OSTI; NTIS; INIS; GPO Dep.

The Interim Drum Yard (S-030) is an outdoor storage area for containerized hazardous waste. The yard is constructed of gravel on native soil and has no liner or containment system. Drums of waste are stored on wooden pallets. A list of wastes that are or have been stored at this facility is given in this report. This report discusses inventory removal, disposal, and decontamination. 4 refs., 3 figs., 4 tabs.

2030 (Y/ER-69) Annual summary report on the Decontamination and Decommissioning Program at the Oak Ridge Y-12 Plant for the period ending September 30, 1992: Environmental Restoration Program. Oak Ridge Y-12 Plant, TN (United States). Feb 1993. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OS21400. Order Number DE93011831. Source: OSTI; NTIS; INIS; GPO Dep.

The Y-12 Decontamination and Decommissioning (D&D) Program provides for the ultimate disposition of plant process buildings and their supporting facilities. The overall objective is to enable the Y-12 Plant to meet applicable environmental regulations and Department of Energy (DOE) orders to protect human health and the environment from contaminated facilities through decommissioning activities. This objective is met by providing for the surveillance and maintenance (S&M) of accepted standby or shutdown facilities awaiting decommissioning; planning for decommissioning of these facilities; and implementing a program to accomplish the safe, cost-effective, and orderly disposition of contaminated facilities. The Y-12 D&D Program was organized during FY 1992 to encompass the needs of surplus facilities at the Y-12 Plant. The need existed for a program which would include Weapons Program facilities as well as other facilities used by several programs within the Y-12 Plant. Building 9201-4 (Alpha 4) is the only facility that is formally in the D&D Program. Funding for the work completed in FY 1992 was shared by the Environmental Restoration and Waste Management Program (EW-20) and Weapons Operations (GB-92). This report summarizes the FY 1992 D&D activities associated with Building 9201-4. A section is provided for each task; the tasks include surveillance, routine and special maintenance, safety, and D&D planning.

2031 (Y/ER/Sub-91-ALV96/3-Draft) Draft postclosure permit application for Bear Creek hydrogeologic regime at the Oak Ridge Y-12 Burial Grounds Hazardous Waste Disposal Unit: Environmental restoration program. Oak Ridge Y-12 Plant, TN (United States); Geraghty and Miller, Inc., Oak Ridge, TN (United States). Sep 1991. 320p. Sponsored by USDOE, Washington, DC (United States). DOE

Contract AC05-84OS21400. Order Number DE92004747. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes closure plans and ground water information of the Y-12 Bear Creek burial grounds hazardous waste disposal unit (HWDU). Wastes disposed in the HWDU include: mop waters; EDTA; oils and coolants; asbestos; solvents; salts; materials contaminated with radioisotopes with radioisotopes; heavy metals; and debris.

2032 (Y/WM-162) Y-12 Plant Decontamination and Decommissioning Program: Surveillance and Maintenance Plan, FY 1992-2000. Oak Ridge Y-12 Plant, TN (United States). Jan 1992. 33p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OS21400. Order Number DE93017226. Source: OSTI; NTIS; INIS; GPO Dep.

The Decontamination and Decommissioning (D and D) Program at the Oak Ridge Y-12 Plant is part of the Environmental Restoration (ER) and Waste Management (WM) Programs (ERWM). The objective of the ER Program is to provide Y-12 the capability to meet applicable environmental regulations through facility development activities and site remedial actions. The WM Program supports the ER program. The D and D Program provides collective management of sites within the Plant which are in need of decontamination and decommissioning efforts, prioritizes those areas in terms of health, safety, and environmental concerns, and implements the appropriate level of remedial action. The D and D Program provides support to identifiable facilities which formerly served one or more of the many Plant functions. Program activities include (1) surveillance and maintenance of facilities awaiting decommissioning; (2) planning safe and orderly facility decommissioning; and (3) implementing a program to accomplish facility disposition in a safe, cost effective, and timely manner. In order to achieve the first objective, a formal plan which documents the surveillance and maintenance needs for each facility has been prepared. This report provides this documentation for the Y-12 facilities currently included in the D and D Program, as well as those planned for future inclusion in the Program, and includes projected resource requirements for the planning period of FY 1993 through FY 2000.

ROBOTICS

Refer also to citation(s) 283, 900, 901, 902, 1402, 1600, 1619, 1753, 2378, 2564, 2566, 2576

2033 (CONF-910223-1) A remote underwater closure of Kerr Hollow Quarry. Blank, J.A. Oak Ridge National Lab., TN (United States). [1990]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 4. topical meeting on robotics and remote systems; Albuquerque, NM (United States); 24-28 Feb 1991. Order Number DE91001523. Source: OSTI; NTIS; GPO Dep.

The purpose of this paper is to discuss the totally remote clean closure of Kerr Hollow Quarry (KHQ) on the Department of Energy Y-12 site in Oak Ridge, TN. KHQ is a flooded limestone quarry, used for the treatment of shock sensitive, water reactive, explosive, and compressed gas materials from 1960 until 1988 at which time it was closed and identified as a RCRA site. The treatment process left some 4000 containers on the bottom of KHQ. Most containers are empty; however, the remote possibility of existing unreacted materials coupled with the explosive nature of the

materials themselves, dictated that KHQ be clean closed by totally remote means. The closure activity involved the use of a combination of commercially available remote underwater water equipment and the use of specially designed prototype equipment. The total cost and schedule duration will be close to the cost and schedule for an in-situ closure. This is the only totally remote RCRA closure, clean, or in-situ, ever performed. 2 figs.

2034 (CONF-910223-8) A demonstration of remote survey and characterization of a buried waste site using the SRIP [Soldier Robot Interface Project] testbed. Burks, B.L.; Richardson, B.S.; Armstrong, G.A.; Hamel, W.R.; Jansen, J.F.; Killough, S.M.; Thompson, D.H.; Emery, M.S. Oak Ridge National Lab., TN (United States). [1990]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 4. topical meeting on robotics and remote systems; Albuquerque, NM (United States); 24-28 Feb 1991. Order Number DE91004515. Source: OSTI; NTIS; INIS; GPO Dep.

During FY 1990, the Oak Ridge National Laboratory (ORNL) supported the Department of Energy (DOE) Environmental Restoration and Waste Management (ER&WM) Office of Technology Development through several projects including the development of a semiautonomous survey of a buried waste site using a remotely operated all-terrain robotic testbed borrowed from the US Army. The testbed was developed for the US Army's Human Engineering Laboratory (HEL) for the US Army's Soldier Robot Interface Project (SRIP). Initial development of the SRIP testbed was performed by a team including ORNL, HEL, Tooele Army Depot, and Odetics, Inc., as an experimental testbed for a variety of human factors issues related to military applications of robotics. The SRIP testbed was made available to the DOE and ORNL for the further development required for a remote landfill survey. The robot was modified extensively, equipped with environmental sensors, and used to demonstrate an automated remote survey of Solid Waste Storage Area No. 3 (SWSA 3) at ORNL on Tuesday, September 18, 1990. Burial trenches in this area containing contaminated materials were covered with soil nearly twenty years ago. This paper describes the SRIP testbed and work performed in FY 1990 to demonstrate a semiautonomous landfill survey at ORNL. 5 refs.

2035 (CONF-911107-25) Combined long reach and dexterous manipulation for waste storage tank applications. Burks, B.L. (Oak Ridge National Lab., TN (United States)); Armstrong, G.A.; Butler, P.L.; Boissiere, P. Oak Ridge National Lab., TN (United States). [1991]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 1991 winter meeting of the American Nuclear Society (ANS); San Francisco, CA (United States); 10-15 Nov 1991. Order Number DE91016770. Source: OSTI; NTIS; INIS; GPO Dep.

One of the highest priority environmental restoration tasks within the Department of Energy (DOE) is the remediation of single-shell waste storage tanks (WSTs), especially those suspected of, or documented as, leakers. Most currently proposed approaches for remediation of large underground WSTs require application of remotely operated long-reach (greater than 10 m), high-lift capacity (greater than 200 kg) manipulator systems. Because of the complexity of in-tank hardware, waste forms, remediation tasks, and variety of end-effector tools, these manipulator systems must also be capable of performing a diverse set of dexterous manipulations. This presentation will describe the integration of a

Spar RMS 2500 manipulator system, a Schilling Titan-7F manipulator, and control systems developed at ORNL and SNL to provide a combined long reach and dexterous manipulation system. The purpose of integrating these two manipulator systems was to study and demonstrate their combined performance, evaluate design requirements for a deployed system, and provide a testbed for control and end-effector technologies that might be applicable to remediation of WSTs. 5 refs.

2036 (CONF-911213-2) Long-reach manipulation for waste storage tank remediation. Jansen, J.F.; Burks, B.L.; Babcock, S.M.; Kress, R.L.; Hamel, W.R. Oak Ridge National Lab., TN (United States). [1991]. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From American Society of Mechanical Engineers (ASME) annual winter meeting; Atlanta, GA (United States); 1-6 Dec 1991. Order Number DE91013234. Source: OSTI; NTIS; INIS; GPO Dep.

Remediation of large underground storage tanks containing hazardous waste provides an application for state-of-the-art technology in flexible link manipulator design and control and a need for additional research and development. Application requirements are described, and preliminary analyses associated with this problem are summarized. Inherent physical limitations of flexible manipulators are discussed. Potential kinematic configurations, drive-train elements, and control issues for both free-space motion and damping of forced vibration are addressed. Also included are future directions for research and development in mechanical components and control strategies. 21 refs., 4 figs., 4 tabs.

2037 (CONF-920307-19) Robotic arm design for a remotely-deployed, in situ waste characterization probe. Kress, R.L.; Jansen, J.F.; Haas, J.W. Oak Ridge National Lab., TN (United States). [1991]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Waste management '92; Tucson, AZ (United States); 1-5 Mar 1992. Order Number DE92008281. Source: OSTI; NTIS; INIS; GPO Dep.

This paper describes some design considerations for a system which will combine robotics and laser spectroscopy to produce an in situ monitoring system for heterogeneous waste materials. The new system will provide faster, cheaper, safer, and more complete characterization of mixed solids and liquids stored in tanks and drums or buried in pits. A small, fiberoptic multiprobe that performs Raman and fluorescence measurements of wastes composed of a variety of organic and inorganic compounds will be described. Design considerations for a novel sensor platform that positions and stabilizes the multiprobe relative to the sampling point in order to make accurate spectroscopic measurements and deploys the sensor in hazardous environments with minimal risk to workers will be presented. The core of the platform will be a 3-Degrees-Of-Freedom (3-DOF), spherical coordinate end effector equipped with a proximity sensor that compensates for errors introduced by the flexible nature of the support arm. The platform can be adapted to operate the most robotic deployment systems used in hazardous environments. The multisensor probe will be coupled to remote, portable laser spectrometer systems by a fiber-optic bundle. 5 refs.

2038 (CONF-9207102-60) Development of robotics technology for remote characterization and remediation of buried waste. Noakes, M.W. (Oak Ridge National

Lab., TN (United States)); Richardson, B.S.; Burks, B.L.; Sandness, G.R. Oak Ridge National Lab., TN (United States). [1992]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Institute of Nuclear Materials Management (INMM) annual meeting; Orlando, FL (United States); 19-22 Jul 1992. Order Number DE92019945. Source: OSTI; NTIS; INIS; GPO Dep.

Detection, characterization, and excavation of buried objects and materials are important steps in the restoration of subsurface disposal sites. The US Department of Energy (DOE), through its Buried Waste Robotics Program, is developing a Remote Characterization System (RCS) to address the needs of remote subsurface characterization and, in a joint program with the US Army, is developing a teleoperated excavator. Development of the RCS is based on recent DOE remote characterization testing and demonstrations performed at Oak Ridge National Laboratory and Idaho National Engineering Laboratory. The RCS, which will be developed and refined over a two- to three-year period, is designed to (1) increase safety by removing on-site personnel from hazardous areas, (2) remotely acquire real-time data from multiple sensors, (3) increase cost-effectiveness and productivity by partial automation of the data collection process and by gathering and evaluating data from multiple sensors in real time, and (4) reduce costs for other waste-related development programs through joint development efforts and reusable standardized subsystems. For retrieval of characterized waste, the Small Emplacement Excavator, an existing US Army backhoe that is being converted to teleoperated control, will be used to demonstrate the feasibility of retrofitting commercial equipment for high-performance remote operations.

2039 (CONF-920851-2) Development of a teleoperated backhoe for buried waste excavation. Burks, B.L.; Killough, S.M.; Thompson, D.H. Oak Ridge National Lab., TN (United States). [1992]. 6p. Sponsored by USDOE, Washington, DC (United States); Department of Defense, Washington, DC (United States). DOE Contract AC05-84OR21400. From Spectrum '92: nuclear and hazardous waste management international topical meeting; Boise, ID (United States); 23-27 Aug 1992. Order Number DE92010543. Source: OSTI; NTIS; INIS; GPO Dep.

For nearly five decades the United States (US) Department of Energy (DOE) and its predecessor agencies have engaged in broad-based research and development activities as well as nuclear weapons component production. As a by-product of these activities, large quantities of waste materials have been granted. One of the most common approaches used for solid waste storage was to bury waste containers in pits and trenches. With the current emphasis on environmental restoration, DOE now plans to either retrieve much of the legacy of buried waste or stabilize the waste in place via in situ vitrification or other means. Because of the variety of materials that have been buried over the years, the hazards of retrieval are significant if performed using conventional manned operations. The potential hazards, in addition to radiation exposure, include pyrophorics, toxic chemicals, and explosives. Although manifests exist for much of the buried waste, these records are often incomplete compared to today's requirements. Because of the potential hazards and uncertainty about waste contents and container integrity, it is highly desirable to excavate these wastes using remotely operated equipment. In this paper the authors describe the development of a teleoperated military tractor called the Small Emplacement Excavator (SEE). Development of the SEE is being funded

jointly by both DOE and the US Army. The DOE sponsor is the Office of Technology Development (OTD) Robotics Program. The US Army sponsor is the Program Manager for Ammunition Logistics, Picatinny Arsenal. The primary interest for DOE is in the application to remote excavation of buried waste, while the primary emphasis for the US Army is in the remote retrieval of unexploded ordnance. Technical requirements for these two tasks are very similar and, therefore, justify a joint development project. 1 ref.

2040 (CONF-9208125-) Transportation management workshop: Proceedings. USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). Transportation Management Div. [1992]. 810p. Sponsored by USDOE, Washington, DC (United States). From Department of Energy (DOE) transportation management program workshop; Gaithersburg, MD (United States); 18-20 Aug 1992. Order Number DE93002378. Source: OSTI; NTIS; GPO Dep.

This report is a compilation of discussions presented at the Transportation Management Workshop held in Gaithersburg, Maryland. Discussions are presented in question/answer format with charts. Topics include waste packaging, personnel training, robotics, transportation routing, certification, containers, and waste classification.

2041 (CONF-9210168-1) Sensor-based whole-arm obstacle avoidance for unstructured environments. Wintenberg, A.L.; Butler, P.L.; Babcock, S.M.; Ericson, M.N.; Armstrong, G.A.; Britton, C.L. Jr.; Hamel, W.R. Oak Ridge National Lab., TN (United States). [1992]. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 1992 American Nuclear Society (ANS) international conference; Chicago, IL (United States); 15-20 Oct 1992. Order Number DE92041265. Source: OSTI; NTIS; INIS; GPO Dep.

Whole-arm obstacle avoidance is needed for a variety of robotic applications in the Environmental Restoration and Waste Management (ER&WM) Program. Typical industrial applications of robotics involve well-defined workspaces, allowing a predetermined knowledge of collision-free paths for manipulator motion. However, many hazardous environments are unstructured or poorly defined, providing a significant potential for collisions between manipulators and the environment. In order to allow applications of robotics in such situations, a sensing system is under development which will provide protection against collisions. Specifics of this system including system architecture and projected implementation are described.

2042 (CONF-9210174-1) An inverse dynamic trajectory planning for the end-point tracking control of a flexible manipulator. Kwon, D.S. (Oak Ridge National Lab., TN (United States)); Babcock, S.M.; Book, W.J. Oak Ridge National Lab., TN (United States). [1992]. 9p. Sponsored by USDOE, Washington, DC (United States); National Aeronautics and Space Administration, Washington, DC (United States). DOE Contract AC05-84OR21400. Grant: NAG 1-623. From 1992 Korean automated control conference (KACC); Seoul (Korea, Republic of); 19-21 Oct 1992. Order Number DE93000428. Source: OSTI; NTIS; GPO Dep.

A manipulator system that needs significantly large workspace volume and high payload capacity has greater link flexibility than typical industrial robots and teleoperators. If link flexibility is significant, position control of the manipulator's end-effector exhibits the nonminimum phase,

noncollocated, and flexible structure system control problems. This paper addresses inverse dynamic trajectory planning issues of a flexible manipulator. The inverse dynamic equation of a flexible manipulator was solved in the time domain. By dividing the inverse system equation into the causal part and the anticausal part, the inverse dynamic method calculates the feedforward torque and the trajectories of all state variables that do not excite structural vibrations for a given end-point trajectory. Through simulation and experiment with a single-link flexible manipulator, the effectiveness of the inverse dynamic method has been demonstrated.

2043 (CONF-921102-9-Extd.Abst.) Sensor-based whole-arm obstacle avoidance for unstructured environments. Wintenberg, A.L.; Butler, P.L.; Babcock, S.M.; Ericson, M.N.; Britton, C.L. Jr.; Hamel, W.R. Oak Ridge National Lab., TN (United States). [1992]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Joint American Nuclear Society/European Nuclear Society (ANS/ENS) international meeting on fifty years of controlled nuclear chain reaction: past, present, and future; Chicago, IL (United States); 15-20 Nov 1992. Order Number DE92017133. Source: OSTI; NTIS; INIS; GPO Dep.

Short communication. ROBOTS/navigation; ROBOTS; NAVIGATION; WASTE PROCESSING; MANIPULATORS; MOTION; INTEGRATED CIRCUITS; DESIGN

2044 (CONF-921102-10) Remote excavation using the telerobotic small emplacement excavator. Burks, B.L.; Killough, S.M.; Thompson, D.H. Oak Ridge National Lab., TN (United States). [1992]. 5p. Sponsored by USDOE, Washington, DC (United States); Department of Defense, Washington, DC (United States). DOE Contract AC05-84OR21400. From Joint American Nuclear Society/European Nuclear Society (ANS/ENS) international meeting on fifty years of controlled nuclear chain reaction: past, present, and future; Chicago, IL (United States); 15-20 Nov 1992. Order Number DE92017158. Source: OSTI; NTIS; GPO Dep.

For nearly five decades the United State Department of Energy (DOE) and its predecessor agencies have engaged in broad-based research and development activities as well as in the production of nuclear weapons components. As a by-product of these activities, large quantities of waste materials have been generated. With the current emphasis on environmental restoration, DOE now plans to either to retrieve much of the legacy of buried waste or to stabilize the waste in place via in situ vitrification or by other means. Because of the potential hazards of these wastes and uncertainty about waste contents and container integrity, it is highly desirable to excavate these wastes using remotely operated equipment. This paper describes the development of a teleoperated military tractor called the Small Emplacement Excavator (SEE). 2 refs.

2045 (CONF-930257-3) Evaluation of field test kits including immunoassays for the detection of contaminants in soil and water. Waters, L.C.; Smith, R.R.; Counts, R.W.; Stewart, J.H.; Jenkins, R.A. Oak Ridge National Lab., TN (United States). [1993]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 3. international symposium of field screening methods for hazardous wastes and toxic chemicals; Las Vegas, NV (United States); 24-26 Feb 1993. Order Number DE93009664. Source: OSTI; NTIS; INIS; GPO Dep.

Effective field test methods are needed for hazardous waste site characterization and remediation. Useful field methods should be rapid, analyte-specific, cost-effective and accurate in the concentration range at which the analyte is regulated. In this study, field test kits for polychlorinated biphenyls (PCBs), mercury, lead and nitrate were evaluated with reference to these criteria. PCBs and mercury, in soils, were analyzed by immunoassay. Ionic lead and nitrate, in water, were measured chemically using test strips. Except for lead, each analyte was measured in both spiked and actual field samples. Twenty to 40 samples per day can be analyzed with the immunoassays and even more with the strip tests. The sensitivity of the immunoassays is in the 1-3 ppm range. Nitrate was consistently detected at ≥ 5 ppm; lead ions at ≥ 20 ppm. Results obtained using these methods compared favorably with those obtained by standard laboratory methods. In addition to being useful field screening methods, these kits can be used in the laboratory to sort out negative samples and/or to define proper dilutions for positive samples requiring further analysis.

2046 (CONF-930403-4) Sensor-based whole-arm obstacle avoidance utilizing ASIC technology. Wintenberg, A.L. (Oak Ridge National Lab., TN (United States)); Ericson, M.N.; Babcock, S.M.; Armstrong, G.A.; Britton, C.L. Jr.; Butler, P.L.; Hamel, W.R.; Newport, D.F. Oak Ridge National Lab., TN (United States). [1993]. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 5. topical meeting on robotics and remote systems; Knoxville, TN (United States); 26-29 Apr 1993. Order Number DE93003602. Source: OSTI; NTIS; INIS; GPO Dep.

Operation of manipulator systems in poorly defined work environments often presents a significant hazard to both the robotic assembly and the environment. In applications relating to the Environmental Restoration and Waste Management (ER&WM) Program, many of the environments are considered hazardous, both, in the structure and composition of the environment. Use of a sensing system that provides information to the manipulator control unit regarding obstacles in close proximity will provide protection against collisions. In this paper, a hierarchical design and implementation of a whole-arm obstacle avoidance system is presented. The system is based on capacitive sensors configured as bracelets for proximity sensing. Each bracelet contains a number of sensor nodes and a processor for sensor node control and readout, and communications with a higher level host, common to all bracelets. The host controls the entire sensing network and communicates proximity information to the manipulator controller. The overall architecture of this system is discussed with detail on the individual system modules. Details of an application specific integrated circuit (ASIC) designed to implement the sensor node electronics are presented. Justifications for the general measurement methods and associated implementation are discussed. Additionally, the current state of development including measured data is presented.

2047 (CONF-930403-8) Robotic system for decommissioning the Gunite tanks at Oak Ridge National Laboratory, Oak Ridge, Tennessee. Chesser, J.B.; Evans, J.H.; Norman, R.E.; Peishel, F.L.; Ruppel, F.R. Oak Ridge National Lab., TN (United States). [1992]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 5. topical meeting on robotics and remote systems; Knoxville, TN (United States); 26-29 Apr

1993. Order Number DE93004161. Source: OSTI; NTIS; INIS; GPO Dep.

Robotic systems and equipment to facilitate removal of the contents of the Oak Ridge National Laboratory (ORNL) Gunite Waste Tanks as well as the tanks themselves are one of several options being considered for this site. The technology described consists of proven remote systems and equipment or remote adaptations of proven industrial concepts. The proposed robotic system would be housed in a portable containment structure, fabricated from steel plate, and reinforced with structural shapes. The structure would be cylindrical and have a domed head. The containment structure would be sized to cover one tank. The tanks are in two sizes: 60 ft and 35 ft diameters. The structures would be supported on driven steel piles and would have an earthen berm around the base to enhance the effectiveness of the containment. Internal to the containment structure, a polar crane bridge equipped with a pair of trolley-mounted telescoping masts would be utilized to support and manipulate the systems, tools, etc., which would perform the individual tasks. The bridge and mast control system and the manipulator control system would provide both teleoperated and robotic modes to support either manual or preprogrammed operations. Equipment mounted at the end of the mast would include servomanipulators, water jet cutter, or a clam shell bucket. The mast would feature an interface plate allowing remote changeout of most mounted equipment. The operating system would be required to have the capability to decontaminate the dome and its equipment to the degree necessary to allow it to be relocated. Viewing would be provided by commercial closed-circuit TV (CCTV). It is believed that the systems described herein represent a feasible approach to removing the contents from the ORNL gunite tanks and implementing remediation of the site.

2048 (CONF-930403-31) Implementation of damped-oscillation crane control for existing ac induction motor-driven cranes. Noakes, M.W. (Oak Ridge National Lab., TN (United States)); Kress, R.L.; Appleton, G.T. Oak Ridge National Lab., TN (United States). [1993]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 5. topical meeting on robotics and remote systems; Knoxville, TN (United States); 26-29 Apr 1993. Order Number DE93010341. Source: OSTI; NTIS; INIS; GPO Dep.

The Oak Ridge National Laboratory (ORNL) has implemented damped-oscillation crane control on one of its existing ac induction motor-driven facility overhead cranes. The purpose of this engineering grade test has been to determine feasibility, determine control and interfacing specifications, and establish the capability of newly available ac motor-control hardware. A flux vector inverter drive is used in the initial demonstration to investigate acceptability for swing-free crane control. Motor performance and restrictions are also examined. Control hardware design is based upon the Environmental Restoration and Waste Management (ER&WM) Robotics Technology Development Program (RTDP) standards. This includes the use of the VME bus and Motorola 680X0-based CPU boards for the hardware and UNIX and VxWorks for the software. However, smaller, cheaper, and more simple embedded controller design constraints are also considered in order to make the technology more attractive for general industrial use. Theoretical background, specific implementation, and recommendations are presented in this paper.

2049 (CONF-930403-33) **Human-factors-based implementation of the remote characterization system high-level control station.** Noakes, M.W. (Oak Ridge National Lab., TN (United States)); Richardson, B.S.; Rowe, J.C.; Draper, J.V.; Sandness, G.R. Oak Ridge National Lab., TN (United States). [1993]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 5. topical meeting on robotics and remote systems; Knoxville, TN (United States); 26-29 Apr 1993. Order Number DE93010340. Source: OSTI; NTIS; INIS; GPO Dep.

The detection and characterization of buried objects and materials is an important first step in the restoration of the numerous US Department of Energy (DOE) and US Department of Defense waste disposal sites. DOE, through its Environmental Restoration and Waste Management Robotics and Technology Development Program, has developed the Remote Characterization System (RCS) to address the needs of remote subsurface characterization. The RCS consists of a low-metal-content (low-metallic-signature) remotely piloted vehicle, a high-level control station (HLCS) where operators can remotely control the vehicle and analyze real-time data from sensors, and an array of sensors that can be chosen to meet the survey task at hand. Communication between the vehicle and the base station is handled by a radio link. Site mapping is made possible through the use of geopositioning satellite data. The primary mode of vehicle operation is teleoperation, but provision has been made for semiautonomous or supervisory control that allows for automated sitesurvey on simple sites. Data analysis and display is supported for both real-time observation and postprocessing of data. The particular emphasis of this paper documents the human-factors-based design influences on the HLCS and describes the design in detail.

2050 (CONF-930403-34) **An architecture for robotic system integration.** Butler, P.L. (Oak Ridge National Lab., TN (United States)); Reister, D.B.; Gourley, C.S.; Thayer, S.M. Oak Ridge National Lab., TN (United States). [1993]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 5. topical meeting on robotics and remote systems; Knoxville, TN (United States); 26-29 Apr 1993. Order Number DE93010829. Source: OSTI; NTIS; INIS; GPO Dep.

An architecture has been developed to provide an object-oriented framework for the integration of multiple robotic subsystems into a single integrated system. By using an object-oriented approach, all subsystems can interface with each other, and still be able to be customized for specific subsystem interface needs. The object-oriented framework allows the communications between subsystems to be hidden from the interface specification itself. Thus, system designers can concentrate on what the subsystems are to do, not how to communicate. This system has been developed for the Environmental Restoration and Waste Management Decontamination and Decommissioning Project at Oak Ridge National Laboratory. In this system, multiple subsystems are defined to separate the functional units of the integrated system. For example, a Human-Machine Interface (HMI) subsystem handles the high-level machine coordination and subsystem status display. The HMI also provides status-logging facilities and safety facilities for use by the remaining subsystems. Other subsystems have been developed to provide specific functionality, and many of these can be reused by other projects.

2051 (CONF-930403-35) **A portable modular architecture for robotic manipulator control.** Butler, P.L. Oak Ridge National Lab., TN (United States). [1993]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 5. topical meeting on robotics and remote systems; Knoxville, TN (United States); 26-29 Apr 1993. Order Number DE93010819. Source: OSTI; NTIS; INIS; GPO Dep.

A control architecture has been developed to provide a framework for robotic manipulator control. This architecture, called the Modular Integrated Control Architecture (MICA), has been successfully applied to two different manipulator systems. MICA is a portable system in two respects. First, it can be used for the control of different types of manipulator systems. Second, the MICA code is portable across several operating environments. This portability allows the sharing of common control code among various systems. A major portion of MICA is the precise control of multiple processors that have to be coordinated to control a manipulator system. By having NUCA control the processor synchronization, the system developer can concentrate on the specific aspects of a new manipulator system. MICA also provides standard functions for trajectory generation that can be used for most manipulators. Custom trajectory generators can be easily added to suit the needs of a particular robotic control system. Another facility that MICA provides is a simulation of the manipulator, allowing the control code to be simulated before trying it on a manipulator system. Using this technique, one can develop code for a manipulator system without risking damage to the arm during development.

2052 (CONF-930403-37) **Overview of the West Valley Vitrification Facility transfer cart control system.** Bradley, E.C.; Ruppel, F.R. Oak Ridge National Lab., TN (United States). [1993]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400 ; AC07-81NE44139. From 5. topical meeting on robotics and remote systems; Knoxville, TN (United States); 26-29 Apr 1993. Order Number DE93010268. Source: OSTI; NTIS; INIS; GPO Dep.

Oak Ridge National Laboratory (ORNL) has designed the control system for the West Valley Demonstration Project Vitrification Facility transfer cart. The transfer cart will transfer canisters of vitrified high-level waste remotely within the Vitrification Facility. The control system will operate the cart under battery power by wireless control. The equipment includes cart mounted control electronics, battery charger, control pendants, engineer's console, and facility antennas.

2053 (CONF-930403-38) **An rf communications system for the West Valley transfer cart.** Crutcher, R.I.; Moore, M.R. Oak Ridge National Lab., TN (United States). [1993]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400 ; AC07-81NE44139. From 5. topical meeting on robotics and remote systems; Knoxville, TN (United States); 26-29 Apr 1993. Order Number DE93010273. Source: OSTI; NTIS; INIS; GPO Dep.

A prototype radio frequency communications system for digital data was designed and built by Oak Ridge National Laboratory for use in controlling the vitrification facility transfer cart at the West Valley Nuclear Services facility in New York. The communications system provides bidirectional wireless data transfer between the operator control station and the material transfer cart. The system was designed to operate in radiation fields of 10^4 R/h while withstanding a

total integrated dose of 10^7 R of gamma radiation. Implementation of antenna spatial diversity, automatic gain control, and spectral processing improves operation in the reflective environment of the metal-lined reprocessing cells.

2054 (CONF-930403-39) Camera calibration in a hazardous environment performed in situ with automated analysis and verification. DePiero, F.W.; Kress, R.L. Oak Ridge National Lab., TN (United States). [1993]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 5. topical meeting on robotics and remote systems; Knoxville, TN (United States); 26-29 Apr 1993. Order Number DE93010274. Source: OSTI; NTIS; INIS; GPO Dep.

Camera calibration using the method of Two Planes is discussed. An implementation of the technique is described that may be performed in situ, e.g., in a hazardous or contaminated environment, thus eliminating the need for decontamination of camera systems before recalibration. Companion analysis techniques used for verifying the correctness of the calibration are presented.

2055 (CONF-930403-40) A video transmission system for low-bandwidth remote driving. DePiero, F.W. (Oak Ridge National Lab., TN (United States)); Noell, T.E.; Gee, T.F. Oak Ridge National Lab., TN (United States). [1993]. 6p. Sponsored by USDOE, Washington, DC (United States); Department of Defense, Washington, DC (United States). DOE Contract AC05-84OR21400. From 5. topical meeting on robotics and remote systems; Knoxville, TN (United States); 26-29 Apr 1993. Order Number DE93010275. Source: OSTI; NTIS; GPO Dep.

Oak Ridge National Laboratory (ORNL) staff have developed a real-time video transmission system for low-bandwidth remote operations. The system supports both continuous transmission of video for remote driving and progressive transmission of still images. Inherent in the system design is a spatiotemporal limitation to the effects of channel errors. The average data rate of the system is 64,000 bits/s, a compression of approximately 1000:1 for the black-and-white National Television Standard Code video. The image quality of the transmissions is maintained at a level that supports the teleoperated driving of a High-Mobility Multipurpose Wheeled Vehicle at speeds of up to 15 mph on a moguled dirt tract. The system also provides video transmissions for a mission package on board the vehicle. The system supports dynamic image quality adjustments that allow the remote driver to adjust to changing scenery and viewing requirements. During driving, the system's nominal configuration had a frame rate of 4 Hz, a compression per frame of 125:1, and a resulting latency of ≈ 1 s.

2056 (CONF-930403-41) Remote vehicle survey tool. Armstrong, G.A. (Oak Ridge National Lab., TN (United States)); Burks, B.L.; Kress, R.L.; Wagner, D.G.; Ward, C.R. Oak Ridge National Lab., TN (United States). [1993]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 5. topical meeting on robotics and remote systems; Knoxville, TN (United States); 26-29 Apr 1993. Order Number DE93010822. Source: OSTI; NTIS; INIS; GPO Dep.

The Remote Vehicle Survey Tool (RVST) is a color graphical display tool for viewing remotely acquired scientific data. The RVST displays the data in the form of a color two-dimensional world model map. The world model map allows movement of the remote vehicle to be tracked by the operator and the data from sensors to be graphically depicted in

the interface. Linear and logarithmic meters, dual channel oscilloscopes, and directional compasses are used to display sensor information. The RVST is user-configurable by the use of ASCII text files. The operator can configure the RVST to work with any remote data acquisition system and teleoperated or autonomous vehicle. The modular design of the RVST and its ability to be quickly configured for varying system requirements make the RVST ideal for remote scientific data display in all environmental restoration and waste management programs.

2057 (CONF-930403-42) Color image digitization and analysis for drum inspection. Muller, R.C. (Oak Ridge National Lab., TN (United States)); Armstrong, G.A.; Burks, B.L.; Kress, R.L.; Heckendorn, F.M.; Ward, C.R. Oak Ridge National Lab., TN (United States). [1993]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 5. topical meeting on robotics and remote systems; Knoxville, TN (United States); 26-29 Apr 1993. Order Number DE93010339. Source: OSTI; NTIS; INIS; GPO Dep.

A rust inspection system that uses color analysis to find rust spots on drums has been developed. The system is composed of high-resolution color video equipment that permits the inspection of rust spots on the order of 0.25 cm (0.1-in.) in diameter. Because of the modular nature of the system design, the use of open systems software (X11, etc.), the inspection system can be easily integrated into other environmental restoration and waste management programs. The inspection system represents an excellent platform for the integration of other color inspection and color image processing algorithms.

2058 (CONF-930403-48) Remote excavation using the telerobotic small emplacement excavator. Thompson, D.H.; Burks, B.L.; Killough, S.M. Oak Ridge National Lab., TN (United States). [1993]. 6p. Sponsored by USDOE, Washington, DC (United States); Department of Defense, Washington, DC (United States). DOE Contract AC05-84OR21400. From 5. topical meeting on robotics and remote systems; Knoxville, TN (United States); 26-29 Apr 1993. Order Number DE93010334. Source: OSTI; NTIS; INIS; GPO Dep.

Oak Ridge National Laboratory is developing remote excavation technologies for the Office of Technology Development, Robotics Technology Development Program. This work is being done to meet the need for remote excavation and removal of radioactive and contaminated buried waste at several DOE sites. System requirements are based on the need to uncover and remove waste from burial sites in a way that does not cause unnecessary personnel exposure or additional environmental contamination. Goals for the current project are to demonstrate dexterous control of a backhoe with force feedback and to implement robotic operations that will improve productivity. The Telerobotic Small Emplacement Excavator is a prototype system that incorporates the needed robotic and telerobotic capabilities on a commercially available platform. The ability to add remote dexterous teleoperation and robotic operating modes is intended to be adaptable to other commercially available excavator systems.

2059 (CONF-930403-54) Parametric design studies of long-reach manipulators. Kwon, D.S.; March-Leuba, S.; Babcock, S.M.; Burks, B.L.; Hamel, W.R. Oak Ridge National Lab., TN (United States). [1993]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract

AC05-84OR21400. From 5. topical meeting on robotics and remote systems; Knoxville, TN (United States); 26-29 Apr 1993. Order Number DE94002456. Source: OSTI; NTIS; INIS; GPO Dep.

A number of different approaches have been studied for remediation of waste storage tanks at various sites. One of the most promising approaches is the use of a high-capacity, long-reach manipulation (LRM) system with a variety of end effectors for dislodging the waste. LRMs may have characteristics significantly different from those of industrial robots due to the long links needed to cover the large workspace. Because link lengths are much greater than their diameters, link flexibility, as well as joint or drive train flexibility, is likely to be significant. LRMs will be required for a variety of applications in the Environmental Restoration and Waste Management Program. While each application will present specific functional, kinematic, and performance requirements, a design approach for determining the kinematic applicability and performance characteristics considering link flexibility is presented with a focus on waste storage tank remediation. This paper addresses key design issues for LRM-based waste retrieval systems. It discusses the effects of parameters such as payload capacity, storage tanks size, and access port diameter on manipulator structural design. The estimated weight, fundamental natural frequency, and static deflection of the manipulator have been calculated for various parameter conditions.

2060 (CONF-930445-15) A modular control architecture for real-time synchronous and asynchronous systems. Butler, P.L.; Jones, J.P. Oak Ridge National Lab., TN (United States). [1993]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Society of Photo-Optical Instrumentation Engineers (SPIE) OE/aerospace science and sensing meeting; Orlando, FL (United States); 11-16 Apr 1993. Order Number DE93015439. Source: OSTI; NTIS; INIS; GPO Dep.

This paper describes a control architecture for real-time control of complex robotic systems. The Modular Integrated Control Architecture (MICA), which is actually two complementary control systems, recognizes and exploits the differences between asynchronous and synchronous control. The asynchronous control system simulates shared memory on a heterogeneous network. For control information, a portable event-scheme is used. This scheme provides consistent interprocess coordination among multiple tasks on a number of distributed systems. The machines in the network can vary with respect to their native operating systems and the internal representation of numbers they use. The synchronous control system is needed for tight real-time control of complex electromechanical systems such as robot manipulators, and the system uses multiple processors at a specified rate. Both the synchronous and asynchronous portions of MICA have been developed to be extremely modular. MICA presents a simple programming model to code developers and also considers the needs of system integrators and maintainers. MICA has been used successfully in a complex robotics project involving a mobile 7-degree-of-freedom manipulator in a heterogeneous network with a body of software totaling over 100,000 lines of code. MICA has also been used in another robotics system, controlling a commercial long-reach manipulator.

2061 (CONF-930519-6) Detailed solution to a complex kinematics chain manipulator. March-Leuba, S.; Jansen, J.F.; Kress, R.L.; Babcock, S.M. Oak Ridge National Lab., TN (United States). [1992]. 10p. Sponsored by

USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Institute of Electrical and Electronics Engineers international conference on robotics and automation; Atlanta, GA (United States); 2-7 May 1993. Order Number DE93004619. Source: OSTI; NTIS; INIS; GPO Dep.

This paper presents a relatively simple method based on planar geometry to analyze the inverse kinematics for closed kinematics chain (CKC) mechanisms. Although the general problem and method of approach are well defined, the study of the inverse kinematics of a closed-chain mechanism is a very complicated one. The current methodology allows closed-form solutions to be found, if a solution exists, for the displacements and velocities of all manipulator joints. Critical design parameters can be identified and optimized by using symbolic models. This paper will focus on planar closed-chain structures extended with a rotational base. However, with open and CKC mechanisms combined in different planes, the extension to the case is straightforward. Further, real-time algorithms are developed that can be handled by existing microprocessor technology. To clarify the methodology, the Soldier Robot Interface Project (SRIP) manipulator is analyzed, and a graphic simulation is presented as a verification of the results. This manipulator has 17 links, 24 one-degree-of-freedom (DOF) joints, and 7 CKC loops working in a plane and a rotational base, which determine its 3 DOFs. The SRIP manipulator allows a decoupled linear motion along the vertical or horizontal directions using only one of its linear actuators. The symbolic solution for the inverse kinematics allows optimization to be performed to further decouple the Cartesian motions by changing link lengths of the manipulator. The conclusion achieved by the optimization is that only two link lengths need to be changed to tune the manipulator for a perfect decoupling at each area of the workspace.

2062 (CONF-930519-8) Numerical kinematic transformation calculations for a parallel link manipulator. Killough, S.M. Oak Ridge National Lab., TN (United States). [1993]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Institute of Electrical and Electronics Engineers international conference on robotics and automation; Atlanta, GA (United States); 2-7 May 1993. Order Number DE93005778. Source: OSTI; NTIS; INIS; GPO Dep.

Parallel link manipulators are often considered for particular robotic applications because of the unique advantages they provide. Unfortunately, they have significant disadvantages with respect to calculating the kinematic transformations because of the high-order equations that must be solved. Presented is a manipulator design that exploits the mechanical advantages of parallel links yet also has a corresponding numerical kinematic solution that can be solved in real time on common microcomputers.

2063 (CONF-930570-2) The application of GIS and remote sensing technologies for site characterization and environmental assessment. Durfee, R.C.; McCord, R.A.; Dobson, J.E. Oak Ridge National Lab., TN (United States). [1993]. 45p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 2. annual Federal environmental restoration conference and exhibition; Washington, DC (United States); 25-27 May 1993. Order Number DE93015435. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental cleanup and restoration of hazardous waste sites are major activities at federal facilities around

the US. Geographic information systems (GIS) and remote sensing technologies are very useful computer tools to aid in site characterization, monitoring, assessment, and remediation efforts. Results from applying three technologies are presented to demonstrate examples of site characterization and environmental assessment for a federal facility. The first technology involves the development and use of GIS within the comprehensive Oak Ridge Environmental Information System (OREIS) to integrate facility data, terrain models, aerial and satellite imagery, demographics, waste area information, and geographic data bases. The second technology presents 3-D subsurface analyses and displays of groundwater and contaminant measurements within waste areas. In the third application, aerial survey information is being used to characterize land cover and vegetative patterns, detect change, and study areas of previous waste activities and possible transport pathways. These computer technologies are required to manage, analyze, and display the large amounts of environmental and geographic data that must be handled in carrying out effective environmental restoration.

2064 (CONF-9305181-) Transportation Management Workshop: Proceedings. USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). Transportation Management Div. [1993]. 592p. Sponsored by USDOE, Washington, DC (United States). From Transportation management workshop; Gaithersburg, MD (United States); 11-13 May 1993. Order Number DE94000411. Source: OSTI; NTIS; INIS; GPO Dep.

This report is a compilation of discussions presented at the Transportation Management Workshop held in Gaithersburg, Maryland. Topics include waste packaging, personnel training, robotics, transportation routing, certification, containers, and waste classification.

2065 (CONF-940353-3) A "model" geophysics program. Nyquist, J.E. Oak Ridge National Lab., TN (United States). [1994]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Symposium on the application of geophysics to environmental and engineering problems; Boston, MA (United States); 27-31 Mar 1994. Order Number DE94007415. Source: OSTI; NTIS; INIS; GPO Dep.

In 1993, I tested a radio-controlled airplane designed by Jim Walker of Brigham Young University for low-elevation aerial photography. Model-air photography retains most of the advantages of standard aerial photography — the photographs can be used to detect lineaments, to map roads and buildings, and to construct stereo pairs to measure topography — and it is far less expensive. Proven applications on the Oak Ridge Reservation include: updating older aerial records to document new construction; using repeated overflights of the same area to capture seasonal changes in vegetation and the effects of major storms; and detecting waste trench boundaries from the color and character of the overlying grass. Aerial photography is only one of many possible applications of radio-controlled aircraft. Currently, I am funded by the Department of Energy's Office of Technology Development to review the state of the art in microavionics, both military and civilian, to determine ways this emerging technology can be used for environmental site characterization. Being particularly interested in geophysical applications, I am also collaborating with electrical engineers at Oak Ridge National Laboratory to design a model plane that will carry a 3-component flux-gate magnetometer and a global positioning system, which I hope to test in the spring of 1994.

2066 (CONF-940550-8) Input shaping filter methods for the control of structurally flexible, long-reach manipulators. Kwon, Dong-Soo; Hwang, Dong-Hwan; Babcock, S.M.; Burks, B.L. Oak Ridge National Lab., TN (United States). [1993]. 8p. Sponsored by USDOE, Washington, DC (United States); Oak Ridge Inst. for Science and Education, TN (United States); Korea Science and Engineering Foundation (Korea, Republic of). DOE Contract AC05-84OR21400. From Institute of Electrical and Electronics Engineers (IEEE) international conference on robotics; San Diego, CA (United States); 8-13 May 1994. Order Number DE94002799. Source: OSTI; NTIS; INIS; GPO Dep.

Within the Environmental Restoration and Waste Management Program of the US Department of Energy, the remediation of single-shell radioactive waste storage tanks is one of the areas that challenge state-of-the-art equipment and methods. Concepts that utilize long-reach manipulators are being seriously considered for this task. Due to high payload capacity and high length-to-cross-section ratio requirements, these long-reach manipulator systems are expected to exhibit significant structural flexibility. To avoid structural vibrations during operation, various types of shaping filter methods have been investigated. A robust notch filtering method and an impulse shaping method were used as simulation benchmarks. In addition to that, two very different approaches have been developed and compared. One new approach, referred to as a "feedforward simulation filter," uses imbedded simulation with complete knowledge of the system dynamics. The other approach, "fuzzy shaping method," employs a fuzzy logic method to modify the joint trajectory from the desired end-position trajectory without precise knowledge of the system dynamics.

2067 (DOE/EM-0007T-Vol.1) Environmental restoration and waste management: Robotics technology development program: Robotics 5-year program plan: Volume 1, Executive summary. USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). Office of Technology Development. [1991]. 19p. Sponsored by USDOE, Washington, DC (United States). Order Number DE91008026. Source: OSTI; NTIS; INIS; GPO Dep.

This plan covers robotics Research, Development, Demonstration, Testing and Evaluation activities in the Program for the next five years. These activities range from bench-scale R&D to full-scale hot demonstrations at DOE sites. This plan outlines applications of existing technology to near-term needs, the development and application of enhanced technology for longer-term needs, and initiation of advanced technology development to meet those needs beyond the five-year plan. The objective of the Robotic Technology Development Program (RTDP) is to develop and apply robotics technologies that will enable Environmental Restoration and Waste Management (ER&WM) operations at DOE sites to be safer, faster and cheaper. Five priority DOE sites were visited in March 1990 to identify needs for robotics technology in ER&WM operations. This 5-Year Program Plan for the RTDP detailed annual plans for robotics technology development based on identified needs. In July 1990 a forum was held announcing the robotics program. Over 60 organizations (industrial, university, and federal laboratory) made presentations on their robotics capabilities. To stimulate early interactions with the ER&WM activities at DOE sites, as well as with the robotics community, the RTDP sponsored four technology demonstrations related to ER&WM needs. These demonstrations integrated commercial technology with robotics technology developed

by DOE in support of areas such as nuclear reactor maintenance and the civilian reactor waste program. 2 figs.

2068 (DOE/EM-0007T-Vol.2) Environmental restoration and waste management: Robotics technology development program: Robotics 5-year program plan: Volume 2, Program plan. USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). Office of Technology Development. [1991]. 93p. Sponsored by USDOE, Washington, DC (United States). Order Number DE91008027. Source: OSTI; NTIS; INIS; GPO Dep.

This plan covers robotics Research, Development, Demonstration, Testing, activities in the Program for the next five years. These activities range from bench-scale R&D to fullscale hot demonstrations at DOE sites. This plan outlines applications of existing technology to near-term needs, the development and application of enhanced technology for longer-term needs, and an initiation of advanced technology development to meet those needs beyond the five-year plan. The objective of the Robotic Technology Development (RTDP) is to develop and apply robotics technologies that will enable Environmental Restoration and Waste Management operations at DOE sites to be safer, faster and cheaper. Five priority DOE sites were visited in March 1990 to identify needs for robotics technology in ER&WM operations. This 5-Year Program Plan for the RTDP detailed annual plans for robotics technology development based on identified needs. This 5-Year Program Plan discusses the overall approach to be adopted by the RTDP to aggressively develop robotics technology and contains discussions of the Program Management Plan, Site Visit and Needs Summary, Approach to Needs-Directed Technical Development, Application-Specific Technical Development, and Cross-Cutting and Advanced Technology. Integrating application-specific ER&WM needs, the current state of robotics technology, and the potential benefits (in terms of faster, safer, and cheaper) of new technology, the Plan develops application-specific road maps for robotics RDDT&E for the period FY 1991 through FY 1995. In addition, the Plan identifies areas where longer-term research in robotics will have a high payoff in the 5- to 20-year time frame. 12 figs.

2069 (DOE/EM-0007T-Vol.3) Environmental restoration and waste management: Robotics technology development program: Robotics 5-year program plan: Volume 3, Site needs and requirements. USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). Office of Technology Development. [1991]. 34p. Sponsored by USDOE, Washington, DC (United States). Order Number DE91008028. Source: OSTI; NTIS; INIS; GPO Dep.

In FY 1990 Robotics Technology Development Program (RTDP) planning teams visited five DOE sites. These sites were selected by the Office of Technology Development to provide a needs basis for developing a 5-Year Plan. Visits to five DOE sites provided identification of needs for robotics technology development to support Environmental Restoration and Waste Management (ER&WM) projects at those sites. Additional site visits will be conducted in the future to expand the planning basis. This volume summarizes both the results of the site visits and the needs and requirements of the priority ER&WM activities at the sites, including potential needs for robotics and remote systems technology. It also discusses hazards associated with the site activities and any problems or technical uncertainties associated with

dealing with the hazards in the performance of the ER&WM work. Robotic or remote systems currently under development for remediation projects or waste operations are also discussed. The information in this document is organized principally by site, activity, and priority. Section 2.0, Site Needs, is based on information from the site visit reports and provides a summary which focuses on the site needs and requirements for each priority activity. Section 2.0 also records evaluations and discussions by the RTDP team following the site visit. Section 3.0, Commonality Assessment, documents similar site needs where common, or cross-cutting, robotics technology might be applied to several activities. Section 4.0 contains a summary of the site needs and requirements in tabular form. 1 tab.

2070 (DOE/EM-0127P) Robotics Technology Development Program: Technology summary. USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). Office of Technology Development. Feb 1994. 110p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94008859. Source: OSTI; NTIS; INIS; GPO Dep.

The Robotics Technology Development Program (RTDP) is a "needs-driven" effort. A lengthy series of presentations and discussions at DOE sites considered critical to DOE's Environmental Restoration and Waste Management (EM) Programs resulted in a clear understanding of needed robotics applications toward resolving definitive problems at the sites. A detailed analysis of the Tank Waste Retrieval (TWR), Contaminant Analysis Automation (CAA), Mixed Waste Operations (MWO), and Decontamination & Dismantlement (D&D). The RTDP Group realized that much of the technology development was common (Cross Cutting-CC) to each of these robotics application areas, for example, computer control and sensor interface protocols. Further, the OTD approach to the Research, Development, Demonstration, Testing, and Evaluation (RDDT&E) process urged an additional organizational break-out between short-term (1-3 years) and long-term (3-5 years) efforts (Advanced Technology-AT). The RTDP is thus organized around these application areas - TWR, CAA, MWO, D&D and CC&AT - with the first four developing short-term applied robotics. An RTDP Five-Year Plan was developed for organizing the Program to meet the needs in these application areas.

2071. (DOE/MC/29112-3641) Intelligent mobile sensor system for drum inspection and monitoring: Phase 1: Topical report, October 1, 1992-June 8, 1993. Martin Marietta Astronautics Group, Littleton, CO (United States). Jun 1993. 79p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-92MC29112. Order Number DE94004062. Source: OSTI; NTIS; INIS; GPO Dep.

The objective of this project was to develop an operational system for monitoring and inspection activities for waste storage facility operations at several DOE sites. Specifically, the product of this effort is a robotic device with enhanced intelligence and maneuverability capable of conducting routine inspection of stored waste drums. The device is capable of operating in narrow aisles and interpolating the free aisle space between rows of stacked drums. The system has an integrated sensor suite for leak detection, and is interfaced with a site database both for inspection planning and for data correlation, updating, and report generation. The system is capable of departing on an assigned mission, collecting required data, recording which positions of its mission had to be aborted or modified due to environmental

constraints, and reporting back when the mission is complete. Successful identification of more than 90% of all drum defects has been demonstrated in a high fidelity waste storage facility mockup. Identified anomalies included rust spots, rust streaks, areas of corrosion, dents, and tilted drums. All drums were positively identified and correlated with the site database. This development effort is separated into three phases of which phase one is now complete. The first phase has demonstrated an integrated system for monitoring and inspection activities for waste storage facility operations. This demonstration system was quickly fielded and evaluated by leveraging technologies developed from previous NASA and DARPA contracts and internal research. The second phase will demonstrate a prototype system appropriate for operational use in an actual storage facility. The prototype provides an integrated design that considers operational requirements, hardware costs, maintenance, safety, and robustness. The final phase will demonstrate commercial viability using the prototype vehicle in a pilot waste operations and inspection project.

2072 (DOE/MC/29113-3405) Integrated Computer-Enhanced Remote Viewing System: Quarterly report No. 1, October-December 1992. Mechanical Technology, Inc., Latham, NY (United States). 12 Mar 1993. 94p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-92MC29113. Order Number DE93040018. Source: OSTI; NTIS; GPO Dep.

The Interactive, Computer-Enhanced, Remote Viewing System (ICERVS) is designed to provide a reliable geometric description of a robotic task space in a fashion that enables robotic remediation to be carried out more efficiently and economically than with present systems. The key elements are a robust way to store empirical data and a friendly user interface that provides an operator with timely access to all that is known about a scene.

2073 (DOE/MC/29113-3536) Interactive Computer-Enhanced Remote Viewing System (ICERVS). Mechanical Technology, Inc., Latham, NY (United States). Aug 1993. 36p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-92MC29113. Order Number DE94000062. Source: OSTI; NTIS; INIS; GPO Dep.

The Integrated Computer-Enhanced Remote Viewing System (ICERVS) supports the robotic remediation of hazardous environments such as underground storage tanks, buried waste sites, and contaminated production facilities. The success of these remediation missions will depend on reliable geometric descriptions of the work environment in order to achieve effective task planning, path planning, and collision avoidance. ICERVS provides a means for deriving a reliable geometric description more effectively and efficiently than current systems by combining a number of technologies: Sensing of the environment to acquire dimensional and material property data; integration of acquired data into a common data structure (based on octree technology); presentation of data to robotic task planners for analysis and visualization; interactive synthesis of geometric/surface models to denote features of interest in the environment and transfer of this information to robot control and collision avoidance systems. A key feature of ICERVS is that it will enable an operator to match xyz data from a sensor with surface models of the same region in space. This capability will help operators to better manage the complexities of task and path planning in three-dimensional (3D) space, thereby leading to safer and more effective remediation. The Phase 1 work performed by MTI has brought the

ICERVS design to Maturity Level 3, Subscale Major Subsystem, and met the established success criteria.

2074 (DOE/MC/29113-3574) Integrated computer-enhanced remote viewing system: Quarterly report No. 2, January-March 1993. Mechanical Technology, Inc., Latham, NY (United States). 3 May 1993. 102p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-92MC29113. Order Number DE94005914. Source: OSTI; NTIS; GPO Dep.

The Interactive, Computer-Enhanced, Remote Viewing System (ICERVS) is a system designed to provide a reliable geometric description of a robotic task space in a fashion that enables robotic remediation to be carried out more efficiently and economically than with present systems. The key elements are a faithful way to store empirical data and a friendly user interface that provides an operator with timely access to all that is known about a scene.

2075 (DOE/MC/29113-3608) Integrated Computer-Enhanced Remote Viewing System: Quarterly report number 4, July-October 1993. Mechanical Technology, Inc., Latham, NY (United States). 30 Nov 1993. 111p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-92MC29113. Order Number DE94005893. Source: OSTI; NTIS; GPO Dep.

The Interactive, Computer-Enhanced, Remote Viewing System (ICERVS) is a system designed to provide a reliable geometric description of a robotic task space in a fashion that enables robotic remediation to be carried out more efficiently and economically than with present systems. The key elements are a faithful way to store empirical data and a friendly user interface that provides an operator with timely access to all that is known about a scene. The development of ICERVS is to occur in three phases. Phase 1 will focus on the development of the Data Library, which contains the geometric data about the task space and the objects in it, and the Toolkit, which includes the mechanisms for manipulating and displaying both empirical and model data. Phase 2 will concentrate on integrating these subsystems with a sensor subsystem into one working system. Some additional functionality will be incorporated in the Data Library and Toolkit subsystems. Phase 3 will expand the configuration to meet the needs of a full scale demonstration of the interactive mapping of some waste site to be identified. The second Phase of the ICERVS project consists of nine tasks. Significant efforts were devoted to the completion of Task 1: Intermediate System Design, and Task 3: Computer Upgrade. This report describes progress in these two tasks.

2076 (DOE/MC/29113-3689) Integrated Computer-Enhanced Remote Viewing System: Quarterly report No. 3, April-June 1993. Mechanical Technology, Inc., Latham, NY (United States). 6 Sep 1993. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-92MC29113. Order Number DE94008633. Source: OSTI; NTIS; GPO Dep.

The Interactive, Computer-Enhanced, Remote Viewing System (ICERVS) is designed to provide a reliable geometric description of a robotic task space in a fashion that enables robotic remediation to be carried out more efficiently and economically than with present systems. The key elements are a robust way to store empirical data and a friendly user interface that provides an operator with timely access to all that is known about a scene. ICERVS will help an operator to analyze a scene and generate additional

geometric data for automating significant portions of the remediation activity. Features that enable this include the following: storage and display of empirical sensor data; ability to update segments of the geometric description of the task space; side-by-side comparisons of a live TV scene and a computer generated view of the same scene; ability to create and display computer models of perceived objects in the task space, together with textual comments; and easy export of data to robotic world models for robot guidance. Phase 1 of this project was essentially completed in the month of June. Phase 1 (Level III) of this project focuses on the development of the Data Library, which contains the geometric data about the task space and the object in it, and the Toolkit, which includes the mechanisms for manipulating and displaying both empirical and model data.

2077 (DOE/MC/29115-93/C0190) Design considerations for an intelligent mobile robot for mixed-waste inspection. Sias, F.R. (Clemson Univ., SC (United States). Dept. of Electrical and Computer Engineering); Dawson, D.M.; Schalkoff, R.J.; Byrd, J.S.; Pettus, R.O. Clemson Univ., SC (United States). [1993]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-92MC29115 ; FC21-92MC28245. (CONF-930873-17: 2. international mixed waste symposium, Baltimore, MD (United States), 17-20 Aug 1993). Order Number DE93015930. Source: OSTI; NTIS; INIS; GPO Dep.

Large quantities of low-level radioactive waste are stored in steel drums at various Department of Energy (DOE) sites in the United States. Much of the stored waste qualifies as mixed waste and falls under Environmental Protection Agency (EPA) regulations that require periodic inspection. A semi-autonomous mobile robot is being developed during Phase 1 of a DOE contract to perform the inspection task and consequently reduce the radiation exposure of inspection personnel to ALARA (as low as reasonably achievable). The nature of the inspection process, the resulting robot design requirements, and the current status of the project are the subjects of this paper.

2078 (DOE/MC/29115-94/C0274) Update on radiation-hardened microcomputers for robotics and teleoperated systems. Sias, F.R. Jr. (Clemson Univ., SC (United States). Dept. of Electrical and Computer Engineering); Tulenko, J.S. Clemson Univ., SC (United States). Dept. of Electrical and Computer Engineering. [1993]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-92MC29115. (CONF-931160-39: American Nuclear Society (ANS) winter meeting, San Francisco, CA (United States), 14-18 Nov 1993). Order Number DE94006006. Source: OSTI; NTIS; INIS; GPO Dep.

Since many programs sponsored by the Department of Defense are being canceled, it is important to select carefully radiation-hardened microprocessors for projects that will mature (or will require continued support) several years in the future. At the present time there are seven candidate 32-bit processors that should be considered for long-range planning for high-performance radiation-hardened computer systems. For Department of Energy applications it is also important to consider efforts at standardization that require the use of the VxWorks operating system and hardware based on the VMEbus. Of the seven processors, one has been delivered and is operating and other systems are scheduled to be delivered late in 1993 or early in 1994. At the present time the Honeywell-developed RH32, the Harris RH-3000 and the Harris RHC-3000 are leading contenders for meeting DOE requirements for a radiation-hardened

advanced 32-bit microprocessor. These are all either compatible with or are derivatives of the MIPS R3000 Reduced Instruction Set Computer. It is anticipated that as few as two of the seven radiation-hardened processors will be supported by the space program in the long run.

2079 (DOE/NE/37969-5) Semi-autonomous robots for reactor containments: Annual summary report, [1993-1994]. Michigan Univ., Ann Arbor, MI (United States). 6 May 1994. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-86NE37969. Order Number DE94012485. Source: OSTI; NTIS; INIS; GPO Dep.

During 1993, the activity at the University was split into two primary groups. One group provided direct support for the development and testing of the RVIR vehicle. This effort culminated in a demonstration of the vehicle at ORNL during December. The second group of researchers focused attention on pushing the technology forward in the areas of radiation imaging, navigation, and sensing modalities. A major effort in technology transfer took place during this year. All of these efforts reflected in the periodic progress reports which are attached. During 1994, our attention will change from the Nuclear Energy program to the Environmental Restoration and Waste Management office. The immediate needs of the Robotics Technology Development Program within the Office of Technology Development of EM drove this change in target applications. The University will be working closely with the national laboratories to further develop and transfer existing technologies to mobile platforms which are currently being designed and employed in seriously hazardous environments.

2080 (EGG-2710) Remote Excavation System technology evaluation report: Buried Waste Robotics Program. EG and G Idaho, Inc., Idaho Falls, ID (United States). Sep 1993. 125p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94002604. Source: OSTI; NTIS; INIS; GPO Dep.

This document describes the results from the Remote Excavation System demonstration and testing conducted at the Idaho National Engineering Laboratory during June and July 1993. The purpose of the demonstration was to ascertain the feasibility of the system for skimming soil and removing various types of buried waste in a safe manner and within all regulatory requirements, and to compare the performances of manual and remote operation of a backhoe. The procedures and goals of the demonstration were previously defined in The Remote Excavation System Test Plan, which served as a guideline for evaluating the various components of the system and discussed the procedures used to conduct the tests.

2081 (EGG-M-92580) T-Rex system for operation in TRU, LLW, and hazardous zones: Transuranic storage area-retrieval enclosure program. Kline, H.M. (EG and G Idaho, Inc., Idaho Falls, ID (United States)); Andreychek, T.P.; Beeson, B.K. EG and G Idaho, Inc., Idaho Falls, ID (United States). [1993]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. (CONF-930403-49: 5. topical meeting on robotics and remote systems, Knoxville, TN (United States), 26-29 Apr 1993). Order Number DE93010803. Source: OSTI; NTIS; INIS; GPO Dep.

There are a large number of sites around the world containing TRU (transuranic) waste, low level waste (LLW), and

hazardous areas that require teleoperated, heavy lift manipulators with long reach and high precision to handle the materials stored there. Teleoperation of the equipment is required to reduce the risk to operating personnel to as-low-as-reasonably-achievable (ALARA) levels. The Transuranic Storage Area Remote Excavator system (T-Rex) is designed to fill this requirement at low cost through the integration of a production front shovel excavator with a control system, local and remote operator control stations, a closed-circuit television system (CCTV), multiple end effectors and a quick-change system. This paper describes the conversion of an off-the-shelf excavator with a hydraulic control system, the integration of an onboard remote control system, vision system, and the design of a remote control station.

2082 (EGG-WTD-9765) Robotics subsurface mapping demonstration technology test plan. Griebenow, B.E. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jun 1991. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE91018786. Source: OSTI; NTIS; INIS; GPO Dep.

The Subsurface Disposal Area (SDA) at the Radioactive Waste Management Complex (RWMC) contains an estimated 2 million cubic feet of contaminated, hazardous, radioactive buried waste. The waste was received in cardboard boxes, steel drums plywood boxes, and as loose material. Possible leaching of the buried waste may have created mixed hazardous fill dirt, with an estimated volume of 6 million cubic feet. The Department of Energy has committed to clean up the SDA. Cleanup efforts will include characterizing and removing the waste. Waste characterization provides information on what, where, and how much waste is buried. This information will be used to determine how the waste will be removed and treated. Limited historical data of the waste buried within the SDA exist, but have not been verified and are believed to be incorrect or incomplete in many cases. There are two objectives to the Robotics Subsurface Mapping Demonstration. The first is to demonstrate the feasibility of using a remotely operated platform to perform characterization operations. In the demonstration, the Soldier Robot Interface Project (SRIP) platform will be equipped with multiple sensors to provide data for buried waste characterization and will be remotely controlled and tracked by the Ultrasonic Ranging and Data System (USRADS). The second objective of the demonstration is to characterize the waste in locations within the SDA, as specified by the Buried Waste Integrated Demonstration (BWID) Project.

2083 (EGG-WTD-9923) Technology evaluation report for the Buried Waste Robotics Program Subsurface Mapping Project. Griebenow, B.E. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jan 1992. 67p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012523. Source: OSTI; NTIS; INIS; GPO Dep.

This document presents a summary of the work performed in support of the Buried Waste Robotics Program Subsurface Mapping Project. The project objective was to demonstrate the feasibility of remotely characterizing buried waste sites. To fulfill this objective, a remotely-operated vehicle, equipped with several sensors, was deployed at the Idaho National Engineering Laboratory. Descriptions of the equipment and areas involved in the project are included in this report. Additionally, this document provides data that was obtained during characterization operations at the Cold Test Pit and the Subsurface Disposal Area, both at the Idaho

National Engineering Laboratory's Radioactive Waste Management Complex, and at the Idaho Chemical Processing Plant. The knowledge gained from the experience, that can be applied to the next generation remote-characterization system, is extensive and is presented in this report.

2084 (EGG-WTD-10703) Remote Excavation System test plan. Walker, S.; Hyde, R.A. EG and G Idaho, Inc., Idaho Falls, ID (United States). May 1993. 93p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94002876. Source: OSTI; NTIS; GPO Dep.

The Office of Technology Development (OTD) established the Robotics Technology Development Program (RTDP) to integrate robotic development activities on a national basis; provide needs-oriented, timely, and economical robotics technology to support environmental and waste operations activities at Department of Energy (DOE) sites; and provide the focus and direction for the near term (less than five years) and guidance for the long-term (five to twenty years) research and development efforts for site-specific problems. The RTDP consists of several programs including the Buried Waste Robotics Program (BWRP), which addresses remote buried waste applications. The Remote Excavation System (RES) was developed under the RTDP to provide a safer method of excavating hazardous materials for both the DOE and the Department of Defense (DOD). The excavator, initially developed by the DOD as a manually-operated small excavator, has been modified for teleoperation with joint funding from the BWRP and the DOD. The Buried Waste Integrated Demonstration (BWID) and the Uranium Soils Integrated Demonstration (USID) are funding the demonstration, testing, and evaluation of the RES covered in this test plan. This document covers testing both at Oak Ridge National Laboratory (ORNL) and the Idaho National Engineering Laboratory (INEL), as funded by BWID and USID. This document describes the tests planned for the RES demonstration for the BWRP. The purposes of the test plan are (1) to establish test parameters to ensure that the demonstration results are deemed useful and usable and (2) to demonstrate performance in a safe manner within all regulatory requirements.

2085 (FEMP-2267) Development and implementation of automated radioactive materials handling systems. Jacoboski, D.L. Fernald Environmental Restoration Management Corp., Cincinnati, OH (United States). Fernald Environmental Management Project. Dec 1992. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-92OR21972. (CONF-9301118-1: Material handling focus '93 annual users conference, Ft. Lauderdale, FL (United States), 13-15 Jan 1993). Order Number DE93016470. Source: OSTI; NTIS; INIS; GPO Dep.

Material handling of radioactive and hazardous materials has forced the need to pursue remotely operated and robotic systems in light of operational safety concerns. Manual maneuvering, repackaging, overpacking and inspecting of containers which store radioactive and hazardous materials is the present mode of operation at the Department of Energy (DOE) Fernald Environmental Management Project (FEMP) in Fernald Ohio. The manual methods are unacceptable in the eyes of concerned site workers and influential community oversight committees. As an example to respond to the FEMP material handling needs, design efforts have been initiated to provide a remotely operated system to repack thousands of degraded drums containing radioactive Thorium. Later, the repackaged Thorium

will be shipped offsite to a predesignated repository again requiring remote operation.

2086 (FEMP-2316) The SWAMI inspection robot: Fernald site requirements. Hazen, F.B. Fernald Environmental Restoration Management Corp., Cincinnati, OH (United States). Fernald Environmental Management Project. 28 Sep 1993. 45p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-92OR21972. Order Number DE94006523. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this document is to introduce and describe the Stored Waste Autonomous Mobile Inspector (SWAMI) robot project and to identify issues that will need to be addressed prior to its field demonstration at Fernald in mid-1995. SWAMI is a mobile robotic vehicle that will perform mandated weekly inspections of waste containers. Fernald has a large inventory of these containers and a need to protect workers from radiation hazards while enhancing the efficiency and effectiveness of the inspections. Fernald's role in this project is to supply the demonstration site and make all necessary preparations. This includes identification of the test areas and plans, and identification and compliance to Federal, State, DOE, and Site regulations on system safety and quality. In addition, Fernald will link SWAMI output images to off-line mass data storage, and also to an on-line ORACLE database. The authors shall initiate a dialog with State and Federal regulators towards the near term goal of acceptance of the SWAMI test plan and a longer term goal of acceptance of SWAMI as a supplement and improvement to present mandated RCRA inspections.

2087 (FEMP/SUB-074) Assessment of the state of the art for Self-Guided Vehicles. Hazen, F.B. (ed.); Hall, E.L.; Arantes, J.C.; An, Jian; Catalan, M.; Deng, S.; Ghayalod, M.P.; Wang, Jianping. Westinghouse Environmental Management Co. of Ohio, Cincinnati, OH (United States). Fernald Environmental Management Project. Aug 1993. 149p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-92OR21972. Order Number DE94007082. Source: OSTI; NTIS; GPO Dep.

This report is the result of a three month research project that was carried out by University of Cincinnati researchers under a contract managed by FERMCO. FERMCO is the contractor responsible for operating the Fernald Environmental Management Project (FEMP), a Department of Energy (DOE) facility located near Cincinnati, Ohio. This site is in the initial stages of being decommissioned and many technical challenges will be encountered during this effort. Other DOE sites that are also slated for decommissioning will benefit from the experience gained during the Fernald remediation process. One aspect of present activities at Fernald is the identification and development of new and novel technologies that will allow the remediation to proceed safer, more efficiently, and at the lowest possible cost to taxpayers. The Office of Technology Development (OTD) is the DOE office that is charged with coordinating these efforts amongst DOE sites and national laboratories and funding them. The Robotics Technology Development Program (RTDP) is the part of the OTD responsible for the development of robots and related systems that can help in the daunting task of remediating the DOE sites. This research report, supported by the RTDP, is intended to identify the state of the art of the component technologies that can be used to develop Self-Guided Vehicles (SGV's). FERMCO and the RTDP have identified SGV's as a type of system that can potentially improve the transportation and movement of

containerized radiological, hazardous, and mixed waste within and between various facilities at remediation sites like Fernald. A preliminary plan has been created to develop SGV's for that purpose, using the resources available through the RTDP. This state of the art report was identified as an important initial step in order to be able to match the specific needs of the sites with the technologies available.

2088 (IS-M-708) Mobile instrumentation platform and robotic accessory for real-time screening of hazardous waste. Anderson, M.S.; Jaselskis, E.J. Ames Lab., IA (United States). [1992]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-82. (CONF-920851-18: Spectrum '92: nuclear and hazardous waste management international topical meeting, Boise, ID (United States), 23-27 Aug 1992). Order Number DE92014390. Source: OSTI; NTIS; INIS; GPO Dep.

An innovative mobile laboratory for real-time field screening of soils for inorganic hazardous waste using laser ablation-inductively coupled plasma-atomic emission spectrometry sampling and analysis technique is being developed at Ames Laboratory. This sampling technique as well as the concept for installing, monitoring, and controlling the instrumentation and utilities in the mobile laboratory, the robotic sampling accessory, and manual sampling method are discussed. Benefits of this mobile configuration and future development plans also are described.

2089 (LA-SUB-93-29) Prototype PC user interface. Los Alamos National Lab., NM (United States). [1993]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93008008. Source: OSTI; NTIS; GPO Dep.

The conceptual model of analytical director is implemented to simulate a robotic analytical laboratory. In this model, the robotic table is represented by an abstract workbench; and the laboratory activities are represented by a set of primitive operations. A PC version user interface, is developed based on the conceptual model using Microsoft Windows 3.0 programming and object-oriented design technique. With the interface, a user can design a robotic procedure on conceptual level.

2090 (ORNL/TM-12185) Waste-surface mapping of the Fernald K-65 silos using a structured light measurement system. Burks, B.L. (Oak Ridge National Lab., TN (United States)); DePiero, F.W.; Dinkins, M.A.; Rowe, J.C.; Selleck, C.B.; Jacoboski, D.L. Oak Ridge National Lab., TN (United States). Oct 1992. 83p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93002874. Source: OSTI; NTIS; INIS; GPO Dep.

A remotely operated surface-mapping measurement system was developed by the Robotics & Process Systems Division at Oak Ridge National Laboratory for use in the K-65 waste-storage silos at Fernald, Ohio. The mapping system used three infrared line-generating laser diodes as illumination sources and three high-resolution, low-lux, calibrated, black-and-white, charge-coupled-device video cameras as receivers. These components were combined to form structured light source range and direction sensors with six different possible emitter-receiver pairs. A technology demonstration and predeployment tests were performed at Fernald using the empty Silo 4 into which was placed rectangular objects of known dimensions. These objects were scanned by the structured light sources to demonstrate functionality and verify that the system was giving

sufficiently accurate range data in three dimensions. The structured light sources were deployed in Silos 1 and 2 to scan the waste surfaces. The resulting data were merged to create three-dimensional maps of those surfaces. A bentonite clay cap was placed over the waste surfaces and surface maps were obtained. The change in surface height before and after bentonite addition was utilized as a measure of clay cap thickness.

2091 (ORNL/TM-12198) Control and analysis of a single-link flexible beam with experimental verification: Robotics Technology Development Program. Jansen, J.F. Oak Ridge National Lab., TN (United States). Dec 1992. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93003756. Source: OSTI; NTIS; GPO Dep.

The objective of this report is to ascertain the general conditions for the avoidance and reduction of residual vibration in a flexible manipulator. Conventional manipulators usually have a 1.5 to 2-m reach, and their associated dynamic models typically are composed of lumped parameter elements; the major compliance emanates from the drive trains because of torsional loading effects. The energy storage of the drive system is predominantly potential energy because of the low inertia in the drive train; thus simple spring models have been adequate. A long-reach manipulator with a large aspect ratio (length to diameter) is a fundamentally different problem. Energy storage for this type of manipulator is distributive by nature because of the potential energy resulting from bending and the kinetic energy due to deflection rates. Instead of ordinary differential equations, partial differential equations are required to describe this system, making the analysis more difficult. The general flexibility problem associated with a distributive dynamic system, with specific emphasis on flexible manipulator, will be addressed in this report. Furthermore, three control schemes will be discussed and demonstrated on a single flexible manipulator to determine their general merits.

2092 (ORNL/TM-12251) Key design requirements for long-reach manipulators. Kwon, D.S.; March-Leuba, S.; Babcock, S.M.; Hamel, W.R. Oak Ridge National Lab., TN (United States). Sep 1993. 54p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94003615. Source: OSTI; NTIS; INIS; GPO Dep.

Long-reach manipulators differ from industrial robots and teleoperators typically used in the nuclear industry in that the aspect ratio (length to diameter) of links is much greater and link flexibility, as well as joint or drive train flexibility, is likely to be significant. Long-reach manipulators will be required for a variety of applications in the Environmental Restoration and Waste Management Program. While each application will present specific functional kinematic, and performance requirements an approach for determining the kinematic applicability and performance characteristics is presented, with a focus on waste storage tank remediation. Requirements are identified, kinematic configurations are considered, and a parametric study of link design parameters and their effects on performance characteristics is presented.

2093 (ORNL/TM-12337) Whole-arm obstacle avoidance system conceptual design. Wintenberg, A.L.; Butler, P.L.; Babcock, S.M.; Ericson, M.N.; Britton, C.L. Jr. Oak Ridge National Lab., TN (United States). Apr 1993. 38p. Sponsored by USDOE, Washington, DC (United

States). DOE Contract AC05-84OR21400. Order Number DE93012093. Source: OSTI; NTIS; INIS; GPO Dep.

Whole-arm obstacle avoidance is needed for a variety of robotic applications in the Environmental Restoration and Waste Management (ER&WM) Program. Typical industrial applications of robotics involve well-defined workspaces, allowing a predetermined knowledge of collision-free paths for manipulator motion. In the unstructured or poorly defined hazardous environments of the ER&WM Program, the potential for significant problems resulting from collisions between manipulators and the environment in which they are utilized is great. The conceptual design for a sensing system that will provide protection against such collisions is described herein. The whole-arm obstacle avoidance system consists of a set of sensor "bracelets," which cover the surface area of the manipulator links to the maximum extent practical, and a host processor. The host processor accepts commands from the robot control system, controls the operation of the sensors, manipulates data received from the bracelets, and makes the data available to the manipulator control system. The bracelets consist of a subset of the sensors, associated sensor interface electronics, and a bracelet interface. Redundant communications links between the host processor and the bracelets are provided, allowing single-point failure protection. The system allows reporting of 8-bit data from up to 1000 sensors at a minimum of 50 Hz. While the initial prototype implementation of the system utilizes capacitance proximity sensor, the system concept allows multiple types of sensors. These sensors are uniquely addressable, allowing remote calibration, thresholding at the bracelet, and correlation of a sensor measurement with the associated sensor and its location on the manipulator. Variable resolution allows high-speed, single-bit sensing as well as lower-speed higher-resolution sensing, which is necessary for sensor calibration and potentially useful in control.

2094 (PNL-SA-20018) Dynamic analysis of the Schilling Titan 7F robotic arm. Baker, C.P. Pacific Northwest Lab., Richland, WA (United States). Oct 1991. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9110255-1: 1991 international DADS users conference, Iowa City, IA (United States), 7-11 Oct 1991). Order Number DE92002136. Source: OSTI; NTIS; INIS; GPO Dep.

A seven degree of freedom hydraulically actuated robotic arm is modeled using DADS. The low level control system for the arm is included in the model, as is the hydraulic system, and model results are compared with experimental results for the arm. Vane type rotary actuators are used in this arm, and a method for modeling them with DADS elements is presented. 10 figs.

2095 (SAND-89-2444) Cask system design guidance for robotic handling. Griesmeyer, J.M.; Drotning, W.D.; Morimoto, A.K.; Bennett, P.C. Sandia National Labs., Albuquerque, NM (United States). Oct 1990. 40p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE91004658. Source: NTIS; PC A03/MF A01; OSTI; INIS; GPO Dep.

Remote automated cask handling has the potential to reduce both the occupational exposure and the time required to process a nuclear waste transport cask at a handling facility. The ongoing Advanced Handling Technologies Project (AHTP) at Sandia National Laboratories is described. AHTP was initiated to explore the use of advanced robotic systems to perform cask handling operations at handling facilities for

radioactive waste, and to provide guidance to cask designers regarding the impact of robotic handling on cask design. The proof-of-concept robotic systems developed in AHTP are intended to extrapolate from currently available commercial systems to the systems that will be available by the time that a repository would be open for operation. The project investigates those cask handling operations that would be performed at a nuclear waste repository facility during cask receiving and handling. The ongoing AHTP indicates that design guidance, rather than design specification, is appropriate, since the requirements for robotic handling do not place severe restrictions on cask design but rather focus on attention to detail and design for limited dexterity. The cask system design features that facilitate robotic handling operations are discussed, and results obtained from AHTP design and operation experience are summarized. The application of these design considerations is illustrated by discussion of the robot systems and their operation on cask feature mock-ups used in the AHTP project. 11 refs., 11 figs.

2096 (SAND-91-2775C) A miniaturized sensor laboratory for in situ characterization of hazardous waste by a robot. Feddema, J.T. Sandia National Labs., Albuquerque, NM (United States). [1991]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-920367-2: Department of Defense (DOD) fiber optics conference, McLean, VA (United States), 25 Mar 1992). Order Number DE92007044. Source: OSTI; NTIS; GPO Dep.

This paper describes current research and development on a miniaturized sensing system for use during in situ characterization of nuclear waste storage tanks. Sandia is designing this sensing system as a tool for a large robotic arm that is deployed through an access port in the top of a storage tank. While the robot arm scans the sensing package over the waste, a distributed computing system acquires sensor data, correlates the data with the position of the robot, and produces maps of the chemical and radiological contents of the tanks in real time. We have built and demonstrated a first prototype system containing eight sensors. 53 refs.

2097 (SAND-91-2794C) Graphical models for simulation and control of robotic systems for waste handling. Drotning, W.D.; Bennett, P.C. Sandia National Labs., Albuquerque, NM (United States). [1991]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-920430-4: 3. international high level radioactive waste management (IHLRWM) conference, Las Vegas, NV (United States), 12-16 Apr 1992). Order Number DE92004398. Source: OSTI; NTIS; INIS; GPO Dep.

Detailed geometric models have been used within a graphical simulation environment to study transportation cask facility design and to perform design and analyses of robotic systems for handling of nuclear waste. The models form the basis for a robot control environment which provides safety, flexibility, and reliability for operations which span the spectrum from autonomous control to tasks requiring direct human intervention.

2098 (SAND-92-0374C) A VMEbus ultrasonic sensor controller for mapping and servo control in robotic systems. Drotning, W.D.; Garcia, P. Sandia National Labs., Albuquerque, NM (United States). [1992]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9209113-1: Sensors expo,

Chicago, IL (United States), 29 Sep - 1 Oct 1992). Order Number DE92013661. Source: OSTI; NTIS; GPO Dep.

An ultrasonic sensor controller has been developed and applied in a variety of robotic systems for operation in hazardous and remote environments. The controller consists of hardware and software that control multiple ultrasonic range sensors and provide workspace information to robot controllers for rapid, safe, and reliable operation. The programmable multichannel controller resides on a VMEbus for high speed communication to a multiprocessor architecture. The sensor controller has been used in a number of applications, which include providing high precision range information for proximity servo control of robots, and performing surface and obstacle mapping functions for safe path planning of robots in unstructured environments. 6 refs.

2099 (SAND-92-1256C) Intelligent automated control of robotic systems for environmental restoration. Harrigan, R.W. Sandia National Labs., Albuquerque, NM (United States). [1992]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-920606-27: American Nuclear Society annual meeting; ISRAM '92: 4th international symposium on robotics and manufacturing, Boston, MA (United States); Santa Fe, NM (United States), 7-12 Jun 1992; 11-13 Nov 1992; CONF-921181-5). Order Number DE92016336. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy's Office of Technology Development (OTD) has sponsored the development of the Generic Intelligent System Controller (GISC) for application to remote system control. Of primary interest to the OTD is the development of technologies which result in faster, safer, and cheaper cleanup of hazardous waste sites than possible using conventional approaches. The objective of the GISC development project is to support these goals by developing a modular robotics control approach which reduces the time and cost of development by allowing reuse of control system software and uses computer models to improve the safety of remote site cleanup while reducing the time and life cycle costs.

2100 (SAND-92-1570C) Application of robotic handling concepts to spent nuclear fuel storage and transport systems. Bennett, P.C. Sandia National Labs., Albuquerque, NM (United States). [1992]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-930403-7: 5. topical meeting on robotics and remote systems, Knoxville, TN (United States), 26-29 Apr 1993; TTC-1221). Order Number DE93003997. Source: OSTI; NTIS; INIS; GPO Dep.

Laboratory demonstrations sponsored by the US Department of Energy at Sandia National Laboratories have shown the feasibility of robotically performing handling operations on spent nuclear fuel casks. These demonstrations have helped form the basis for cask design for robotic handling. Animated models of the operations have evolved into the cornerstone of the robotic control system. They are used for autonomous path and motion planning and execution, and to provide computer assistance and intervention during tele-operated robotic control to enhance operator effectiveness. The animated models are fed directly into the robot control system, automatically programming the robots for validation by demonstration. These models have also assisted in the visualization of tasks within facilities, and can enhance facility performance evaluations.

2101 (SAND-92-1604C) A capacitance-based proximity sensor for whole arm obstacle avoidance. Novak, J.L.; Feddema, J.T. Sandia National Labs., Albuquerque, NM (United States). 2 Nov 1992. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-930403-14: 5. topical meeting on robotics and remote systems, Knoxville, TN (United States), 26-29 Apr 1993). Order Number DE93006773. Source: OSTI; NTIS; INIS; GPO Dep.

This paper discusses an application of capacitive sensors for detecting incipient collisions during robot motion in unknown or partially modeled environments. Forty-five sensors capable of detecting obstacles up to 330 mm (13 in.) away were distributed over the surface of a PUMA 560 robot arm. Each sensor consisted of a 4 mm thick, 37 mm diameter rings around 21 mm diameter disks. These sensors can detect both conductive and non-conductive obstacles of arbitrary color and shape. The sensor hardware is reliable and inexpensive, and it may be fabricated using flexible printed circuit boards to provide whole-arm and joint protection for any robot or manipulator. Simple collision avoidance control algorithms that perturb the joint commands from a spaceball to avoid collisions have been implemented on the PUMA 560 robot.

2102 (SAND-93-0003C) Graphical programming: On-line robot simulation for telerobotic control. McDonald, M.J.; Palmquist, R.D. Sandia National Labs., Albuquerque, NM (United States). [1993]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-930491-2: International robots and vision conference, Detroit, MI (United States), 6-8 Apr 1993). Order Number DE93009796. Source: OSTI; NTIS; INIS; GPO Dep.

Sandia has developed an advanced operational control system approach, caged Graphical Programming, to design and operate robotic waste cleanup and other hazardous duty robotic systems. The Graphical Programming approach produces robot systems that are faster to develop and use, safer in operation, and cheaper overall than alternative teleoperation or autonomous robot control systems. The Graphical Programming approach uses 3-D visualization and simulation software with intuitive operator interfaces for the programming and control of complex robotic systems. Graphical Programming Supervisor software modules allow an operator to command and simulate complex tasks in a graphic preview mode and, when acceptable, command the actual robots and monitor their motions with the graphic system. Graphical Programming Supervisors maintain registration with the real world and allow the robot to perform tasks that cannot be accurately represented with models alone by using a combination of model and sensor-based control. This paper describes the Graphical Programming approach, several example control systems that use Graphical Programming, and key features necessary for implementing successful Graphical Programming systems.

2103 (SAND-93-0207C) Selective retrieval of buried waste using mobile robot manipulator systems. Boissiere, P.T. (Sandia National Labs., Albuquerque, NM (United States)); Little, C.Q.; Wilson, C. Sandia National Labs., Albuquerque, NM (United States). [1993]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-930403-25: 5. topical meeting on robotics and remote systems, Knoxville, TN (United States), 26-29 Apr 1993). Order Number DE93008338. Source: OSTI; NTIS; INIS; GPO Dep.

Hazardous operations which involve the dextrous manipulation of dangerous materials in the field have, in the past, been completed by technicians. Use of humans in such hazardous operations is under increased scrutiny due to high costs and low productivity associated with providing protective clothing and environments. Remote systems are needed to accomplish many tasks such as the clean up of waste sites in which the exposure of personnel to radiation, chemical, explosive, and other hazardous constituents is unacceptable. Traditional remote manual field operations have, unfortunately, proven to have very low productivity when compared with unencumbered human operators. Recent advances in the integration of wars and computing into the control of remotely operated equipment have shown great promise for reducing the cost of remote systems while providing faster and safer remote systems. This paper discusses applications of such advances to remote field operations.

2104 (SAND-93-0588C) Automating the operation of robots in hazardous environments. Harrigan, R.W. Sandia National Labs., Albuquerque, NM (United States). 21 Feb 1993. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-930736-2: 1993 Institute of Electrical and Electronics Engineers/Robotics Society of Japan (IEEE/RSJ) international conference on intelligent robots and systems (IROS), Yokohama (Japan), 26-30 Jul 1993). Order Number DE93009850. Source: OSTI; NTIS; GPO Dep.

Hazardous operations which in the past have been completed by technicians are under increased scrutiny due to high costs and low productivity associated with providing protective clothing and environments. As a result, remote systems are needed to accomplish many hazardous materials handling tasks such as the clean up of waste sites in which the exposure of personnel to radiation, chemical, explosive, and other hazardous constituents is unacceptable. Traditional remote operations have proven to have very low productivity when compared with unencumbered humans. Computer models augmented by sensing and structured, modular computing environments are proving to be effective in automating many unstructured hazardous tasks.

2105 (SAND-93-0589C) Application of sensors to the control of robotic systems. Harrigan, R.W. Sandia National Labs., Albuquerque, NM (United States). [1993]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9306127-1: 50. anniversary spring conference on experimental mechanics, Dearborn, MI (United States), 9 Jun 1993). Order Number DE93009837. Source: OSTI; NTIS; INIS; GPO Dep.

Hazardous operations which in the past have been completed by technicians are under increased scrutiny due to high costs and low productivity associated with providing protective clothing and environments. As a result, remote systems are needed to accomplish many hazardous materials handling tasks such as the clean up of waste sites in which the exposure of personnel to radiation, chemical, explosive, and other hazardous constituents is unacceptable. Traditional remote manual operations have proven to have very low productivity when compared with unencumbered humans. Computer models augmented by sensing and structured, modular computing environments are proving to be effective in automating many unstructured hazardous tasks.

2106 (SAND-93-0678C) Adding intelligence to conventional industrial robots. Harrigan, R.W. Sandia National Labs., Albuquerque, NM (United States). [1993]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-930403-51: 5. topical meeting on robotics and remote systems, Knoxville, TN (United States), 26-29 Apr 1993). Order Number DE93011557. Source: OSTI; NTIS; INIS; GPO Dep.

Remote systems are needed to accomplish many tasks such as the clean up of waste sites in which the exposure of personnel to radiation, chemical, explosive, and other hazardous constituents is unacceptable. In addition, hazardous operations which in the past have been completed by technicians are under increased scrutiny due to high costs and low productivity associated with providing protective clothing and environments. Traditional remote operations have, unfortunately, proven to also have very low productivity when compare with unencumbered human operators. However, recent advances in the integration of sensors and computing into the control of conventional remotely operated industrial equipment has shown great promise for providing systems capable of solving difficult problems.

2107 (SAND-93-1361C) Generic data acquisition system for robotic waste characterization. Feddema, J.T.; Spletzer, B.L. Sandia National Labs., Albuquerque, NM (United States). [1993]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-940214-1: Space 94: international conference and exposition on engineering, construction, and operations in space, Albuquerque, NM (United States), 26 Feb - 3 mar 1994). Order Number DE93017497. Source: OSTI; NTIS; INIS; GPO Dep.

This paper describes a generic data acquisition system for robotic characterization of DOE production facilities and waste sites. While the specific suite of characterization sensors on the end of a robotic arm or vehicle will depend on site needs, many of the data acquisition, display, archival and interpretation requirements of the sites are common. Therefore, the objective is to create a generic, reusable computing and data acquisition system which can accept a multitude of sensors. This paper discusses the progress to date and future plans for the system.

2108 (SAND-93-1468C) Automating the control of robotic systems in unstructured environments. Harrigan, R.W. Sandia National Labs., Albuquerque, NM (United States). [1993]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9308171-1: 8. Institute of Electrical and Electronics Engineers (IEEE) international symposium on intelligent control, Chicago, IL (United States), 25-27 Aug 1993). Order Number DE93040753. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department Energy's Office of Technology Development has sponsored the development of generic robotics technologies for application to a wide range of remote systems. Of primary interest is the development of technologies which enable faster, safer, and cheaper cleanup of hazardous waste sites than is possible using conventional human contact or remote manual approaches. The development of model-based sensor-directed robot control approaches supports these goals by developing modular control technologies which reduce the time and cost of development by allowing reuse of control system software. In addition, the use of computer models improves the safety of remote site cleanup by allowing automated errors detection

and recovery while reducing the time for technology development.

2109 (SAND-93-1568C) Automating construction through the use of robotics and Graphical Programming. McDonald, M.J.; Palmquist, R.D. Sandia National Labs., Albuquerque, NM (United States). [1993]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-931093-1: Conference on fossil plant construction, Palm Beach, FL (United States), 26-28 Oct 1993). Order Number DE93019084. Source: OSTI; NTIS; GPO Dep.

Sandia has developed an advanced operational control system approach, called Graphical Programming, to design and operate robot systems in unstructured environments. This Graphical Programming approach produces robot systems that are faster to develop and use, safer in operation, and cheaper overall than alternative teleoperation or autonomous robot control systems. This approach uses 3-D visualization and simulation software with intuitive operator interfaces for the programming and control of complex robotic systems. Supervisor software modules allow an operator to command and simulate complex tasks in a graphic preview mode and, when acceptable, command the actual robots and monitor their motions with the graphic system. Graphical Programming Supervisors maintain registration with the real world and allow the robot to perform tasks that cannot be accurately represented with models alone by using a combination of model and sensor-based control. All of these capabilities when combined result in a flexible system which is readily able to meet the demands called for in construction automation. This paper describes the Graphical Programming approach, several example control systems that use Graphical Programming, key features necessary for implementing successful Graphical Programming systems, and specific examples of applying these systems to robotic operations.

2110 (SAND-93-2380C) Whole arm obstacle avoidance for teleoperated robots. Feddema, J.T.; Novak, J.L. Sandia National Labs., Albuquerque, NM (United States). [1993]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-940550-5: Institute of Electrical and Electronics Engineers (IEEE) international conference on robotics, San Diego, CA (United States), 8-13 May 1994). Order Number DE94001419. Source: OSTI; NTIS; GPO Dep.

This paper describes a collision avoidance system using Whole Arm Proximity (WHAP) sensors on a PUMA 560 robot arm. The capacitance-based sensors generate electric fields which can completely encompass the robot arm and detect obstacles as they approach from any direction. The directional obstacle information gathered by the WHAP sensors together with the sensor geometry and robot configuration is used to scale the commanded joint velocities of the robot. A linearized relationship between the WHAP sensor reading and the distance from the obstacle allows direct transformation of perturbations in WHAP readings to perturbations in joint velocities. The WHAP reading is used to directly reduce the component of the command input velocity along the normal axis of the sensor, allowing graceful reductions in speed as the arm approaches the obstacle. By scaling only the component of the velocity vector in the direction of the nearest obstacles, the control system restricts motion in the direction of obstacles while permitting unconstrained motion in other directions.

2111 (SAND-93-2742C) Graphical programming at Sandia National Laboratories. McDonald, M.J. (Sandia National Labs., Albuquerque, NM (United States)); Palmquist, R.D.; Desjarlais, L. Sandia National Labs., Albuquerque, NM (United States). Sep 1993. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-9310216-4: 7. Deneb robotics user group meeting, Troy, MI (United States), 12-15 Oct 1993). Order Number DE94003803. Source: OSTI; NTIS; INIS; GPO Dep.

Sandia has developed an advanced operational control system approach, called Graphical Programming, to design, program, and operate robotic systems. The Graphical Programming approach produces robot systems that are faster to develop and use, safer in operation, and cheaper overall than alternative teleoperation or autonomous robot control systems. Graphical Programming also provides an efficient and easy-to-use interface to traditional robot systems for use in setup and programming tasks. This paper provides an overview of the Graphical Programming approach and lists key features of Graphical Programming systems. Graphical Programming uses 3-D visualization and simulation software with intuitive operator interfaces for the programming and control of complex robotic systems. Graphical Programming Supervisor software modules allow an operator to command and simulate complex tasks in a graphic preview mode and, when acceptable, command the actual robots and monitor their motions with the graphic system. Graphical Programming Supervisors maintain registration with the real world and allow the robot to perform tasks that cannot be accurately represented with models alone by using a combination of model and sensor-based control.

2112 (SAND-94-1111C) Visual Servoing: A technology in search of an application. Feddema, J.T. Sandia National Labs., Albuquerque, NM (United States). [1994]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-940550-12: Institute of Electrical and Electronics Engineers (IEEE) international conference on robotics, San Diego, CA (United States), 8-13 May 1994). Order Number DE94010803. Source: OSTI; NTIS; GPO Dep.

Considerable research has been performed on Robotic Visual Servoing (RVS) over the past decade. Using real-time visual feedback, researchers have demonstrated that robotic systems can pick up moving parts, insert bolts, apply sealant, and guide vehicles. With the rapid improvements being made in computing and image processing hardware, one would expect that every robot manufacturer would have a RVS option by the end of the 1990s. So why aren't the Fanucs, ABBs, Adepts, and Motomans of the world investing heavily in RVS? I would suggest four reasons: cost, complexity, reliability, and lack of demand. Solutions to the first three are approaching the point where RVS could be commercially available; however, the lack of demand is keeping RVS from becoming a reality in the near future. A new set of applications is needed to focus near term RVS development. These must be applications which currently do not have solutions. Once developed and working in one application area, the technology is more likely to quickly spread to other areas. DOE has several applications that are looking for technological solutions, such as agile weapons production, weapons disassembly, decontamination and dismantlement of nuclear facilities, and hazardous waste remediation. This paper will examine a few of these areas and suggest directions for application-driven visual servoing research.

2113 (UCRL-JC-111199) Applying interactive control to waste processing operations. Gras, E.L.; Merrill, R.D.; Couture, S.A. Lawrence Livermore National Lab., CA (United States). Aug 1992. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-921181-2: ISRAM '92: 4th international symposium on robotics and manufacturing, Santa Fe, NM (United States), 11-13 Nov 1992). Order Number DE92040404. Source: OSTI; NTIS; INIS; GPO Dep.

At present waste and residue processing includes steps that require human interaction. The risk of exposure to unknown hazardous materials and the potential for radiation contamination motivates the desire to remove operators from these processes. Technologies that facilitate this include glove box robotics, modular systems for remote and automated servicing, and interactive controls that minimize human intervention. LLNL is developing an automated system which is designed to supplant the operator for glove box tasks, thus protecting the operator from the risk of radiation exposure and minimizing operator-associated waste. Although most of the processing can be automated with minimal human interaction, there are some tasks where intelligent intervention is both desirable and necessary to adapt to unexpected circumstances and events. These activities require that the operator interact with the process using a remote manipulator which provides or reflects a natural feel to the operator. The remote manipulation system which was developed incorporates sensor fusion and interactive control, and provides the operator with an effective means of controlling the robot in a potentially unknown environment. This paper describes recent accomplishments in technology development and integration, and outlines the future goals of Lawrence Livermore National Laboratory for achieving this integrated interactive control capability.

2114 (UCRL-JC-112985) The development of control technologies applied to waste processing operations. Gras, E.; Baker, S.; Couture, S.; Dennison, D.; Holliday, M.; Hurd, R.; Kettering, B.; Merrill, R.; Wilhelmson, K. Lawrence Livermore National Lab., CA (United States). Feb 1993. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-930403-30: 5. topical meeting on robotics and remote systems, Knoxville, TN (United States), 26-29 Apr 1993). Order Number DE93009066. Source: OSTI; NTIS; INIS; GPO Dep.

Typical waste and residue processes involve some level of human interaction. The risk of exposure to unknown hazardous materials and the potential for radiation contamination provide the impetus for physically separating or removing operators from such processing steps. Technologies that facilitate separation of the operator from potential contamination include glove box robotics; modular systems for remote and automated servicing; and interactive controls that minimize human intervention. Lawrence Livermore National Laboratory (LLNL) is developing an automated system which by design will supplant the operator for glove box tasks, thus affording protection from the risk of radiation exposure and minimizing operator associated waste. This paper describes recent accomplishments in technology development and integration, and outlines the future goals at LLNL for achieving this integrated, interactive control capability.

2115 (WHC-SA-0934) Remote handling equipment for removal of waste from single-shell tanks at the Hanford Site. Jenkins, W.W. Westinghouse Hanford Co., Richland, WA (United States). Sep 1990. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract

AC06-87RL10930. (CONF-901101-39: American Nuclear Society (ANS) winter meeting, Washington, DC (United States), 11-16 Nov 1990). Order Number DE91001282. Source: NTIS; PC A02/MF A01; OSTI; INIS; GPO Dep.

Mechanical retrieval equipment concepts are being developed for remote 'mining' of the radioactive waste in underground storage tanks at the Hanford Site in Washington State. This paper presents a description of the tanks, the waste, the key design considerations, and some of the more promising concepts for mechanical waste retrieval. 6 refs., 4 figs.

2116 (WHC-SA-1042) Robot control system for tank waste retrieval. Hill, L.F. (Westinghouse Hanford Co., Richland, WA (USA)); Bennett, D.W.; Harrigan, R.W. Westinghouse Hanford Co., Richland, WA (United States). Nov 1990. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-910252-1: 1991 American Nuclear Society (ANS) meeting, Albuquerque, NM (United States), 24-28 Feb 1991). Order Number DE91004575. Source: OSTI; NTIS; INIS; GPO Dep.

This paper overviews the potential application of robotics for retrieval of radioactive wastes from storage tanks. In a relatively unstructured work environment, intelligent robotics control is needed that allows considerable operator freedom yet adjusts details of the operation to accomplish the real objective. This requires the control system to have cognizance of the world environment as well as the special needs of each end-effector.

2117 (WHC-SA-1269) Robotics technology demonstration program for underground storage tank remediation. Jaquish, W.R.; Shen, E.J.; Yount, J.A. Westinghouse Hanford Co., Richland, WA (United States). Sep 1991. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-911107-59: 1991 winter meeting of the American Nuclear Society (ANS), San Francisco, CA (United States), 10-15 Nov 1991). Order Number DE92008360. Source: OSTI; NTIS; INIS; GPO Dep.

To address the technological problems associated with waste retrieval from underground storage tanks, the US Department of Energy Office of Technology Development has created the Robotics Technology Demonstration Program for Underground Storage Tanks. The mission of this program is to develop existing and emerging technologies for possible use in storage tank remediation activities. In 1991, this program has created the Robotics Technology Test Bed at the Hanford Site, Washington. A waste storage tank mockup and multiple robotic manipulators, sensors, and surveillance systems have been installed in this test bed. The test and evaluation activities being performed in the test bed will lead to the development of faster and safer methods for waste retrieval, inspection, and surveillance. 3 refs.

2118 (WHC-SA-1735) Tolerancing requirements for remote handling at the Hanford Waste Vitrification Plant. Van Katwijk, C. (Westinghouse Hanford Co., Richland, WA (United States)); Keenan, R.M.; Bullis, R.E. Westinghouse Hanford Co., Richland, WA (United States). [1993]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930408-67: 10. international high-level radioactive waste management conference, Las Vegas, NV (United States), 25-29 Apr 1993). Order Number DE93011277. Source: OSTI; NTIS; INIS; GPO Dep.

The Hanford Waste Vitrification Plant (HWVP) is being designed by Fluor Daniel, Inc. with Waste Chem Corporation as Fluor Daniel, Inc.'s major subcontractor specializing in vitrification and remote system technologies. United Engineers and Constructors (UE&C)/Catalytic (UCAT) will construct the plant. Westinghouse Hanford Company is the Project Integration manager and Business manager, and as the plant operator it provides technical direction to the Architect/Engineer team (A/E) and constructor on behalf of the US Department of Energy - Richland Field Office. The A/E has developed, in cooperation with UE&C, Westinghouse Hanford Company, and the US Department of Energy, a new and innovative approach to installations of the many remote nozzles and electrical connectors that must be installed to demanding tolerances. This paper summarizes the key elements of the HWVP approach.

2119 (WHC-SA-1977) An approach to software quality assurance for robotic inspection systems. Kiebel, G.R. Westinghouse Hanford Co., Richland, WA (United States). Oct 1993. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-931160-38: American Nuclear Society (ANS) winter meeting, San Francisco, CA (United States), 14-18 Nov 1993). Order Number DE94005419. Source: OSTI; NTIS; INIS; GPO Dep.

Software quality assurance (SQA) for robotic systems used in nuclear waste applications is vital to ensure that the systems operate safely and reliably and pose a minimum risk to humans and the environment. This paper describes the SQA approach for the control and data acquisition system for a robotic system being developed for remote surveillance and inspection of underground storage tanks (UST) at the Hanford Site.

2120 (WINCO-1155) Idaho National Engineering Laboratory decontamination and decommissioning robotics development program. McKay, M.D. Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (United States). Apr 1993. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-84ID12435. Order Number DE94008914. Source: OSTI; NTIS; INIS; GPO Dep.

As part of the Idaho National Engineering Laboratory (INEL) Robotics Technology Development Program (RTDP) Decontamination & Decommissioning (D&D) robotics program, a task was designed to integrate the plasma arc cutting technology being developed under the Waste Facility Operations (WFO) robotics program into D&D cutting applications. The plasma arc cutting technology is based upon the use of a high energy plasma torch to cut metallic objects. Traditionally, D&D workers removing equipment and processes from a facility have used plasma arc cutting to accomplish this task. The worker is required to don a protective suit to shield from the high electromagnetic energy released from the cutting operation. Additionally, the worker is required to don protective clothing to shield against the radioactive materials and contamination. This protective clothing can become restrictive and cumbersome to work in. Because some of the work areas contain high levels of radiation, the worker is not allowed to dwell in the environment for sustained periods of time. To help alleviate some of the burdens required to accomplish this task, reduce or eliminate the safety hazardous to the worker, and reduce the overall cost of remediation, a program was established through the Office of Technology Development (OTD) to design and develop a robotic system capable of performing cutting operations using a plasma arc torch. Several D&D

tasks were identified having potential for use of the plasma arc cutting technology. The tasks listed below were chosen to represent common D&D type activities where the plasma arc cutting technology can be applied.

2121 (WSRC-MS-92-155) Overview of the DOE Waste Facilities Operations Robotics Technology Development Program. Ward, C.R. Westinghouse Savannah River Co., Aiken, SC (United States). [1992]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-920851-28: Spectrum '92: nuclear and hazardous waste management international topical meeting, Boise, ID (United States), 23-27 Aug 1992). Order Number DE92015336. Source: OSTI; NTIS; GPO Dep.

The Department of Energy's Office of Technology Development has initiated a Robotics Technology Development Program that includes technology aimed at DOE Waste Facilities Operations (WFO). Much of this technology may also be applicable to waste facilities outside of DOE and will be available for use. This is a team effort of several DOE Laboratories and Sites. The WFO team includes the Savannah River Technology Center, Sandia National Laboratories, Oak Ridge National Laboratory, Idaho National Engineering Laboratory, Lawrence Livermore National Laboratory, the Fernald Environmental Management Project and the Waste Isolation Pilot Plant. DOE has waste facilities currently in operation at many sites and many more of these facilities are planned as part of the DOE site cleanup effort. As the cleanup continues, existing facilities and new facilities will be taxed with an increasing volume of waste, more varied waste streams, more complex processing requirements, more challenging waste characteristics, more stringent waste form criteria, and stricter regulations. The WFO Robotics Technology Development Program will address these challenges by developing robotic systems technology that will be safer, better, faster, and cheaper than existing technology. The goals of this technology development are to remove humans from both radiologically and physically dangerous environments in waste facilities, improve the quality and quality assurance of operations, increase the throughput of operations, increase the flexibility of facilities, reduce the manpower requirements for operations and meet federal, state and local regulations. There are four areas within the WFO program; the Mixed Waste Treatment Project, Stored Waste, the Waste Isolation Pilot Plant and Remote Size Reduction.

CHARACTERIZATION

Refer also to citation(s) 145, 150, 282, 357, 359, 361, 362, 416, 429, 431, 447, 448, 449, 453, 456, 467, 492, 493, 544, 937, 1448, 1449, 1764, 1932, 1940, 2589, 2590

2122 (ANL/CMT/CP-77587) Field demonstration of technologies for characterization of uranium contamination in surface soils. Cunnane, J.C. (Argonne National Lab., IL (United States)); Lee, S.Y.; Perry, D.L.; Tidwell, V.C.; Schwing, J.; Nuhfer, K.R. Argonne National Lab., IL (United States). [1993]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930205-22: Waste management '93, Tucson, AZ (United States), 28 Feb - 4 mar 1993). Order Number DE93008654. Source: OSTI; NTIS; INIS; GPO Dep.

One means of improving the efficiency of studies associated with CERCLA and RCRA investigations of sites

contaminated with uranium is to introduce new field screening technologies capable of quickly delineating the contamination distribution in surface soils. To this end, the performance of four technologies suitable for field measurement of uranium concentrations in soils was evaluated at the Fernald Environmental Management Project. The four technologies tested were high-resolution gamma spectroscopy, wide-area beta scintillation counting, laser ablation-inductively coupled plasma-atomic emission spectroscopy (LA-ICP-AES), and long-range alpha detection (LRAD). The performance of each technique was assessed by comparing of the results obtained in the field and by comparing the field measurements to data obtained from laboratory analysis of soil samples.

2123 (ANL/CMT/CP-77656) Analytical Electron Microscopy examination of uranium contamination at the DOE Fernald operation site. Buck, E.C.; Dietz, N.L.; Bates, J.K.; Cunnane, J.C. Argonne National Lab., IL (United States). Feb 1993. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930205-21: Waste management '93, Tucson, AZ (United States), 28 Feb - 4 mar 1993). Order Number DE93008653. Source: OSTI; NTIS; INIS; GPO Dep.

Analytical Electron Microscopy (AEM) has been used to identify uranium-bearing phases present in contaminated soils from the DOE Fernald operation site. A combination of optical microscopy, scanning electron microscopy with backscattered electron detection (SEM/BSE), and AEM was used in isolating and characterizing uranium-rich regions of the contaminated soils. Soil samples were prepared for transmission electron microscopy (TEM) by ultramicrotomy using an embedding resin previously employed for aquatic colloids and biological samples. This preparation method allowed direct comparison between SEM and TEM images. At the macroscopic level much of the uranium appears to be associated with clays in the soils; however, electron beam analysis revealed that the uranium is present as discrete phases, including iron oxides, silicates (soddyite), phosphates (autunites), and fluorite. Only low levels of uranium were actually within the clay minerals. The distribution of uranium phases was inhomogeneous at the submicron level.

2124 (ANL/CMT/CP-78043) Unvented thermal process for treatment of hazardous and mixed wastes. Nelson, P.A.; Swift, W.M. Argonne National Lab., IL (United States). [1993]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930572-12: 12. annual international symposium on thermal treatment technologies - incineration conference, Knoxville, TN (United States), 3-7 May 1993). Order Number DE93040824. Source: OSTI; NTIS; INIS; GPO Dep.

An Unvented Thermal Process is being developed that does not release gases during the thermal treatment operation. The main unit in the process is a fluidized-bed processor containing a bed of calcined limestone (CaO), which reacts with gases given off during oxidation of organic materials. Gases that will react with CaO include CO₂, SO₂, HCl, HBr, and other acid gases. Water vapor formed during the oxidation process is carried off with the fluidizing gas and is removed in a condenser. Oxygen is added to the remaining gas (mainly nitrogen), which is recirculated to the oxidizer. The most flexible arrangement of equipment involves separating the processor into two units: An oxidizer, which may be any of a variety of types including standard incinerators, and a carbon dioxide sorber.

2125 (ANL/CMT/CP-78935) Soil washing as a potential remediation technology for contaminated DOE sites. Devgun, J.S. (Argonne National Lab., IL (United States)); Beskid, N.J.; Natsis, M.E.; Walker, J.S. Argonne National Lab., IL (United States). [1993]. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930205-25: Waste management '93, Tucson, AZ (United States), 28 Feb - 4 mar 1993). Order Number DE93009205. Source: OSTI; NTIS; INIS; GPO Dep.

Frequently detected contaminants at US Department of Energy (DOE) sites include radionuclides, heavy metals, and chlorinated hydrocarbons. Remediation of these sites requires application of several technologies used in concert with each other, because no single technology is universally applicable. Special situations, such as mixed waste, generally require innovative technology development. This paper, however, focuses on contaminated soils, for which soil washing and vitrification technologies appear to have wide ranging application potential. Because the volumes of contaminated soils around the DOE complex are so large, soil washing can offer a potentially inexpensive way to effect remediation or to attain waste volume reduction. As costs for disposal of low-level and mixed wastes continue to rise, it is likely that volume-reduction techniques and in-situ containment techniques will become increasingly important. This paper reviews the status of the soil washing technology, examines the systems that are currently available, and discusses the potential application of this technology to some DOE sites, with a focus on radionuclide contamination and, primarily, uranium-contaminated soils

2126 (ANL/CMT/CP-79780) Distribution of uranium-bearing phases in soils from Fernald. Buck, E.C.; Brown, N.R.; Dietz, N.L. Argonne National Lab., IL (United States). [1993]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-931108-15: Fall meeting of the Materials Research Society (MRS), Boston, MA (United States), 29 Nov - 3 dec 1993). Order Number DE94004576. Source: OSTI; NTIS; INIS; GPO Dep.

Electron beam techniques have been used to characterize uranium-contaminated soils and the Fernald Site, Ohio. Uranium particulates have been deposited on the soil through chemical spills and from the operation of an incinerator plant on the site. The major uranium phases have been identified by electron microscopy as uraninite, autunite, and uranium phosphite $[U(PO_3)_4]$. Some of the uranium has undergone weathering resulting in the redistribution of uranium within the soil.

2127 (ANL/CMT/PP-79479) Uranium-contaminated soils: Ultramicrotomy and electron beam analysis. Buck, E.C.; Dietz, N.L.; Bates, J.K.; Cunnane, J.C. Argonne National Lab., IL (United States). [1994]. 31p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE94009804. Source: OSTI; NTIS; INIS; GPO Dep.

Uranium contaminated soils from the Fernald Operation Site, Ohio, have been examined by a combination of optical microscopy, scanning electron microscopy with backscattered electron detection (SEM/BSE), and analytical electron microscopy (AEM). A method is described for preparing of transmission electron microscopy (TEM) thin sections by ultramicrotomy. By using these thin sections, SEM and TEM images can be compared directly. Uranium was found in iron oxides, silicates (soddyite), phosphates (autunites), and

fluorite. Little uranium was associated with clays. The distribution of uranium phases was found to be inhomogeneous at the microscopic level.

2128 (ANL/CP-70819) Overview of DOE's field screening technology development activities. Frank, C.W. (USDOE Office of Environmental Restoration and Waste Management, Washington, DC (USA). Office of Technology Development); Anderson, T.D.; Cooley, C.R.; Hain, K.E.; Lien, S.C.T.; Snipes, R.L.; Erickson, M.D. Argonne National Lab., IL (United States). [1991]. 16p. Sponsored by USDOE, Washington, DC (USA). DOE Contract W-31109-ENG-38. (CONF-910278-7: 2. international symposium on field screening methods for hazardous wastes and toxic chemicals, Las Vegas, NV (United States), 12-14 Feb 1991). Order Number DE91010628. Source: OSTI; NTIS; INIS; GPO Dep.

The Department of Energy (DOE) has recently created the Office of Environmental Restoration and Waste Management, into which it consolidated those activities. Within this new organization, the Office of Technology Development (OTD) is responsible for research, development, demonstration, testing, and evaluation (RDDT&E) activities aimed at meeting DOE cleanup goals, while minimizing cost and risk. Site characterization using traditional drilling, sampling, and analytical methods comprises a significant part of the environmental restoration efforts in terms of both cost and time to accomplish. It can also be invasive and create additional pathways for spread of contaminants. Consequently, DOE is focusing on site characterization as one of the areas in which significant technological advances are possible which will decrease cost, reduce risk, and shorten schedules for achieving restoration goals. DOE is investing considerably in R&D and demonstration activities which will improve the abilities to screen chemical, radiological, and physical parameters in the field. This paper presents an overview of the program objectives and status and reviews some of the projects which are currently underway in the area. 1 ref.

2129 (ANL/CP-71331) Research and development for DOE environmental restoration and waste management. Erickson, M.D. (Argonne National Lab., IL (USA)); Borys, S.S.; Bugielski, D.; Lien, S.C.T.; Hain, K.E. Argonne National Lab., IL (United States). [1991]. 14p. Sponsored by USDOE, Washington, DC (USA). DOE Contract W-31109-ENG-38. (CONF-910287-5: National research and development conference on the control of hazardous materials, Anaheim, CA (United States), 20-22 Feb 1991). Order Number DE91010283. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy (DOE) recently consolidated its environmental restoration and waste management activities. Within that new organization, DOE has committed to support Research, Development, Demonstration, Testing and Evaluation (RDDT&E) activities with the following objectives: rapidly advance beyond currently available technologies; provide solutions to key technical issues that will improve effectiveness, efficiency, and safety; and enhance DOE's ability to meet its 30-year compliance and cleanup goals. DOE has already supported a number of R&D activities in this area and plans to continue that support in the future. DOE's Office of Technology Development is interested in eliciting broad participation from qualified organizations who can contribute to RDDT&E activities. This presentation addresses the on-going and future R&D, with an emphasis on the private sector activities. To focus private sector capabilities on the high-priority needs of DOE, a series of competitive solicitations was started in FY 1990. On

May 1, 1990, on behalf of DOE's Office of Technology Development, Argonne National Laboratory issued a Request for Proposals that solicited proposals for research and development in the areas of (1) groundwater remediation, (2) soil remediation, (3) characterization of contamination and geological and hydrological features, and (4) containment of contaminated sites. In response to this solicitation, Argonne National Laboratory received 147 proposals. Fifteen of the proposals totaling \$5.7 million were funded in FY 1990. The scope of work and evaluation criteria used in the procurement and the workscope of the resultant contracts are reviewed in this paper. The FY 1991 plans for competitive private sector research and development activities will also be presented at the conference. Funding levels, technical workscope, evaluation criteria, and schedule for the FY 1991 Request for Proposals will be detailed. 2 tabs.

2130 (ANL/CP-72972) Assessing exposures and risks in heterogeneously contaminated areas: A simulation approach. Fingleton, D.J. (Argonne National Lab., IL (United States)); MacDonell, M.M.; Haroun, L.A.; Oezkaynak, H.; Butler, D.A.; Jianping Xue. Argonne National Lab., IL (United States). [1991]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-910981-45: Environmental remediation '91 conference, Pasco, WA (United States), 8-11 Sep 1991). Order Number DE92003373. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy (DOE) is responsible for cleanup activities at a number of facilities under its Environmental Restoration and Waste Management Program. The major goals of this program are to eliminate potential hazards to human health and the environment that are associated with contamination of these sites and, to the extent possible, make surplus real property available for other uses. The assessment of potential baseline health risks and ecological impacts associated with a contaminated site is an important component of the remedial investigation/feasibility study (RI/FS) process required at all Superfund sites. The purpose of this paper is to describe one phase of the baseline assessment, i.e., the characterization of human health risks associated with exposure to chemical contaminants in air and on interior building surfaces at a contaminated site. The model combines data on human activity patterns in a particular microenvironment within a building with contaminant concentrations in that microenvironment to calculate personal exposure profiles and risks within the building. The results of the building assessment are presented as probability distributions functions and cumulative distribution functions, which show the variability and uncertainty in the risk estimates. 23 refs., 2 figs., 1 tab.

2131 (ANL/CP-72987) PCB toxic equivalent factors: Significance for the utilities. Erickson, M.D. Argonne National Lab., IL (United States). [1991]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9110209-2: 1991 Electric Power Research Institute (EPRI) PCB seminar, Baltimore, MD (United States), 8-11 Oct 1991). Order Number DE91018563. Source: OSTI; NTIS; GPO Dep.

The concept of Toxic of Equivalent Factors (TEFs) has been used in dioxin/furan studies to reduce large tables of concentration for the individual congeners into a single number, the TCDD equivalent. This has been used by scientists and regulators for a variety of purposes. Recent toxicological research has shown that some but not all PCB congeners act upon biochemical system like TCDD because

they can assume a planar conformation in which these congeners, "look like" TCDD to the dioxin receptor. For these PCB, the observed toxic and biochemical responses are postulated to occur by the same mechanisms as TCDD. Sufficient in vitro and in vivo have been accumulated to assign toxic potencies to some PCB congeners relative to TCDD. From these data it is reasonably straightforward to calculate TEF values for PCBs. Application of TEFs to PCB problems has far-reaching implications for the electrical utility community with respect to cleanup goals, regulations, and liability. The development, application, and status of TEFs for PCBs are presented. 9 refs., 1 fig., 1 tab.

2132 (ANL/CP-73007) Standard method for toxic PCB congener analysis. Erickson, M.D. Argonne National Lab., IL (United States). [1991]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9110209-1: 1991 Electric Power Research Institute (EPRI) PCB seminar, Baltimore, MD (United States), 8-11 Oct 1991). Order Number DE91018562. Source: OSTI; NTIS; GPO Dep.

The use of Toxic Equivalent Factors (TEFs) for dioxins and furans has recently expanded to include the co-planar PCBs which have similar toxicological properties. In the ad hoc application of PCB TEFs, researchers have utilized PCB concentration data obtained by a number of different methods. As the use of PCB TEFs expands into more formal applications, methods for these relatively minor components of Aroclors need to be standardized to ensure accuracy and comparability. A standard list of analytes needs to be agreed upon, and reliable standards need to be developed and made available. A standard method would specify the appropriate cleanup, determination, and data reduction techniques. Specific recommendations for such a method will be made, and the potential problems with implementation will be discussed. 11 refs., 1 tab.

2133 (ANL/EA/CP-79850) Aquifer characterization and groundwater modeling in support of remedial actions at the Weldon Spring Site. Durham, L.A. (Argonne National Lab., IL (United States)); Carman, J.D. Argonne National Lab., IL (United States). [1993]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE94001278. Source: OSTI; NTIS; INIS; GPO Dep.

Aquifer characterization studies were performed to develop a hydrogeologic understanding of an unconfined shallow aquifer at the Weldon Spring site west of St. Louis, Missouri. The 88-ha site became contaminated because of uranium and thorium processing and disposal activities that took place from the 1940s through the 1960s. Slug and pumping tests provided valuable information on the lateral distribution of hydraulic conductivities, and packer tests and lithologic information were used to determine zones of contrasting hydrologic properties within the aquifer. A three-dimensional, finite-element groundwater flow model was developed and used to simulate the shallow groundwater flow system at the site. The results of this study show that groundwater flow through the system is predominantly controlled by a zone of fracturing and weathering in the upper portion of the limestone aquifer. The groundwater flow model, developed and calibrated from field investigations, improved the understanding of the hydrogeology and supported decisions regarding remedial actions at the site. The results of this study illustrate the value, in support of remedial actions, of combining field investigations with numerical

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modeling to develop an improved understanding of the hydrogeology at the site.

2134 (ANL/EA/CP-79884) Significance of radon exposures in developing cleanup criteria for radium-contaminated soil at the Weldon Spring Site. Blunt, D.L. (Argonne National Lab., IL (United States)); Peterson, J.M.; Hillman, D.J. Argonne National Lab., IL (United States). Oct 1993. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-931095-64: Department of Energy environmental remediation conference, Augusta, GA (United States), 24-28 Oct 1993). Order Number DE94003213. Source: OSTI; NTIS; INIS; GPO Dep.

The Weldon Spring site, located in St. Charles County, Missouri, is included on the National Priorities List (NPL) of the US Environmental Protection Agency (EPA), and the US Department of Energy (DOE) is currently conducting cleanup activities at the site. This paper discusses the significance of radon exposures that may result from radium-contaminated soil and the approach currently being taken at the Weldon Spring site to address this issue.

2135 (ANL/EA/CP-79945) The evolution of risk communication at the Weldon Spring site. McCracken, S. (USDOE Weldon Spring Site, St. Charles, MO (United States)); Sizemore, M.; Meyer, L.; MacDonell, M.; Haroun, L. Argonne National Lab., IL (United States). [1993]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-931095-63: Department of Energy environmental remediation conference, Augusta, GA (United States), 24-28 Oct 1993). Order Number DE94003214. Source: OSTI; NTIS; INIS; GPO Dep.

Clear risk communication is one of the keys to establishing a positive relationship with the public at an environmental restoration site. This effort has been evolving at the Weldon Spring site over the past few years, with considerable input from the local community. The recent signing of the major cleanup decision for this site, which identifies on-site disposal as the remedy reflects the strength of the communication program that has evolved for the project.

2136 (ANL/EA/CP-81474) RESRAD: A computer code for evaluating radioactively contaminated sites. Yu, C. (and others); Zielen, A.J.; Cheng, J.J. Argonne National Lab., IL (United States). [1993]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9311157-1: Risk assessment model review workshop, Washington, DC (United States), 30 Nov - 1 Dec 1993). Order Number DE94005121. Source: OSTI; NTIS; INIS; GPO Dep.

This document briefly describes the uses of the RESRAD computer code in calculating site-specific residual radioactive material guidelines and radiation dose-risk to an on-site individual (worker or resident) at a radioactively contaminated site. The adoption by the DOE in order 5400.5, pathway analysis methods, computer requirements, data display, the inclusion of chemical contaminants, benchmarking efforts, and supplemental information sources are all described. (GHH)

2137 (ANL/EAD/TM-2) Adaptive sampling strategy support for the unlined chromic acid pit, chemical waste landfill, Sandia National Laboratories, Albuquerque, New Mexico. Johnson, R.L. Argonne National Lab., IL (United States). Nov 1993. 24p. Sponsored by

USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE94004538. Source: OSTI; NTIS; GPO Dep.

Adaptive sampling programs offer substantial savings in time and money when assessing hazardous waste sites. Key to some of these savings is the ability to adapt a sampling program to the real-time data generated by an adaptive sampling program. This paper presents a two-prong approach to supporting adaptive sampling programs: a specialized object-oriented database/geographical information system (SitePlanner™) for data fusion, management, and display and combined Bayesian/geostatistical methods (PLUME) for contamination-extent estimation and sample location selection. This approach is applied in a retrospective study of a subsurface chromium plume at Sandia National Laboratories' chemical waste landfill. Retrospective analyses suggest the potential for characterization cost savings on the order of 60% through a reduction in the number of sampling programs, total number of soil boreholes, and number of samples analyzed from each borehole.

2138 (ANL/EAS-3) RESRAD parameter sensitivity analysis. Cheng, J.J.; Yu, C.; Zielen, A.J. Argonne National Lab., IL (United States). Environmental Assessment and Information Sciences Div. Aug 1991. 46p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE92003356. Source: OSTI; NTIS; INIS; GPO Dep.

Three methods were used to perform a sensitivity analysis of RESRAD code input parameters - enhancement of RESRAD by the Gradient Enhanced Software System (GRESS) package, direct parameter perturbation, and graphic comparison. Evaluation of these methods indicated that (1) the enhancement of RESRAD by GRESS has limitations and should be used cautiously, (2) direct parameter perturbation is tedious to implement, and (3) the graphics capability of RESRAD 4.0 is the most direct and convenient method for performing sensitivity analyses. This report describes procedures for implementing these methods and presents a comparison of results. 3 refs., 9 figs., 8 tabs.

2139 (ANL/EAS/CP-77680) Efficient analysis using custom interactive visualization tools at a Superfund site. Williams, G. (Northwestern Univ., Evanston, IL (United States)); Durham, L. Argonne National Lab., IL (United States). [1992]. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-921235-1: Hazardous Materials Control/Superfund '92: 13th annual conference and exhibition, Washington, DC (United States), 1-3 Dec 1992). Order Number DE93004202. Source: OSTI; NTIS; INIS; GPO Dep.

Custom visualization analysis programs were developed and used to analyze contaminant transport calculations from a three-dimensional numerical groundwater flow model developed for a Department of Energy Superfund site. The site hydrogeology, which is highly heterogeneous, includes both fractured limestone and dolomite and alluvium deposits. Three-dimensional interactive visualization techniques were used to understand and analyze the three-dimensional, double-porosity modeling results. A graphical object oriented programming environment was applied to efficiently develop custom visualization programs in a coarse-grained data structure language. Comparisons were made, using the results from the three-dimensional, finite-difference model, between traditional two-dimensional analyses (contour and vector plots) and interactive three-dimensional techniques.

Subjective comparison areas include the accuracy of analysis, the ability to understand the results of three-dimensional contaminant transport simulation, and the capability to transmit the results of the analysis to the project management. In addition, a quantitative comparison was made on the time required to develop a thorough analysis of the modeling results. The conclusions from the comparative study showed that the visualization analysis provided an increased awareness of the contaminant transport mechanisms, provided new insights into contaminant migration, and resulted in a significant time savings.

2140 (ANL/EAIS/CP-80710) Adaptive sampling program support for expedited site characterization. Johnson, R. Argonne National Lab., IL (United States). [1993]. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-931095-7: Department of Energy environmental remediation conference, Augusta, GA (United States), 24-28 Oct 1993). Order Number DE94000468. Source: OSTI; NTIS; INIS; GPO Dep.

Expedited site characterizations offer substantial savings in time and money when assessing hazardous waste sites. Key to some of these savings is the ability to adapt a sampling program to the "real-time" data generated by an expedited site characterization. This paper presents a two-prong approach to supporting adaptive sampling programs: a specialized object-oriented database/geographical information system for data fusion, management and display; and combined Bayesian/geostatistical methods for contamination extent estimation and sample location selection.

2141 (ANL/EAIS/TM-42) Preliminary radiation dose assessment for the Palmerton ore storage site, Palmerston, Pennsylvania. Nimmagadda, M.; Yu, C. Argonne National Lab., IL (United States). Environmental Assessment and Information Sciences Div. Feb 1991. 33p. Sponsored by USDOE, Washington, DC (USA). DOE Contract W-31109-ENG-38. Order Number DE91011424. Source: OSTI; NTIS; INIS; GPO Dep.

Potential maximum radiation doses rates were calculated for the Palmerton ore storage site in Palmerston, Pennsylvania. The RESRAD computer code, which implements the methodology described in the US Department of Energy's manual for establishing residual radioactive material guidelines, was used in this evaluation. Four potential scenarios were considered for the Palmerton ore storage site. Two scenarios were developed on the basis of industrial use of the site, and two were developed on the basis of residential use of the site. The scenarios also vary with regard to time spent at the site, sources of food consumed, and source terms. The RESRAD code was used to analyze potential radiation doses from three exposure pathways. The results indicate that the basic dose limit of 100 mrem/yr would not be exceeded in Scenarios A (industrial use, hot spot), B (industrial use, homogenous contamination), and C (residential use, homogenous contamination), but would be exceeded in Scenario D (residential use, hot spot). The potential maximum dose rates for Scenarios A, B, C, and D are 1.0 mrem/yr, 0.66 mrem/yr, and 360 mrem/yr, respectively. 3 refs., 3 tabs.

2142 (ANL/ER/CP-77595) Site characterization for the in situ bioremediation of the vadose zone. Montemagno, C.D. (Argonne National Lab., IL (United States)); Leo, A.; Craig, J. Argonne National Lab., IL (United States). [1993]. 16p. Sponsored by USDOE, Washington, DC

(United States). DOE Contract W-31109-ENG-38. (CONF-930585-2: 2. USA/CIS joint conference on environmental hydrology and hydrogeology, Washington, DC (United States), 16-29 May 1993). Order Number DE93010665. Source: OSTI; NTIS; INIS; GPO Dep.

Studies were conducted to determine whether bioremediation can be used to treat a diesel fuel spill in the deep vadose zone (>30 m). After laboratory studies confirmed the ability of the natural population of organisms to degrade the diesel fuel, the technological issue of transporting the required mass of nutrients to the contaminated soils was addressed. Laboratory studies demonstrated that nutrient and oxygen transport can be enhanced by the addition of divalent cations to injected waters. This addition of minerals caused the observed hydraulic conductivity to be maintained at elevated levels that allowed the macronutrient nitrogen, provided as ammonium ion, to be more uniformly distributed to target soil domains.

2143 (ANL/EWM/VU-82273) CP-5 Reactor yard characterization study. Patel, P.B.; Swale, R.E. Argonne National Lab., IL (United States). [1994]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-940406-5: International symposium on decontamination and decommissioning, Knoxville, TN (United States), 27-29 Apr 1994). Order Number DE94008463. Source: OSTI; NTIS; GPO Dep.

This paper presents the results of a characterization study of the yard of the CP-5 Reactor at Argonne National Laboratory, Argonne, Illinois. Low-level radiological contamination is suspected to have occurred at the yard primarily because of leaks from the cooling tower located in the yard. The CP-5 Reactor was a 5-MW research reactor that operated from 1954 until its shutdown in 1979. The CP-5 yard also stored a number of pieces of scientific equipment that exhibited measurable amounts of radioactivity. The reactor and associated yard area are in the process of being decommissioned. As a preliminary step in this direction, a single exploratory monitoring well was installed in the yard. Levels of hydrogen-3 (tritium) ranged from 6.5 to 15.9 nCi/L, and the level of strontium-90 in groundwater ranged from 1.23 to 3.32 pCi/L. Preliminary characterization included drilling two additional monitoring wells and several soil borings in order to collect sufficient soil and groundwater samples. Samples were analyzed for organic, inorganic, and radiological parameters. Low analytical sensitivity for tritium was emphasized for this project. The RESRAD code was used to convert the radiological results of soil samples into human dosage equivalents.

2144 (ANL/FC/CP-77558) Characterization of mixed CH-TRU waste at Argonne-West: A WIPP project update. Dwight, C.C. (Argonne National Lab., Idaho Falls, ID (United States)); Guay, K.P.; Courtney, J.C.; Connolly, M.J.; Higgins, P.J. Argonne National Lab., Idaho Falls, ID (United States). 29 Jan 1993. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38 ; FG02-89ER12896. (CONF-930205-79: Waste management '93, Tucson, AZ (United States), 28 Feb - 4 mar 1993). Order Number DE93017444. Source: OSTI; NTIS; INIS; GPO Dep.

Argonne National Laboratory is participating in the Department of Energy's Waste Isolation Pilot Plant (WIPP) Experimental Test Program by characterizing and repackaging mixed contact-handled transuranic waste. Argonne's initial activities in the Program were described last year at Waste Management '92. Since then, additional waste has

been characterized and repackaged, resulting in six bins ready for shipment to WIPP upon the initiation of the bin tests. Lessons learned from these operations are being factored in the design and installation of a new characterization facility, the Enhanced Waste Characterization Facility (EWCF). The objectives of the WIPP Experimental Test Program have also undergone change since last year leading to an accelerated effort to factor sludge sampling capability into the EWCF. Consequently, the initiation of non-sludge operations in the waste characterization chamber has been delayed to Summer 1993 while the sludge sampling modifications are incorporated into the facility. Benefits in operational flexibility, effectiveness, and efficiency and reductions in potential facility and personnel contamination and exposure are expected from the enhanced waste characterization facility within the Hot Fuel Examination Facility at Argonne-West. This paper summarizes results and lessons learned from recent characterization and repackaging efforts and future plans for characterization. It also describes design features and status of the EWCF.

2145 (ANL/RE/CP-78949) Associated-particle sealed-tube neutron probe for characterization of materials. Rhodes, E. (Argonne National Lab., IL (United States)); Dickerman, C.E.; Peters, C.W. Argonne National Lab., IL (United States). 1993. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE94001341. Source: OSTI; NTIS; GPO Dep.

A neutron diagnostic probe system has been developed that can identify and image most elements having a larger atomic number than boron. It can satisfy van-mobile and fixed-portal requirements for nondestructive detection of contraband drugs, explosives, and nuclear and chemical warfare weapon materials, and for treaty verification of sealed munitions and remediation of radioactive waste. The probe is based on a nonpulsed associated-particle sealed-tube neutron generator (APSTNG) that interrogates the object with a 14-MeV neutrons and detects alpha-particle associated with each neutron. Gamma-ray spectra of resulting neutron reactions (primarily inelastic scattering) identify nuclides associated with drugs, explosives, and other contraband. Flight times determined from detection times of gamma-rays and alpha-particles yield a separate coarse tomographic image of each identified nuclide. Chemical substances are identified and imaged by comparing relative spectra fine intensities with ratios of elements in reference compounds. The High-energy neutrons in gamma-rays will penetrate large objects and dense materials. The source and emission detection systems can be on the same side, allowing measurements with access to one side only. A high signal-to-background ratio is obtained and maximum information is extracted from each detected gamma-ray, yet high-bandwidth data acquisition is not required. The APSTNG also forms the basis for a compact fast-neutron transmission imaging system. No collimators are required, and only minimal shielding is needed. The small and relatively inexpensive neutron generator tube exhibits high reliability and can be quickly replaced. The detector arrays and associated electronics can be made reliable with low maintenance cost.

2146 (BNL-47775) Computer models used to support cleanup decision-making at hazardous and radioactive waste sites. Moskowitz, P.D.; Pardi, R.; De-Phillips, M.P.; Meinhold, A.F. Brookhaven National Lab., Upton, NY (United States). Jul 1992. 102p. Sponsored by

USDOE, Washington, DC (United States); Environmental Protection Agency, Washington, DC (United States); Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE92040575. Source: OSTI; NTIS; INIS; GPO Dep.

Massive efforts are underway to cleanup hazardous and radioactive waste sites located throughout the US To help determine cleanup priorities, computer models are being used to characterize the source, transport, fate and effects of hazardous chemicals and radioactive materials found at these sites. Although, the US Environmental Protection Agency (EPA), the US Department of Energy (DOE), and the US Nuclear Regulatory Commission (NRC) have provided preliminary guidance to promote the use of computer models for remediation purposes, no Agency has produced directed guidance on models that must be used in these efforts. To identify what models are actually being used to support decision-making at hazardous and radioactive waste sites, a project jointly funded by EPA, DOE and NRC was initiated. The purpose of this project was to: (1) Identify models being used for hazardous and radioactive waste site assessment purposes; and (2) describe and classify these models. This report presents the results of this study.

2147 (CONF-9002111-3) Preliminary screening analysis of the off-site environment downstream of the US Department of Energy Oak Ridge Reservation. Blaylock, B.G.; Hoffman, F.O.; Frank, M.L. Oak Ridge National Lab., TN (United States). [1990]. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Data analysis and interpretation for environmental surveillance conference; Lexington, KY (United States); 5-7 Feb 1990. Order Number DE91016284. Source: OSTI; NTIS; INIS; GPO Dep.

Operations and waste disposal activities at the Y-12 Plant, the Oak Ridge National Laboratory (ORNL), and the Oak Ridge Gaseous Diffusion Plant (ORGP), located on the US Department of Energy (DOE) Oak Ridge Reservation (ORR) in eastern Tennessee, have introduced airborne, liquid, and solid wastes into the surrounding environment. Some of these wastes may affect off-site areas by entering local streams that ultimately drain into the Clinch River. Previously reported concentrations of radionuclides, metals, and organic compounds in water, sediment, and biota of the Clinch River and Watts Bar Reservoir suggest the presence of contaminants of possible concern to the protection of human health and the environment. A preliminary screening was conducted of contaminants in the off-site surface water environments downstream of the DOE ORR. This screening analysis represents part of a scoping phase of the Clinch River Resource Conservation and Recovery Facilities Investigation (CRRFI). The purpose of this preliminary screening analysis is to use existing data on off-site contaminant concentrations to identify and prioritize potential contaminants of concern for further evaluation and investigation. The primary objective of this screening analysis is to ensure that CRRFI sampling and analysis efforts focus on those contaminants that may possibly contribute to human health or environmental risk. 8 refs., 3 figs., 6 tabs.

2148 (CONF-911107-50) Buried waste remote survey of the Idaho National Engineering Laboratory subsurface disposal area. Richardson, B.S. (Oak Ridge National Lab., TN (United States)); Noakes, M.W.; Griebenow, B.E.; Josten, N.E. Oak Ridge National Lab., TN (United States). [1991]. 9p. Sponsored by USDOE,

Washington, DC (United States). DOE Contract AC05-84OR21400. From 1991 winter meeting of the American Nuclear Society (ANS); San Francisco, CA (United States); 10-15 Nov 1991. Order Number DE92004347. Source: OSTI; NTIS; INIS; GPO Dep.

Burial site characterization is an important first step in the restoration of subsurface disposal sites. Testing and demonstration of technology for remote buried waste site characterization were performed at the Idaho National Engineering Laboratory (INEL) by a team from five US Department of Energy (DOE) laboratories. The US Army's Soldier Robot Interface Project (SRIP) vehicle, on loan to the Oak Ridge National Laboratory (ORNL), was used as a remotely operated sensor platform. The SRIP was equipped with an array of sensors including terrain conductivity meter, magnetometer, ground-penetrating radar (GPR), organic vapor detector, gamma-based radar detector, and spectrum analyzer. The testing and demonstration were successfully completed and provided direction for future work in buried waste site characterization.

2149 (CONF-9111105-1) Characterization technologies for environmental remediation. Pruett, J.G. Oak Ridge National Lab., TN (United States). [1991]. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Caribbean Haztech conference; San Juan (Puerto Rico); 13-15 Nov 1991. Order Number DE92001671. Source: OSTI; NTIS; GPO Dep.

Improved site characterization technologies are being developed at Martin Marietta Energy Systems for the US Department of Energy (DOE) Office of Technology Development (OTD) in support of environmental restoration activities throughout the DOE complex. Since site characterization is an expensive and time consuming process that must be performed prior to, during, and following remediation efforts, an obvious way to reduce the overall cost of remediation is to develop improved characterization methods. For example, the Derivative Ultraviolet Absorption Spectrometer (DUVAS), which is being field tested as part of the OTD program, is a fiberoptic device for in situ, real time measurement of aromatic organic compounds in groundwater. A transportable, direct sampling Ion Trap Mass Spectrometer (ITMS) is being developed for continuous monitoring of hazardous organic compounds in air. In areas where the environment is hazardous to human health, it is desirable to perform site characterization remotely; if robotics are to be employed, the Ultrasonic Ranging and Data System (USRADS) can be used to provide telemetry information on robot location as well as sensor measurements. Once fully developed, these technologies can be transferred to the private sector. 19 refs., 2 tabs.

2150 (CONF-920606-8) ISV of a simulated seepage trench: A Radioactive Field Test at ORNL. Tixier, J.S. (Pacific Northwest Lab., Richland, WA (United States)); Powell, T.D.; Jacobs, G.K.; Spalding, B.P. Oak Ridge National Lab., TN (United States). [1992]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400; AC06-76RL01830. From American Nuclear Society annual meeting; Boston, MA (United States); 7-12 Jun 1992. Order Number DE92007832. Source: OSTI; NTIS; INIS; GPO Dep.

The pits and trenches used at Oak Ridge National Laboratory (ORNL) from 1951 through 1966 to dispose of over a million curies of radioactive liquid wastes are currently undergoing remedial investigations/feasibility studies to identify potential technologies for cleanup and/or stabilization. In situ

vitrification (ISV) is a leading technology candidate because of the high risks associated with options requiring retrieval, and because of the high-quality waste form produced by ISV. The Radioactive Field Test, conducted on a simulated ORNL seepage trench, in May 1991, is the second step in evaluating ISV as a remedial action at these sites. This document discusses this field test.

2151 (CONF-920606-11) Final results of the application of a structured light source for surface mapping in the Fernald K-65 silos. Burks, B.L. (Oak Ridge National Lab., TN (United States)); DePiero, F.W.; Dinkins, M.A.; Rowe, J.C.; Jacoboski, D.L.; Selleck, C.B. Oak Ridge National Lab., TN (United States). [1992]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From American Nuclear Society annual meeting; Boston, MA (United States); 7-12 Jun 1992. Order Number DE92008894. Source: OSTI; NTIS; GPO Dep.

During 1991, a remotely operated surface mapping measurement system was developed at Oak Ridge National Laboratory for use in the K-65 waste storage silos at Fernald, Ohio. Preliminary reports have been presented discussing the planned development project and intermediate results. In this report the authors discuss the sensor system development and present the final results of the hot deployment. The K-65 silos are above-ground, domed, concrete and reinforced steel structures built in the early 1950s to store uranium residue from the Feed Materials Production Center (FMPC), Fernald, Ohio. Two of the four silos contain a waste material that is rich in radium content and, hence, generate large amounts of radon gas. During the fall of 1991, a layer of bentonite clay was deposited over the entire waste surface in silos 1 and 2. This bentonite layer was placed to act as absorber to capture the emitted radon gas. We describe the application of a structured light source to obtain waste surface contour data before bentonite deposition and to obtain bentonite surface contour data after deposition. The thickness of bentonite at any point along the waste surface can be determined by the change in surface height. Development of this technology and cold testing in silo 4 was sponsored by the DOE Environmental Restoration and Waste Management Office of Technology (OTD) while hot deployment was sponsored by the DOE Office of Environmental Restoration.

2152 (CONF-920791-) Proceedings of the information exchange meeting on characterization, sensors, and monitoring technologies. USDOE Assistant Secretary for Environmental Restoration and Waste Management, Washington, DC (United States). Jul 1992. 261p. Sponsored by USDOE, Washington, DC (United States). From Information exchange meeting on characterization sensors and monitoring technologies; Dallas, TX (United States); 15-16 Jul 1992. Order Number DE93005318. Source: OSTI; NTIS; GPO Dep.

This document contains discussions pertaining to characterization, sensors, and monitoring technologies for use in environmental remediation and waste management. The topics were presented at a meeting sponsored by the Department of Energy (DOE) in Dallas, Texas, July 15-16, 1992. Sessions included information on CRADAs and licensing, technology transfer, environmental restoration needs, tank waste characterization needs, soil decontamination, monitoring of plumes in groundwater, in-situ measuring methods, real time systems, remote sensing, chemical analysis, electrical resistance tomography, and high resolution S-wave reflection techniques for environmental monitoring.

Individual reports are processed separately for the data bases.

2153 (CONF-9207100-2) Characterization of radioactive mixed wastes: The scientific perspective. Griest, W.H.; Stokely, J.R. Jr. Oak Ridge National Lab., TN (United States). [1992]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 8. annual waste testing and quality assurance symposium; Arlington, VA (United States); 13-17 Jul 1992. Order Number DE92016907. Source: OSTI; NTIS; INIS; GPO Dep.

This paper is concerned with the physical and chemical characterization of radioactive mixed wastes (RMW): what should be determined and how; the applications and limitations of current analytical methodologies, promising new technologies, and areas where further methodology research is needed. Constituents to be determined, sample collection, preparation, and analysis are considered. The scope concerns mainly low level and very low level RMW whose activities allow contact handling and analysis by Nuclear Regulatory Commission- or Agreement State-licensed commercial laboratories.

2154 (CONF-930482-11) Application of microbial biomass and activity measures to assess in situ bioremediation of chlorinated solvents. Phelps, T.J. (Oak Ridge National Lab., TN (United States)); Herbes, S.E.; Palumbo, A.V.; Piffner, S.M.; Mackowski, R.; Ringelberg, D.; White, D.C. Oak Ridge National Lab., TN (United States). [1993]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 2. international symposium in situ and on-site bioreclamation; San Diego, CA (United States); 5-8 Apr 1993. Order Number DE94002489. Source: OSTI; NTIS; INIS; GPO Dep.

Evaluating the effectiveness of chlorinated solvent remediation in the subsurface can be a significant problem given uncertainties in estimating the total mass of contaminants present. If the remediation technique is a biological activity, information on the progress and success of the remediation may be gained by monitoring changes in the mass and activities of microbial populations. The in situ bioremediation demonstration at the US Department of Energy (DOE) Savannah River Site (SRS) is designed to test the effectiveness of methane injection for the stimulation of in sediments. Past studies have shown the potential for degradation by native microbial populations. The design and implementation of the SRS Integrated Demonstration is described in this volume. A control phase without treatment was followed by a phase withdrawing air. The next phase included vacuum extraction plus air injection into the lower horizontal well located below the water table. The next period included the injection of 1% methane in air followed by injection of 4% methane in air. Based on the literature, it was hypothesized that the injection of methane would stimulate methanotrophic populations and thus accelerate biological degradation of TCE. Measuring the success of bioremediation is a complex effort that includes monitoring of changes in microbial populations associated with TCE degradation. These monitoring efforts are described in this paper and in related papers in this volume.

2155 (CONF-930570-4) Source control strategy accelerates remediation. Garland, S.B. II (Oak Ridge National Lab., TN (United States)); Hammond, R. Oak Ridge National Lab., TN (United States). [1993]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 2. annual Federal environmental restoration conference and exhibition; Washington, DC

(United States); 25-27 May 1993. Order Number DE93015923. Source: OSTI; NTIS; GPO Dep.

Shallow land burial of ion-level radioactive wastes at ORNL has resulted in the release of contaminants into surrounding soil, groundwater, and surface water. Multiple contaminated areas occurring in close proximity make it difficult to relate contaminant releases to a specific site. To address this issue, similar and contiguous contaminated sites within the same drainage area have been combined into Waste Area Groupings. These Waste Area Groupings were prioritized and became the focus of the Comprehensive Environmental Response, Compensation, and Liability Act remediation process. Since the majority of the groupings are in the White Oak Creek drainage basin, the remediation strategy is to control contaminant releases from these source areas first, followed by remediation of White Oak Creek. In planning the remediation program, it became clear that until the issues of ultimate land use and institutional control, waste treatment technologies, and waste disposal facilities are resolved, final remediation objectives cannot be defined and remedial alternatives cannot be evaluated. Consequently, instead of postponing remedial actions until these issues are resolved, a strategy to control the sources of contaminant release with a series of interim actions was developed. In the near term, this strategy reduces off-site risk by eliminating contaminant releases and controls on-site risk through institutional control. Source control will allow time to achieve consensus on long-term institutional control and land use issues to develop appropriate treatment technologies, and to construct the necessary disposal facilities without further environmental degradation.

2156 (CONF-9307141-1) Direct Sampling Ion Trap Mass Spectrometry. Thompson, C.V.; Wise, M.B.; Buchanan, M.V.; Guerin, M.R. Oak Ridge National Lab., TN (United States). [1993]. 17p. Sponsored by USDOE, Washington, DC (United States); Department of Defense, Washington, DC (United States). DOE Contract AC05-84OR21400. From Mobile Analytical Laboratory workshop; Los Alamos, NM (United States); 20-21 Jul 1993. Order Number DE93040606. Source: OSTI; NTIS; GPO Dep.

This presentation describes the development and field testing of Direct Sampling Ion Trap Mass Spectrometry (DSITMS) for the rapid analysis of volatile organics in air, water, and soil, with an emphasis on the fieldable version of the instrumentation. Direct Sampling Ion Trap Mass Spectrometry (DSITMS) has been developed in our laboratory to provide faster and less costly methods for the screening and analysis of environmental samples. "Direct sampling" involves the introduction of analytes directly into the mass spectrometer with no sample preconcentration and little or no sample preparation. Analytes can be monitored in real-time or near real-time at low part-per-billion (ppb) levels with analysis times ranging from instantaneous to approximately 3 minutes, depending on the sample matrix, the degree of specificity, and the level of quantification required. Particular attention has been given to developing instrumentation which is suitable to field applications. This includes applicability in mobile laboratories and stand-alone vehicle transportation. This paper summarizes the characteristics of DSITMS and describes currently developed instrumentation.

2157 (CONF-9310205-1) Integrating state-of-the-science technology for a cost-effective hazardous waste site characterization. Muhr, C.A. (Oak Ridge National Lab., Grand Junction, CO (United States)); Dickerson, K.S.; Korte, N.E. Oak Ridge National Lab., TN (United States). [1993].

19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 7. annual Colorado Hazardous Waste Society conference and exhibition; Denver, CO (United States); 13-15 Oct 1993. Order Number DE94002196. Source: OSTI; NTIS; INIS; GPO Dep.

Oak Ridge National Laboratory's Environmental Technology Section in Grand Junction, Colorado has performed numerous hazardous waste site characterization since 1985. One of the most costly aspects of site characterization is the installation of groundwater monitoring wells and the subsequent long-term sampling and analysis costs. By optimizing the location of monitoring wells, better information can be obtained from fewer points, resulting in considerable cost savings to the project. A number of different screening techniques can be used prior to monitoring well installation allowing optimal well and soil-boring placement. Additionally, these screening techniques can provide a large amount of data in a small area to provide insight into local heterogeneities in the subsurface. Several screening techniques have been used by ORNL to accomplish these goals including: (1) geophysical surveys (electromagnetic and magnetic) conducted with the UltraSonic Ranging and Data System (USRADS®), (2) installation of temporary monitoring wells, (3) analysis of samples in the field with a gas chromatograph (GC), and (4) use of the colloidal borescope for determining groundwater flow directions and velocities.

2158 (CONF-940178-1) Evaluation of passive alpha detectors for sensitive/inexpensive/fast characterization of radiological contamination on surfaces and in soils. Meyer, K.E. (Oak Ridge National Lab., TN (United States)); Gammage, R.B.; Dudney, C.S.; Kotrappa, P.; Wheeler, R.; Salasky, M. Oak Ridge National Lab., TN (United States). [1994]. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 2. international conference on on-site analysis and field-portable instrumentation; Houston, TX (United States); 24-26 Jan 1994. Order Number DE94010123. Source: OSTI; NTIS; GPO Dep.

Passive alpha-particle detectors, originally developed for indoor radon measurements, offer the potential for cost-effective and sensitive measurements of radiological contamination in soils and on surfaces for field screening and radiological survey applications. We have carried out field demonstrations of electret ionization chambers (EIC's) and alpha track detectors (ATD's). The EIC's offer the advantages of immediate on-site readout, good sensitivity, ruggedness, and simplicity of operation. The use of parallel screened and unscreened EIC measurement allows the separation of alpha-particle response from radon/gamma/beta response. The advantages of the ATD's include the potential for hot-particle counting, permanent records of contaminated and post-remediation activity levels, and inexpensive depth profiling of contamination in soil. At this time, the ATD's are routinely shipped to the vendor after exposure in the field for processing and readout. It is feasible that the necessary processing and readout equipment could be deployed in a mobile laboratory for fast on-site analysis. We will present results from environmental measurements at the Nevada Test Site and indoor surface contamination measurements carried out at ORNL.

2159 (CONF-940225-99) Environmental technology demonstrations at US DOE facilities: Observations regarding the current process and methods for improvement. Morris, M.I. (Oak Ridge National Lab., TN (United States)); Siegrist, R.L.; Davenport, D.T. Oak Ridge

National Lab., TN (United States). [1994]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Waste management '94; Tucson, AZ (United States); 27 Feb - 3 Mar 1994. Order Number DE94010130. Source: OSTI; NTIS; GPO Dep.

Technology demonstrations to evaluate innovative processes prior to full-scale implementation is an important element in the overall US Department of Energy (DOE) strategy for the remediation of contaminated sites and/or the treatment of wastes. These demonstrations provide the opportunity to evaluate and compare multiple technologies on a side-by-side basis in order to choose the process that meets the treatment goals most effectively and economically. Technology demonstrations performed at DOE sites entail working under a unique set of constraints that are not typically encountered in the private sector. Not only do the contractors have to meet all applicable federal, state, and local requirements, but also they have the additional constraints of meeting all DOE Orders and specific and sometimes unique site requirements and interfaces. This paper will discuss the past demonstration experience of the authors and provide insight on how researchers and contractors may conduct demonstrations at a DOE facility.

2160 (CONF-940386-3) Cost comparison of laboratory methods and four field screening technologies for uranium-contaminated soil. Douthat, D.M.; Armstrong, A.Q. Oak Ridge National Lab., TN (United States). [1994]. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Cost efficient acquisition and utilization of data in the management of hazardous waste sites; Herndon, VA (United States); 23-25 Mar 1994. Order Number DE94012752. Source: OSTI; NTIS; INIS; GPO Dep.

To address the problem of characterizing uranium-contaminated surface soil at federal facilities, the Department of Energy has the development of four uranium field screening technologies, under the direction of the Uranium-in-Soils Integrated Demonstration (USID) Program. These four technologies include: a long-range alpha detector a beta scintillation detector, an in situ gamma detector, and a mobile laser ablation-inductively coupled plasma/atomic emission spectrometry (LA-ICP/AES) laboratory. As part of the performance assessment for these field screening technologies, cost estimates for the development and operation of each technology were created. A cost study was conducted to compare three of the USID field screening technologies to the use of traditional field surveying equipment to adequately characterize surface soils of a one-acre site. The results indicate that the use of traditional equipment costs more than the in situ gamma detector, but less than the beta scintillation detector and LRAD. The use of traditional field surveying equipment results in cost savings of 4% and 34% over the use of the beta scintillation and LRAD technologies, respectively. A study of single-point surface soil sampling and laboratory analysis costs was also conducted. Operational costs of the mobile LA-ICP/AES laboratory were compared with operational costs of traditional sampling and analysis, which consists of collecting soil samples and conducting analysis in a radiochemical laboratory. The cost study indicates that the use of the mobile LA-ICP/AES laboratory results in cost savings of 23% and 40% over traditional field sampling and laboratory analysis conducted by characterization groups at two DOE facilities.

2161 (DOE/AL/62350-58F) Radiological audit of remedial action activities at the processing site, transfer

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site, and Cheney disposal site Grand Junction, Colorado: Audit date, August 9-11, 1993: Final report. Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Aug 1993. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE93040748. Source: OSTI; NTIS; INIS; GPO Dep.

The Uranium Mill Tailing Remedial Action (UMTRA) Project's Technical Assistance Contractor (TAC) performed a radiological audit of the Remedial Action Contractor (RAC), MK-Ferguson and CWM Federal Environmental Services, Inc., at the processing site, transfer site, and Cheney disposal site in Grand Junction, Colorado. Jim Hylko and Bill James of the TAC conducted this audit August 9 through 11, 1993. Bob Cornish and Frank Bosiljevec represented the US Department of Energy (DOE). This report presents one programmatic finding, eleven site-specific observations, one good practice, and four programmatic observations.

2162 (DOE/CH-9202) Minimally Invasive three-dimensional site characterization system: Final report. Steedman, D. (Applied Research Associates, Inc., Albuquerque, NM (United States)); Seusy, F.E.; Gibbons, J.; Bratton, J.L. Argonne National Lab., IL (United States); Applied Research Associates, Inc., Albuquerque, NM (United States). Sep 1993. 62p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE94007974. Source: OSTI; NTIS; INIS; GPO Dep.

This paper presents an improved for hazardous site characterization. The major components of the systems are: (1) an enhanced cone penetrometer test, (2) surface geophysical surveys and (3) a field database and visualization code. The objective of the effort was to develop a method of combining geophysical data with cone penetrometer data in the field to produce a synergistic effect. Various aspects of the method were tested at three sites. The results from each site are discussed and the data compared. This method allows the data to be interpreted more fully with greater certainty, is faster, cheaper and leads to a more accurate site characterization. Utilizing the cone penetrometer test rather than the standard drilling, sampling and laboratory testing reduces the workers exposure to hazardous materials and minimizes the hazardous material disposal problems. The technologies employed in this effort are, for the most part, state-of-the-art procedures. The approach of using data from various measurement systems to develop a synergistic effect was a unique contribution to environmental site characterization. The use of the cone penetrometer for providing "ground truth" data and as a platform for subsurface sensors in environmental site characterization represents a significant advancement in environmental site characterization.

2163 (DOE/EA-0339-Rev.1) Environmental assessment of remedial action at the Slick Rock uranium mill tailings sites, Slick Rock, Colorado: Revision 1. Jacobs Engineering Group, Inc., Albuquerque, NM (United States). May 1994. 152p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94011036. Source: OSTI; NTIS; INIS; GPO Dep.

The Uranium Mill Tailings Radiation Control Act of 1978 (42 USC §7901 et seq.), hereafter referred to as the UMTRCA, authorized the US Department of Energy (DOE) to clean up two uranium mill tailings processing sites near Slick Rock, Colorado, in San Miguel County. Contaminated materials cover an estimated 63 acres of the Union Carbide (UC) processing site and 15 ac of the North Continent (NC) processing site. The sites are within 1 mile of each other and

are adjacent to the Dolores River. The sites contain concrete foundations of mill buildings, tailings piles, and areas contaminated by windblown and waterborne radioactive tailings materials. The total estimated volume of contaminated materials is approximately 621,300 cubic yards (yd³). In addition to the contamination in the two processing site areas, four VPs were found to contain contamination. As a result of the tailings being exposed to the environment, contamination associated with the UC and NC sites has leached into shallow ground water. Surface water has not been affected. The closest residence is approximately 0.3 air mi from either site. The proposed action is to remediate the UC and NC sites by removing all contaminated materials within the designing site boundaries or otherwise associated with the sites, and relocating them to, and stabilizing them at, a location approximately 5 road mi northeast of the sites on land administered by the Bureau of Land Management (BLM).

2164 (DOE/EA-0489) Engineering evaluation/cost analysis for the proposed decontamination of properties in the vicinity of the Hazelwood Interim Storage Site, Hazelwood, Missouri - environment assessment. Picel, M.H. (Argonne National Lab., IL (USA). Environmental Assessment and Information Sciences Div.); Peterson, J.M.; Williams, M.J. Argonne National Lab., IL (United States). Environmental Assessment and Information Sciences Div.; Bechtel National, Inc., Oak Ridge, TN (United States). May 1991. 80p. Sponsored by USDOE, Washington, DC (USA). Order Number DE91014301. Source: OSTI; NTIS; GPO Dep.

The US Department of Energy (DOE), under its Formerly Utilized Sites Remedial Action Program (FUSRAP), is implementing a cleanup program for three groups of properties in the St. Louis, Missouri, area. None of the properties is owned by DOE, but each property contains radioactive residues from federal uranium-processing activities conducted at the SLDS during and after World War II. This engineering evaluation/cost analysis (EE/CA) report has been prepared to support the interim cleanup measures for the contaminated properties in the Hazelwood and Berkeley, Missouri area. The near-term cleanup measures that may be necessary at the vicinity properties are evaluated in the main body of this report. Because of the range of active land uses in the Hazelwood and Berkeley areas and because of the extent of contamination on public and private properties, the potential exists for disturbance and spreading of soil contamination. Specifically, implementation of the proposed action would allow DOE to remove, transport, and safely store contaminated soils from properties where other activities (not involving DOE) are likely to result in either spreading contamination or otherwise complicating ultimate cleanup measures. 25 refs., 4 figs., 6 tabs.

2165 (DOE/EA-0489-Rev.1) Engineering evaluation/cost analysis-environmental assessment for the proposed decontamination of properties in the vicinity of the Hazelwood Interim Storage Site, Hazelwood, Missouri: Revision 1. Picel, M.H. (Argonne National Lab., IL (United States). Environmental Assessment and Information Sciences Div.); Peterson, J.M.; Williams, M.J. USDOE Oak Ridge Field Office, TN (United States). Former Sites Restoration Div. Mar 1992. 77p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92010382. Source: OSTI; NTIS; GPO Dep.

The US Department of Energy (DOE), under its Formerly Utilized Sites Remedial Action Program (FUSRAP), is implementing a cleanup program for three groups of properties in

the St. Louis, Missouri, area. None of the properties is owned by DOE, but each property contains radioactive residues from federal uranium-processing activities conducted at the SLDS during and after World War II. This engineering evaluation/cost analysis (EE/CA) report has been prepared to support the interim cleanup measures for the contaminated properties in the Hazelwood and Berkeley, Missouri area. The near-term cleanup measures that may be necessary at the vicinity properties are evaluated in the main body of this report. Because of the range of active land uses in the Hazelwood and Berkeley areas and because of the extent of contamination on public and private properties, the potential exists for disturbance and spreading of soil contamination. Specifically, implementation of the proposed action would allow DOE to remove, transport, and safely store contaminated soils from properties where other activities (not involving DOE) are likely to result in either spreading contamination or otherwise complicating ultimate cleanup measures.

2166 (DOE/EA-0499) Retrieval and re-storage of transuranic storage area waste at the Idaho National Engineering Laboratory: Environmental assessment. USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). May 1992. 49p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93001936. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy (DOE) has prepared this environmental assessment (EA) to identify and evaluate the environmental consequences of retrieving and re-storing waste at the Transuranic Storage Area (TSA) within the Radioactive Waste Management Complex (RWMC) at the Idaho National Engineering Laboratory (INEL). Approximately 95% of the TSA waste is contaminated with chemically hazardous/toxic constituents and is termed "mixed" waste. It is conservatively estimated, based on previous waste retrieval and container deterioration studies, that up to 10% of the waste containers may be breached. Approximately 43% of the 65,000 M³ of TSA waste is expected to be reclassified as LLW or mixed LLW. The reclassified LLW and mixed LLW would eventually be disposed of in approved land disposal sites after any necessary treatment is accomplished. The remaining 57% of the TSA waste is expected to remain classified as TRU waste. DOE's strategy for long-term management of CH TRU waste stored at the INEL and other DOE facilities is to eventually transport the waste to DOE's Waste Isolation Pilot Plant, a deep geologic repository near Carlsbad, New Mexico, for final disposal. The proposed action is to retrieve and re-store TSA waste at the INEL's RWMC. The purpose of the proposed action is to: (1) prevent or delay possible deterioration of TSA waste containers to decrease the probability of future environmental contamination; and (2) bring the TSA waste storage facilities into compliance with the Resource Conservation and Recovery Act and the State of Idaho's Hazardous Waste Management Act requirements.

2167 (DOE/EH-94007658) Remedial Investigation/Feasibility Study (RI/FS) process, elements and techniques guidance. USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (United States). RCRA/CERCLA Div. Dec 1993. 728p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94007658. Source: OSTI; NTIS; GPO Dep.

This manual provides detailed guidance on Remedial Investigation/Feasibility Studies (RI/FSs) conducted pursuant

to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) at Department of Energy (DOE) facilities. The purpose of the RI/FS, to assess the risk posed by a hazardous waste site and to determine the best way to reduce that risk, and its structure (site characterization, risk assessment, screening and detailed analysis of alternatives, etc.) is defined in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) and further explained in the Environmental Protection Agency's (EPA's) Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (Interim Final) 540/G-89/004, OSWER Directive 9355.3-01, October 1988. Though issued in 1988, the EPA guidance remains an excellent source of information on the conduct and structure of an RI/FS. This document makes use of supplemental RI/FS-related guidance that EPA has developed since its initial document was issued in 1988, incorporates practical lessons learned in more than 12 years of experience in CERCLA hazardous site remediation, and drawing on those lessons, introduces the Streamlined Approach For Environmental Restoration (SAFER), developed by DOE as a way to proceed quickly and efficiently through the RI/FS process at DOE facilities. Thus as its title implies, this guidance is intended to describe in detail the process and component elements of an RI/FS, as well as techniques to manage the RI/FS effectively.

2168 (DOE/EM-0158P) Sampling quality assurance guidance in support of EM environmental sampling and analysis activities. USDOE Assistant Secretary for Environmental Management, Washington, DC (United States). Analytical Services Div. May 1994. 37p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94013041. Source: OSTI; NTIS; INIS; GPO Dep.

This document introduces quality assurance guidance pertaining to the design and implementation of sampling procedures and processes for collecting environmental data for DOE's Office of EM (Environmental Restoration and Waste Management).

2169 (DOE/EM-0159P) Analytical laboratory quality assurance guidance in support of EM environmental sampling and analysis activities. USDOE Assistant Secretary for Environmental Management, Washington, DC (United States). Analytical Services Div. May 1994. 40p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94013042. Source: OSTI; NTIS; INIS; GPO Dep.

This document introduces QA guidance pertaining to design and implementation of laboratory procedures and processes for collecting DOE Environmental Restoration and Waste Management (EM) ESAA (environmental sampling and analysis activities) data. It addresses several goals: identifying key laboratory issues and program elements to EM HQ and field office managers; providing non-prescriptive guidance; and introducing environmental data collection program elements for EM-263 assessment documents and programs. The guidance describes the implementation of laboratory QA elements within a functional QA program (development of the QA program and data quality objectives are not covered here).

2170 (DOE/EM-0160P) The Integrated performance evaluation program quality assurance guidance in support of EM environmental sampling and analysis activities. USDOE Assistant Secretary for Environmental Management, Washington, DC (United States). Analytical

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Services Div. May 1994. 29p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94013043. Source: OSTI; NTIS; INIS; GPO Dep.

EM's (DOE's Environmental Restoration and Waste Management) Integrated Performance Evaluation Program (IPEP) has the purpose of integrating information from existing PE programs with expanded QA activities to develop information about the quality of radiological, mixed waste, and hazardous environmental sample analyses provided by all laboratories supporting EM programs. The guidance addresses the goals of identifying specific PE sample programs and contacts, identifying specific requirements for participation in DOE's internal and external (regulatory) programs, identifying key issues relating to application and interpretation of PE materials for EM headquarters and field office managers, and providing technical guidance covering PE materials for site-specific activities. (PE) Performance Evaluation materials or samples are necessary for the quality assurance/control programs covering environmental data collection.

2171 (DOE/EM-0161P) Management Assessment Quality Assurance Guidance in support of EM environmental sampling and analysis activities. USDOE Assistant Secretary for Environmental Management, Washington, DC (United States). Analytical Services Div. May 1994. 15p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94013376. Source: OSTI; NTIS; GPO Dep.

This document is one of several guidance documents developed by DOE EM pertaining to environmental restoration and waste management sampling and analysis activities. This guidance contains performance objectives and representative assessment criteria that can be used to conduct management assessments.

2172 (DOE/ID/13042-T4) Supplemental Investigations in support of environmental assessments by the Idaho INEL Oversight Program at the Idaho National Engineering Laboratory: Status report, June 30, 1992. Idaho Dept. of Health and Welfare, Boise, ID (United States). 1992. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC07-91ID13042. Order Number DE93003254. Source: OSTI; NTIS; INIS; GPO Dep.

This document reports on the status of supplemental investigations in support of environmental assessments by the Idaho INEL Oversight Program at the Idaho National Engineering Laboratory. Included is information on hydrology studies in wells open through large intervals, unsaturated zone contamination and transport processes, surface water-groundwater interactions, regional groundwater flow, and independent testing of air quality data.

2173 (DOE/METC-94/1003) US Department of Energy's weapons complex scrap metal inventory: Research report. Duda, J.R. USDOE Morgantown Energy Technology Center, WV (United States). Jul 1993. 89p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94000085. Source: OSTI; NTIS; GPO Dep.

Two tasks comprise the thrust of this contracted effort. Task 1 is the development of a Source List and is based on determining a list of public documents pertaining to contaminated/uncontaminated scrap metals, equipment, and other materials of value, were they not contaminated or could they be decontaminated. Task 2 is to develop an inventory of such materials from the Task 1 list of public documentation. In more detail, the Task 2 Inventory Report is based upon

fulfillment of the following requirement to prepare and submit an Inventory Report based on the information obtained in the Source List. The Inventory Report shall define the type, quantity, and location of used equipment, scrap metal, and other materials existing within DOE's system. The Inventory Report shall list: the site where the equipment, scrap metal, or other material resides; the type and size of equipment; the type and volume and/or weight of scrap metal or other material; its source; the type and level of contamination; its accessibility; the current annual rate of generation; and the projected annual rate of generation of the material.

2174 (DOE/METC/C-94/7119) Field-usable portable analyzer for chlorinated organic compounds. Buttner, W.J. (Transducer Research, Inc., Naperville, IL (United States)); Stetter, J.R.; Nakaishi, C.V. USDOE Morgantown Energy Technology Center, WV (United States). [1993]. 15p. Sponsored by USDOE, Washington, DC (United States). (CONF-931095-78: Department of Energy environmental remediation conference; 5. national technology information exchange (TIE) workshop, Augusta, GA (United States); Denver, CO (United States), 24-28 Oct 1993; 16-18 Nov 1993; CONF-9311190-1). Order Number DE94007312. Source: OSTI; NTIS; GPO Dep.

Recently, a solid-state sensor was developed which has remarkable selectivity for chlorinated organic vapors and sub-ppm sensitivity. DOE and TRI are currently developing an advanced chlorinated organic vapor monitor. Objective is to extend the analytical capabilities of this new sensing technology by designing and building an advanced instrument package. Specific instrument design goals include (1) a user-friendly, conveniently packaged instrument; (2) a broad dynamic range provided by intelligent sampler systems including, direct sampling, autodilution, and preconcentration; and (3) an analytical capability for condensed media with a specialized sampler. Field testing, of the advanced chlorinated organic vapor monitor demonstrated that the advanced instrument system is capable of providing, rapid, selective, on-site chemical analyses in a way not available by alternative techniques. Soil around 100N Bunker C area at DOE Hanford has trace contamination levels of chlorinated solvents, but is also heavily contaminated by oils which will show up on the OVM. The advanced chlorinated organic vapor monitor performed soil gas analysis on 5 soil gas probes in less than 30 minutes with vapor levels ranging between 0 and 2 ppm and without the interference from oil that would be present using a photoionization detector. Area surveys were performed at Hanford by site personnel who received training, sessions lasting less than five minutes, demonstrating ease of instrument operation.

2175 (DOE/RL-89-18-Rev.1) United States Department of Energy Field Office, Richland, Environmental Protection Implementation Plan, November 9, 1990-November 9, 1991: Revision 1. Paasch, R.A. Westinghouse Hanford Co., Richland, WA (United States). Integration Dept. Sep 1991. 69p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92008365. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy (DOE) Order 5400.1 (DOE 1988a), General Environmental Protection Program, establishes environmental protection program requirements, authorities, and responsibilities to ensure that DOE operations are in compliance with applicable federal, state and local environmental protection laws and regulations, executive orders, and internal department policies. Chapter 3 of

DOE Order 5400.1 requires that each field organization prepare a plan for implementing the requirements of this order and update this plan annually. Therefore, this update to the US Department of Energy – Richland Operations Office Environmental Protection Implementation Plan for the Hanford Site, Richland, Washington, initially prepared November 9, 1989, is being issued. Responsibility for coordinating preparation of the annual update of this plan is assigned to the US Department of Energy Field Office, Richland, Safety and Environment Division's Environmental Oversight Branch.

2176 (DOE/RL-91-40) Hanford past-practice strategy. Thompson, K.M. USDOE Richland Operations Office, WA (United States). Nov 1991. 35p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93041114. Source: OSTI; NTIS; GPO Dep.

In May 1989, the US Environmental Protection Agency (EPA), the State of Washington Department of Ecology (Ecology) and the US Department of Energy (DOE) entered into an Interagency Agreement to provide a legal and procedural framework for cleanup and regulatory compliance at numerous hazardous waste sites at the Hanford Site. Four subareas of the Hanford Site (the 100, 200, 300, and 1100 Areas) have been included on the EPA's National Priorities List (NPL). Under the Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement), the more than 1,000 inactive waste disposal and unplanned release sites were originally grouped into 78 operable units (74 source operable units and 4 groundwater operable units, which underlie the source units). The contamination is in the form of solely hazardous waste, radioactive mixed waste, and other Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) hazardous substances. Included within the Tri-Party Agreement are 55 Resource Conservation and Recovery Act (RCRA) treatment, storage, or disposal (TSD) facilities, which will be closed or permitted to operate in accordance with Washington Administrative Code (WAC) 173-303 (RCRA) regulations. The parties have undertaken an ongoing dialogue over the past year to develop a new strategy for streamlining the past-practice corrective action process. This strategy provides new concepts for (1) accelerating decision making by maximizing the use of existing data consistent with data quality objectives and (2) undertaking expedited response actions and/or interim remedial measures as appropriate to either remove threats to human health and welfare and the environment or to reduce risk by reducing toxicity, mobility, or volume of contaminants.

2177 (DOE/RL-93-06) Limited field investigation report for the 100-BC-1 Operable Unit. Roberts, J.W. (Westinghouse Hanford Co., Richland, WA (United States)). USDOE Richland Operations Office, WA (United States). Apr 1994. 281p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94010339. Source: OSTI; NTIS; INIS; GPO Dep.

This limited field investigation (LFI) report summarizes the data collection and analysis activities conducted during the 100BC-1 Source Operable Unit LFI and the associated qualitative risk assessment (QRA), and makes recommendations on the continued candidacy of high-priority sites for interim remedial measures (IRM). The results and recommendations presented in this report are generally independent of future land use scenarios. The purpose of the report is to identify those sites that are recommended to remain as candidates for IRMs, provide a preliminary summary of site characterization studies, refine the conceptual

model as needed, identify contaminant- and location-specific applicable or relevant and appropriate requirements (ARARs), and provide a qualitative assessment of the risks associated with the sites. The assessment includes consideration of whether contaminant concentrations pose an unacceptable risk that warrants action through IRMs.

2178 (DOE/RW-0006-Rev.7) Integrated Data Base for 1991: US spent fuel and radioactive waste inventories, projections, and characteristics: Revision 7. Oak Ridge National Lab., TN (United States). Oct 1991. 310p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Source: INIS; OSTI (Free of Charge).

The Integrated Data Base (IDB) Program has compiled current data on inventories and characteristics of commercial spent fuel and both commercial and US government-owned radioactive wastes through December 31, 1990. These data are based on the most reliable information available from government sources, the open literature, technical reports, and direct contacts. The current projections of future waste and spent fuel to be generated generally through the year 2020 and characteristics of these materials are also presented. The information forecasted is consistent with the latest US Department of Energy/Energy Information Administration (DOE/EIA) projections of US commercial nuclear power growth and the expected DOE-related and private industrial and institutional (I/I) activities. The radioactive materials considered are spent fuel, high-level waste, transuranic waste, low-level waste, commercial uranium mill tailings, environmental restoration wastes, commercial reactor and fuel cycle facility decommissioning wastes, and mixed (hazardous and radioactive) low-level waste. For most of these categories, current and projected inventories are given through the year 2020, and the radioactivity and thermal power are calculated based on reported or estimated isotopic compositions. In addition, characteristics and current inventories are reported for miscellaneous radioactive materials that may require geologic disposal. 160 refs., 61 figs., 142 tabs.

2179 (DOE/RW-0006-Rev.8) Integrated Data Base for 1992: US spent fuel and radioactive waste inventories, projections, and characteristics: Revision 8. Oak Ridge National Lab., TN (United States). Oct 1992. 341p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (ORNL/M-2524). Source: INIS; OSTI (Free of Charge).

The Integrated Data Base (IDB) Program has compiled current data on inventories and characteristics of commercial spent fuel and both commercial and US government-owned radioactive wastes through December 31, 1991. These data are based on the most reliable information available from government sources, the open literature, technical reports, and direct contacts. The information forecasted is consistent with the latest US Department of Energy/Energy Information Administration (DOE/EIA) projections of US commercial nuclear power growth and the expected DOE-related and private industrial and institutional (I/I) activities. The radioactive materials considered, on a chapter-by-chapter basis, are spent nuclear fuel, high-level waste, transuranic waste, low-level waste, commercial uranium mill tailings, environmental restoration wastes, commercial reactor and fuel cycle facility decommissioning wastes, and mixed (hazardous and radioactive) low-level waste. For most of these categories, current and projected inventories are given through the year 2030, and the radioactivity and thermal

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power are calculated based on reported or estimated isotopic compositions. In addition, characteristics and current inventories are reported for miscellaneous radioactive materials that may require geologic disposal.

2180 (DOE/UMTRA-3050-93-1235-Vol.2) Uranium Mill Tailings Remedial Action Project Annual Environmental Monitoring Report calendar year 1992: Volume 2. MK-Ferguson Co., Albuquerque, NM (United States); Jacobs Engineering Group, Inc., Albuquerque, NM (United States); Chem Waste Management (CWM) Federal Environmental Services, Inc. (United States). [1993]. 414p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL62350. Order Number DE94007206. Source: OSTI; NTIS; INIS; GPO Dep.

This report contains environmental monitoring information for the following UMTRA sites for the 1992 Calendar Year: Lakeview, OR; Lowman, ID; Mexican Hat, UT; Monument Valley, AZ; Rifle, CO; Riverton, WY; Shiprock, NM; Spook, WY; Tuba City, AZ. Each site report contains a site description, compliance summary, environmental program information, environmental radiological and non-radiological program information, water resources protection, and quality assurance information.

2181 (EGG-ER-10792) Acceptance sampling methods for sample results verification. Jesse, C.A. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jun 1993. 42p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94002882. Source: OSTI; NTIS; GPO Dep.

This report proposes a statistical sampling method for use during the sample results verification portion of the validation of data packages. In particular, this method was derived specifically for the validation of data packages for metals target analyte analysis performed under United States Environmental Protection Agency Contract Laboratory Program protocols, where sample results verification can be quite time consuming. The purpose of such a statistical method is to provide options in addition to the "all or nothing" options that currently exist for sample results verification. The proposed method allows the amount of data validated during the sample results verification process to be based on a balance between risks and the cost of inspection.

2182 (EGG-WTD-9735) Test plan for rapid transuranic monitoring of soil and air dusts by direct large-area alpha spectrometry and L-shell x-ray spectrometry. Sill, C.W.; Gehrke, R.J. EG and G Idaho, Inc., Idaho Falls, ID (United States). May 1991. 35p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE91018829. Source: OSTI; NTIS; GPO Dep.

This test plan defines experimental parameters for evaluating rapid techniques for monitoring transuranic (TRU) nuclides in soils, smears, and air dusts in a field application setting. The monitoring techniques include direct alpha spectrometry using a large-area detector and direct measurement of x-rays to determine quantitatively the activity present. The direct alpha spectrometry employs a circular ionization chamber 35 cm in diameter which accommodates a sample holder 25 cm in diameter. Experimental conditions necessary to obtain sufficient spectral resolution to permit identification of the alpha emitters present are described. The x-ray method involves the counting of L x-rays emitted in the alpha decay of plutonium radionuclides with a thin-window, high-resolution Ge spectrometer. By optimization of

the spectrometer, including detector dimensions and resolution of the sample container diameter and thickness and of the methods of analysis, measurements of activities as small as 30 pCi/g for soil and 3×10^{-4} pCi/L for air dusts collected for 1 hour at 20 cfm might be achieved in a 1-hour count. These test plans define objectives, instrumental and experimental procedures, and requirements for data quality and safety. 12 refs., 1 fig.

2183 (EGG-WTD-9736) Particle characterization of contaminated soil. Miller, J.D.; Hupka, J.; Weidner, J.R. EG and G Idaho, Inc., Idaho Falls, ID (United States). May 1991. 36p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE91018830. Source: OSTI; NTIS; INIS; GPO Dep.

Samples collected from Test Reactor Area Warm Waste Pond sediments at the Idaho National Engineering Laboratory were characterized in the test facilities in the Metallurgy Department, University of Utah. The sediments were characterized in terms of several physical, chemical, and mineralogical properties judged to be most important for separating radioactive materials and hazardous metals from the sediment matrix. The properties include particle size, distribution, effects of heating at 600°C, electrophoretic properties, magnetic separation, acid leaching, and analyses using ultra-violet light, infra-red, and x-ray diffraction. The results show that most radioactive and hazardous metals are present in the ≤ 150 micron size fraction and that 80% of the sediments occur in the ≥ 150 micron size fraction. No significant concentration of hazardous metals was found to be related to magnetic properties. Organic matter, probably as a thin film, was shown to be present. The mineralogy of the samples include quartz, chlorite, kaolinite, illite, calcite, and dolomite. 3 refs., 17 figs., 5 tabs.

2184 (EGG-WTD-9749) Characterization studies on: (A) Contaminated batch of Rocky Flats soil (B) Uncontaminated batch of INEL soil. Lee, Jae-Ho; Martins, G.P.; Weidner, J.R. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jun 1991. 50p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE91018785. Source: OSTI; NTIS; INIS; GPO Dep.

Transuranic waste (TRU) contaminated soil samples collected near Rocky Flats 903 Pad and uncontaminated INEL soil collected from the Lost River spreading area A adjacent to the Radioactive Waste Management Complex were characterized in the analytical facilities of the Department of Metallurgical and Materials Engineering, Colorado School of Mines. The soils were characterized in terms of chemical, physical and mineralogical properties judged to be important for separating hazardous materials from the soil matrix. These properties include particle size distribution, density measurements, determination of micro-morphology, micro-chemical analysis, cation exchange capacity, and mineralogical and chemical analysis. The results indicate that the two soils are distinctly different from one another, but share some features. Rocky Flats soils contain about 47 wt% quartz, 38 wt% clay minerals, 13 wt% feldspars, and minor constituents. INEL soil contains about 37 wt% quartz, 48 wt% clay minerals, 10 wt% calcite, and minor constituents. The cation exchange capacities of each soil are low and are approximately the same when ashed. The radioactivity, relative to unclassified soil, as a function of particle size suggests that TRU metals are concentrated by a factor of approximately 20% in the less than 300 μ m particle size fraction. 29 figs.

2185 (EGG-WTD-9845) A computational model for viscous fluid flow, heat transfer, and melting in in situ vitrification melt pools. McHugh, P.R.; Ramshaw, J.D. EG and G Idaho, Inc., Idaho Falls, ID (United States). Nov 1991. 97p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012215. Source: OSTI; NTIS; INIS; GPO Dep.

MAGMA is a FORTRAN computer code designed to viscous flow in in situ vitrification melt pools. It models three-dimensional, incompressible, viscous flow and heat transfer. The momentum equation is coupled to the temperature field through the buoyancy force terms arising from the Boussinesq approximation. All fluid properties, except density, are assumed variable. Density is assumed constant except in the buoyancy force terms in the momentum equation. A simple melting model based on the enthalpy method allows the study of the melt front progression and latent heat effects. An indirect addressing scheme used in the numerical solution of the momentum equation voids unnecessary calculations in cells devoid of liquid. Two-dimensional calculations can be performed using either rectangular or cylindrical coordinates, while three-dimensional calculations use rectangular coordinates. All derivatives are approximated by finite differences. The incompressible Navier-Stokes equations are solved using a new fully implicit iterative technique, while the energy equation is differenced explicitly in time. Spatial derivatives are written in conservative form using a uniform, rectangular, staggered mesh based on the marker and cell placement of variables. Convective terms are differenced using a weighted average of centered and donor cell differencing to ensure numerical stability. Complete descriptions of MAGMA governing equations, numerics, code structure, and code verification are provided. 14 refs.

2186 (EGG-WTD-9980) Identification of buried structures (aerial surveillance and analysis of buried waste) long-range project plan. Williams, K.L. EG and G Idaho, Inc., Idaho Falls, ID (United States). Nov 1991. 31p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012216. Source: OSTI; NTIS; INIS; GPO Dep.

This long-range plan presents the plan (i.e., budget, schedule, justification, and plans for technology deployment) for implementation of the Identification of Buried Structures project. Two subcontractors will test and demonstrate their technologies at the Idaho National Engineering Laboratory during October and November 1991, and will analyze their data and submit final reports to EG&G Idaho, Inc., by the end of December 1991. By February 21, 1992, EG&G Idaho will present a final report to the Department of Energy, assessing the subcontractor's results and recommending further action.

2187 (EGG-WTD-10180) Evaluation of airborne thermal, magnetic, and electromagnetic characterization technologies. Josten, N.E. EG and G Idaho, Inc., Idaho Falls, ID (United States). Mar 1992. 69p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92013101. Source: OSTI; NTIS; INIS; GPO Dep.

The identification of Buried Structures (IBS) or Aerial Surveillance Project was initiated by the US Department of Energy (DOE) Office of Technology Development to demonstrate airborne methods for locating and identifying buried waste and ordnance at the Idaho National Engineering Laboratory (INEL). Two technologies were demonstrated: (a) a

thermal infrared imaging system built by Martin Marietta Missile Systems and (b) a magnetic and electromagnetic (EM) geophysical surveying system operated by EBASCO Environmental. The thermal system detects small differences in ground temperature caused by uneven heating and cooling of the ground by the sun. Waste materials on the ground can be detected when the temperature of the waste is different than the background temperature. The geophysical system uses conventional magnetic and EM sensors. These sensors detect disturbances caused by magnetic or conductive waste and naturally occurring magnetic or conductive features of subsurface soils and rock. Both systems are deployed by helicopter. Data were collected at four INEL sites. Tests at the Naval Ordnance Disposal Area (NODA) were made to evaluate capabilities for detecting ordnance on the ground surface. Tests at the Cold Simulated Waste Demonstration Pit were made to evaluate capabilities for detecting buried waste at a controlled site, where the location and depth of buried materials are known. Tests at the Subsurface Disposal Area and Stationary Low-Power Reactor-1 burial area were made to evaluate capabilities for characterizing hazardous waste at sites that are typical of DOE buried waste sites nationwide.

2188 (EGG-WTD-10507) In situ secondary ion mass spectrometry analysis: 1992 Summary report. Groenewold, G.S.; Applehans, A.D.; Ingram, J.C.; Delmore, J.E.; Dahl, D.A. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jan 1993. 31p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93012185. Source: OSTI; NTIS; GPO Dep.

The direct detection of tributyl phosphate (TBP) on rocks using molecular beam surface analysis [MBSA or in situ secondary ion mass spectrometry (SIMS)] is demonstrated. Quantities as low as 250 ng were detected on basalt and sandstone with little or no sample preparation. Detection of TBP on soil has proven to be more problematic and requires further study. Ethylenediaminetetraacetic acid (EDTA) is more difficult to detect because it is very reactive with surfaces of interest. Nevertheless, it is possible to detect EDTA if the acidity of the surface is controlled. The detection of EDTA-metal complexes is currently an open question, but evidence is presented for the detection of ions arising from a EDTA-lead complex. Carboxylic acids (i.e., citric, ascorbic, malic, succinic, malonic, and oxalic) give characteristic SIM spectra, but their detection on sample surfaces awaits evaluation.

2189 (EGG-WTD-10566) Rapid Geophysical Surveyor: Final report. Roybal, L.G.; Carpenter, G.S.; Josten, N.E. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jan 1993. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93007641. Source: OSTI; NTIS; INIS; GPO Dep.

The Rapid Geophysical Surveyor (RGS) is a system designed to rapidly and economically collect closely-spaced geophysical data used for characterization of US Department of Energy waste sites. Geophysical surveys of waste sites are an important first step in the remediation and closure of these sites; especially older sites where historical records are inaccurate and survey benchmarks have changed because of refinements in coordinate controls and datum changes. Closely-spaced data are required to adequately differentiate pits, trenches, and soil vault rows whose edges may be only a few feet from each other. A prototype vehicle designed to collect magnetic field data was built at the Idaho National Engineering Laboratory (INEL) during the

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summer of 1992. The RGS was funded by the Buried Waste Integrated Demonstration program. This vehicle was demonstrated at the Subsurface Disposal Area (SDA) within the Radioactive Waste Management Complex at the INEL in September 1992. Magnetic data were collected over two areas in the SDA, with a total survey area of about 1.7 acres. Data were collected at a nominal density of $2\frac{1}{2}$ in. along survey lines spaced 1-ft apart. Over 350,000 data points were collected over a 6 day period corresponding to about 185 worker-days using conventional ground survey techniques.

2190 (EGG-WTD-10663) Factors affecting thermal infrared images at selected field sites. Sisson, J.B.; Ferguson, J.S. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jul 1993. 145p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94002850. Source: OSTI; NTIS; INIS; GPO Dep.

A thermal infrared (TIR) survey was conducted to locate surface ordnance in and around the Naval Ordnance Disposal Area, and a thermal anomaly was found. This report documents studies conducted to identify the position of cause of the thermal anomaly. Also included are results of a long path Fourier transform infrared survey, soil sampling activities, soil gas surveys, and buried heater studies. The results of these studies indicated that the thermal anomaly was caused by a gravel pad, which had thermal properties different than those of the surrounding soil. Results from this investigation suggest that TIR is useful for locating surface objects having a high thermal inertia compared to the surrounding terrain, but TIR is of very limited use for characterizing buried waste or other similar buried objects at the INEL.

2191 (EGG-WTD-10677) Application of neural networks to waste site screening. Dabiri, A.E.; Garrett, M.; Kraft, T.; Hilton, J.; VanHammersveld, M. EG and G Idaho, Inc., Idaho Falls, ID (United States). Feb 1993. 142p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93012163. Source: OSTI; NTIS; INIS; GPO Dep.

Waste site screening requires knowledge of the actual concentrations of hazardous materials and rates of flow around and below the site with time. The present approach consists primarily of drilling boreholes near contaminated sites and chemically analyzing the extracted physical samples and processing the data. This is expensive and time consuming. The feasibility of using neural network techniques to reduce the cost of waste site screening was investigated. Two neural network techniques, gradient descent back propagation and fully recurrent back propagation were utilized. The networks were trained with data received from Westinghouse Hanford Corporation. The results indicate that the network trained with the fully recurrent technique shows satisfactory generalization capability. The predicted results are close to the results obtained from a mathematical flow prediction model. It is possible to develop a new tool to predict the waste plume, thus substantially reducing the number of the bore sites and samplings. There are a variety of applications for this technique in environmental site screening and remediation. One of the obvious applications would be for optimum well siting. A neural network trained from the existing sampling data could be utilized to decide where would be the best position for the next bore site. Other applications are discussed in the report.

2192 (EGG-WTD-10875) Test plan for the Rapid Geophysical Surveyor. Roybal, L.G. EG and G Idaho, Inc.,

Idaho Falls, ID (United States). Jun 1993. 39p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94002846. Source: OSTI; NTIS; INIS; GPO Dep.

This document describes the test plan for demonstrating and testing a set of optically pumped cesium-based total field magnetometers using the Rapid Geophysical Surveyor platform. The proposed testing will be used to assess the function of these magnetometers as deployed on the Rapid Geophysical Surveyor and evaluate the practical utility of high resolution magnetic data for supporting waste retrieval efforts.

2193 (ES/ER/TM-26/R1) Project plan for the Background Soil Characterization Project on the Oak Ridge Reservation, Oak Ridge, Tennessee. Oak Ridge National Lab., TN (United States). Aug 1992. 159p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93000788. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental Sciences Division Publication 3818.

The Background Soil characterization Project (BSCP) will provide background concentration levels of selected metals, organic compounds, and radionuclides in soils from uncontaminated on-site areas at the Oak Ridge Reservation (ORR), and off-site in the western part of Roane County and the eastern part of Anderson County. The BSCP will establish a database, recommend how to use the data for contaminated site assessment, and provide estimates of the potential human health and environmental risks associated with the background level concentrations of potentially hazardous constituents.

2194 (ES/ER/TM-33) Approach and strategy for performing ecological risk assessments for the Department of Energy Oak Ridge Field Office Environmental Restoration Program: Environmental Restoration Program. Suter, G.W. II; Redfearn, A.; White, R.K.; Shaw, R.A. Oak Ridge National Lab., TN (United States). Jul 1992. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92019010. Source: OSTI; NTIS; INIS; GPO Dep.

This document is intended to supplement existing US Environmental Protection Agency (EPA) guidance for ecological risk assessment at hazardous waste sites by providing guidance that is more specific and more tailored to US Department of Energy sites than the guidance available from the EPA. However, it is a conceptual strategy document and does not include specific guidance on data, assumptions, and models. That detailed guidance is under development and will be presented in subsequent documents. Ecological risk assessments are equal to human health risk assessments in regulatory importance and can use many of the same data and some of the same estimation methods. However, they also have peculiar data needs and methods. Ecological risk assessments begin with an initial scoping phase, termed hazard definition, that characterizes the sources, the potentially environment, and the assessment endpoints. In the subsequent measurement and estimation phase, in which data are obtained concerning source of the endpoint biota to the contaminants and the effects of those exposures, and assumptions and models are used to relate the data to the desired exposure and effects parameters. Finally, in an integration phase, termed risk characterization, the various exposure and effects estimates are combined to infer the existence, cause, magnitude, and extent of effects of contaminants on the ecological endpoints. This phase is

much more complicated for ecological risk assessments than for human health assessments because more types of data are available. Ecological risk assessments estimate effects using laboratory toxicity test results, like human health assessments, but also use results of ambient toxicity tests and biological surveys.

2195 (ES/ER/TM-62) Aerial remote sensing surveys progress report: Helicopter geophysical survey of the Oak Ridge Reservation. Doll, W.E. (Oak Ridge National Lab., TN (United States)); Nyquist, J.E.; King, A.D.; Bell, D.T.; Holladay, J.S.; Labson, V.F.; Pellerin, L. Oak Ridge National Lab., TN (United States). Mar 1993. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93011828. Source: OSTI; NTIS; INIS; GPO Dep.

The 35,252 acre Department of Energy Oak Ridge Reservation (ORR) in the western portion of the Appalachian Valley and Ridge Province in Tennessee, has been a nuclear production and development facility for 50 years. Contaminants in the many waste sites on the ORR include a wide variety of radioactive isotopes as well as many organic and inorganic compounds. The locations, geometry, and contents of many of these waste sites are reasonably well known, while others are poorly known or unknown. To better characterize the reasonably well known sites and search for additional potentially environmentally hazardous sites, a two-phase aerial survey of the ORR was developed. Phase I began in March 1992 and consisted of aerial radiation, multispectral scanner, and photographic (natural color and color infrared) surveys. Phase II began in November 1992 and is described in this report. Phase II consisted of helicopter electromagnetic (HEM), magnetic, and gamma radiation surveys. Targets of the survey included both man-made (drums, trench boundaries, burn pits, well heads) and geologic (fractures, faults, karst features, geologic contacts) features. The Phase II survey has three components: testing, reconnaissance, and high-resolution data acquisition. To date, the testing and reconnaissance data acquisition have been completed, and some of the data have been processed. They indicate that: (1) magnetic and HEM data are complementary and do not always highlight the same anomaly; (2) under favorable circumstances, helicopter magnetometer systems are capable of detecting groups of four or more 55-gal drums at detector altitudes of 15 m or less; (3) HEM data provide data that compare favorably with surface data collected over burial trenches, (4) well casings may be related to magnetic monopole anomalies, as would be expected; and (5) changes in HEM and magnetic anomaly character are related to lithologic changes and may be used to track contacts between known outcrops.

2196 (ES/ER/TM-78) Methodology for estimating radiation dose rates to freshwater biota exposed to radionuclides in the environment. Blaylock, B.G.; Frank, M.L.; O'Neal, B.R. Oak Ridge National Lab., TN (United States). Aug 1993. 39p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94009495. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this report is to present a methodology for evaluating the potential for aquatic biota to incur effects from exposure to chronic low-level radiation in the environment. Aquatic organisms inhabiting an environment contaminated with radioactivity receive external radiation from radionuclides in water, sediment, and from other biota such as vegetation. Aquatic organisms receive internal radiation from radionuclides ingested via food and water and, in some

cases, from radionuclides absorbed through the skin and respiratory organs. Dose rate equations, which have been developed previously, are presented for estimating the radiation dose rate to representative aquatic organisms from alpha, beta, and gamma irradiation from external and internal sources. Tables containing parameter values for calculating radiation doses from selected alpha, beta, and gamma emitters are presented in the appendix to facilitate dose rate calculations. The risk of detrimental effects to aquatic biota from radiation exposure is evaluated by comparing the calculated radiation dose rate to biota to the U.S. Department of Energy's (DOE's) recommended dose rate limit of 0.4 mGy h^{-1} (1 rad d^{-1}). A dose rate no greater than 0.4 mGy h^{-1} to the most sensitive organisms should ensure the protection of populations of aquatic organisms. DOE's recommended dose rate is based on a number of published reviews on the effects of radiation on aquatic organisms that are summarized in the National Council on Radiation Protection and Measurements Report No. 109 (NCRP 1991). DOE recommends that if the results of radiological models or dosimetric measurements indicate that a radiation dose rate of 0.1 mGy h^{-1} will be exceeded, then a more detailed evaluation of the potential ecological consequences of radiation exposure to endemic populations should be conducted.

2197 (ES/ER/TM-85) Toxicological benchmarks for screening potential contaminants of concern for effects on terrestrial plants: Environmental Restoration Program. Suter, G.W. II; Will, M.E.; Evans, C. Oak Ridge National Lab., TN (United States). Sep 1993. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94009875. Source: OSTI; NTIS; INIS; GPO Dep.

One of the initial stages in ecological risk assessment for hazardous waste sites is the screening of contaminants to determine which of them are worthy of further consideration as "contaminants of potential concern." This process is termed "contaminant screening." It is performed by comparing measured ambient concentrations of chemicals to benchmark concentrations. Currently, no standard benchmark concentrations exist for assessing contaminants in soil with respect to their toxicity to plants. This report presents a standard method for deriving benchmarks for this purpose (phytotoxicity benchmarks), a set of data concerning effects of chemicals in soil or soil solution on plants, and a set of phytotoxicity benchmarks for 34 chemicals potentially associated with US Department of Energy (DOE) sites. Chemicals that are found in soil at concentrations exceeding both the phytotoxicity benchmark and the background concentration for the soil type should be considered contaminants of potential concern. The purpose of this report is to present plant toxicity data and discuss their utility as benchmarks for determining the hazard to terrestrial plants caused by contaminants in soil. Benchmarks are provided for soils and solutions.

2198 (ES/ER/TM-91) Environmental Restoration Program pollution prevention checklist guide for the facility characterization project phase. Martin Marietta Energy Systems, Inc., Oak Ridge, TN (United States). Sep 1993. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94001034. Source: OSTI; NTIS; INIS; GPO Dep.

A facility characterization (FC) is conducted to determine the nature and extent contamination at a potential hazardous facility waste site. The information gathered during an FC includes (1) data on the volume and chemical nature

of the waste, (2) information on the extent of contamination and the migration potential of the contaminants, (3) preliminary information on evaluation of alternative concepts that can or cannot be considered, and (4) supportive technical and cost data. For the purposes of identification, the following operational phases will be used for definition for this phase of the decommissioning and decontamination process (1) facility characterization before clean up, (2) characterization during clean up, (3) characterization of waste materials, and (4) site characterization after clean up. A key consideration in this process is the prevention of any waste to be generated from these characterization activities. The purpose of this checklist guide is to assist users with incorporating pollution prevention/waste minimization (PP/WM) in all FC phase projects of the Environmental Restoration (ER) Program. This guide will help users document PP/WM activities for technology transfer and reporting requirements. Automated computer screens will be created from the checklist data to assist users with implementing and evaluating waste reduction.

2199 (ES/ER/TM-95) Toxicological benchmarks for screening potential contaminants of concern for effects on sediment-associated biota: Environmental Restoration Program ESD Publication 4107. Hull, R.N.; Suter, G.W. II. Oak Ridge National Lab., TN (United States). Aug 1993. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94006324. Source: OSTI; NTIS; INIS; GPO Dep.

Because a hazardous waste site may contain hundreds of chemicals, it is important to screen contaminants of concern for the ecological risk assessment. Often this screening is done as part of a Screening Assessment, the purpose of which is to evaluate the available data, identify data gaps, and screen potential contaminants of concern. Screening may be accomplished by using a set of toxicological benchmarks. These benchmarks are helpful in determining whether contaminants warrant further assessment or are at a level that requires no further attention. If a chemical concentration or the reported detection limit exceeds a proposed lower benchmark, more analysis is needed to determine the hazards posed by that chemical. If, however, the chemical concentration falls below the lower benchmark value, the chemical may be eliminated from further study. This report briefly describes three categories of approaches to the development of sediment quality benchmarks. These approaches are based on analytical chemistry, toxicity test results, and field survey data. A fourth integrative approach incorporates all three types of data.

2200 (ES/ER/TM-96) Toxicological benchmarks for screening of potential contaminants of concern for effects on aquatic biota on the Oak Ridge Reservation, Oak Ridge, Tennessee: Environmental Restoration Program ESD Publication 3940. Sutter, G.A. II (Oak Ridge National Lab., TN (United States)); Futrell, M.A.; Kerchner, G.A. Oak Ridge National Lab., TN (United States). Sep 1992. 80p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94006320. Source: OSTI; NTIS; GPO Dep.

This report presents potential screening benchmarks for protection of aquatic life from contaminants in water. Because there is no guidance for screening benchmarks, a set of alternative benchmarks is presented here. The alternative benchmarks are based on different conceptual approaches to estimating concentrations causing significant effects. For the upper screening benchmark, they are the acute National

Ambient Water Quality Criterion (NAWQC) and the acute pesticide advisory value (a concentration that is estimated with 95% confidence not to exceed the unknown acute NAWQC for those chemicals with no NAWQC). The alternative chronic benchmarks are the chronic NAWQC, the chronic pesticide screening value, the lowest chronic values for fish and daphnids, the lowest concentration that produces a response in 20% of fish and daphnids [effective concentration 20 (EC₂₀)] as established through chronic toxicity tests, the estimated EC₂₀ for a sensitive species, and the concentration estimated to cause a 20% reduction in the recruit abundance of largemouth bass. It is recommended that ambient chemical concentrations be compared to all of these benchmarks. To the extent that toxicity data are available, this report presents the alternative benchmarks for chemicals that have been detected on the Oak Ridge Reservation. It also presents the data used to calculate the benchmarks, and the sources of the data. It compares the benchmarks and discusses their relative conservatism and utility.

2201 (ES/ER/TM-97) Strategic plan for the utilization of remote sensing technologies in the environmental restoration program. King, A.D.; Doll, W.E.; Durfee, R.C.; Luxmoore, R.J.; Conder, S.R.; Nyquist, J.E. Oak Ridge National Lab., TN (United States). Dec 1993. 34p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94006503. Source: OSTI; NTIS; INIS; GPO Dep.

The objectives of the Environmental Restoration (ER) Remote Sensing and Special Surveys Program are to apply state-of-the-art remote sensing and geophysical technologies and to manage routine and remotely-sensed examinations of the Oak Ridge Reservation (ORR), the Paducah Gaseous Diffusion Plant (PGDP), the Portsmouth Gaseous Diffusion Plant (PORTS), and their adjacent off-site areas. Repeated multispectral scanner (MSS) imagery, gamma, and photographic surveys will allow monitoring of the degradation that might occur in waste containment vessels and monitoring (at a later stage in the remediation life cycle) of improvements from restoration efforts and cleanup. These technologies, in combination with geophysical surveys, will provide an effective means for identifying unknown waste sites and contaminant transport pathways. All of the data will be maintained in a data base that will be accessible to site managers in the ER Program. The complete analysis of collected data will provide site-specific data to the ER Program for characterizing and monitoring ER Program hazardous waste sites.

2202 (ES/ESH-36) Paducah Gaseous Diffusion Plant environmental report for 1992. Horak, C.M. (ed.) (Martin Marietta Energy Systems, Inc., Oak Ridge, TN (United States)). Martin Marietta Energy Systems, Inc., Oak Ridge, TN (United States); Paducah Gaseous Diffusion Plant, KY (United States). Sep 1993. 353p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-76OR00001 ; AC05-84OR21400. Order Number DE94001937. Source: OSTI; NTIS; INIS; GPO Dep.

This two-part report, Paducah Gaseous Diffusion Plant Environmental Report for 1992, is published annually. It reflects the results of an environmental monitoring program designed to quantify potential increases in the concentration of contaminants and potential doses to the resident human population. The Paducah Gaseous Diffusion Plant (PGDP) overall goal for environmental management is to protect the environment and PGDP's neighbors and to maintain full

compliance with all current regulations. The current environmental strategy is to identify any deficiencies and to develop a system to resolve them. The long-range goal of environmental management is to minimize the source of pollutants, reduce the generation of waste, and minimize hazardous waste by substitution of materials.

2203 (ES/ESH-37) Portsmouth Gaseous Diffusion Plant environmental report for 1992. Horak, C.M. (ed.) (Martin Marietta Energy Systems, Inc., Oak Ridge, TN (United States)). Martin Marietta Energy Systems, Inc., Oak Ridge, TN (United States); Portsmouth Gaseous Diffusion Plant, OH (United States). Sep 1993. 285p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400 ; AC05-76OR00001. (POEF-3030). Order Number DE94001936. Source: OSTI; NTIS; INIS; GPO Dep.

This calendar year (CY) 1992 annual report on environmental surveillance of the US Department of Energy's (DOE's) Portsmouth Gaseous Diffusion Plant (PORTS) and its environs consists of two parts: narrative, summaries, and conclusions (Part 1) and data presentation (Part 2). The objectives of this report are to: (1) report 1992 monitoring data for the installation and its environs that may have been affected by operations on the plant site, (2) provide reasonably detailed information about the plant site and plant operations, (3) provide detailed information on input and assumptions used in all calculations, (4) provide trend analyses (where appropriate) to indicate increases and decreases in environmental impact, and (5) provide general information on plant quality assurance.

2204 (ESTSC-000597IBMPC00) GWSCREEN2.0: Groundwater Screen. Rood, A.S. (Idaho National Engineering Lab., Idaho Falls, ID (United States)). EG and G Idaho, Inc., Idaho Falls, ID (United States). 1 Jun 1993. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Source: ESTSC.

Description: IBM PC; MS DOS 5.0; FORTRAN77; 1 3.5 Diskette. The default input file name is GWSCREEN.PAR and the default output file name is GWSCREEN.OUT. The user may use any MS DOS legal file name (Maximum of 12 characters). In the sample problems, the following conventions were used. filename.PAR Input file that contains values to the GWSCREEN parameters and variables. filename.OUT Output file for the maximum concentration calculation and limiting soil of pond effluent concentration. filename.LST Output file for concentration verses time output.

GWSCREEN was developed for assessment of the groundwater pathway from leaching of radioactive and non radioactive substances from surface or buried sources and release to percolation ponds. The code calculates the limiting soil concentration or effluent release concentration such that, after leaching and transport to the aquifer, regulatory contaminant levels in groundwater are not exceeded. The code uses a mass conservation approach to model three processes: Contaminant release from a source volume, contaminant transport in the unsaturated zone, and contaminant transport in the saturated zone. The source model considers the sorptive properties and solubility of the contaminant. Transport in the saturated zone is calculated with a semi-analytical solution to the advection dispersion equation in groundwater. Concentration as a function of time at a user specified receptor point and maximum concentration averaged over the exposure interval are also calculated. In addition, the code calculates transport and impacts of radioactive progeny. Input to GWSCREEN is through one,

free format ASCII file. This code was designed for assessment and screening of the groundwater pathway when field data is limited. It was not intended to be a predictive tool.

2205 (ESTSC-000597IBMPC01) GWSCREEN2.01: Groundwater Screen. Rood, A.S. (Idaho National Engineering Lab., Idaho Falls, ID (United States)). EG and G Idaho, Inc., Idaho Falls, ID (United States). 1 Aug 1993. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Source: ESTSC.

Description: IBM PC; MS DOS 5.0; FORTRAN77; 1 3.5 Diskette. The default input file name is GWSCREEN.PAR and the default output file name is GWSCREEN.OUT. The user may use any MS DOS legal file name (Maximum of 12 characters). In the sample problems, the following conventions were used. filename.PAR Input file that contains values to the GWSCREEN parameters and variables. filename.OUT Output file for the maximum concentration calculation and limiting soil of pond effluent concentration. filename.LST Output file for concentration verses time output.

GWSCREEN was developed for assessment of the groundwater pathway from leaching of radioactive and non radioactive substances from surface or buried sources and release to percolation ponds. The code calculates the limiting soil concentration or effluent release concentration such that, after leaching and transport to the aquifer, regulatory contaminant levels in groundwater are not exceeded. The code uses a mass conservation approach to model three processes: Contaminant release from a source volume, contaminant transport in the unsaturated zone, and contaminant transport in the saturated zone. The source model considers the sorptive properties and solubility of the contaminant. Transport in the unsaturated zone is described by a plug flow model. Transport in the saturated zone is calculated with a semi-analytical solution to the advection dispersion equation in groundwater. Concentration as a function of time at a user specified receptor point and maximum concentration averaged over the exposure interval are also calculated. In addition, the code calculates transport and impacts of radioactive progeny. Input to GWSCREEN is through one, free format ASCII file. This code was designed for assessment and screening of the groundwater pathway when field data is limited. It was not intended to be a predictive tool.

2206 (ESTSC-000597IBMPC02) GWSCREEN2.02: Groundwater Screen. Rood, A.S. (EG and G Idaho Inc., Idaho Falls, ID (United States)). EG and G Idaho, Inc., Idaho Falls, ID (United States). 1 Aug 1993. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Source: ESTSC.

Description: IBM PC; MS DOS 5.0; FORTRAN77; 1 3.5 Diskette. The default input file name is GWSCREEN.PAR and the default output file name is GWSCREEN.OUT. The user may use any MS DOS legal file name (Maximum of 12 characters). In the sample problems, the following conventions were used. filename.PAR Input file that contains values to the GWSCREEN parameters and variables. filename.OUT Output file for the maximum concentration calculation and limiting soil of pond effluent concentration. filename.LST Output file for concentration verses time output.

GWSCREEN was developed for assessment of the groundwater pathway from leaching of radioactive and non radioactive substances from surface or buried sources and release to percolation ponds. The code calculates the limiting soil concentration or effluent release concentration such that, after leaching and transport to the aquifer, regulatory contaminant levels in groundwater are not exceeded. The

code uses a mass conservation approach to model three processes: Contaminant release from a source volume, contaminant transport in the unsaturated zone, and contaminant transport in the saturated zone. The source model considers the sorptive properties and solubility of the contaminant. Transport in the unsaturated zone is described by a plug flow model. Transport in the saturated zone is calculated with a semi-analytical solution to the advection dispersion equation in groundwater. Concentration as a function of time at a user specified receptor point and maximum concentration averaged over the exposure interval are also calculated. In addition, the code calculates transport and impacts of radioactive progeny. Input to GWSCREEN is through one, free format ASCII file. This code was designed for assessment and screening of the groundwater pathway when field data is limited. It was not intended to be a predictive tool.

2207 (FEMP-2301) Accuracy, precision, and lower detection limits (a deficit reduction approach). Bishop, C.T. Fernald Environmental Restoration Management Corp., Cincinnati, OH (United States). 12 Oct 1993. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-92OR21972. (CONF-9310228-1: 39. annual conference on bioassay, analytical and environmental radiochemistry, Colorado Springs, CO (United States), 11-15 Oct 1993). Order Number DE94003189. Source: OSTI; NTIS; INIS; GPO Dep.

The evaluation of the accuracy, precision and lower detection limits of the determination of trace radionuclides in environmental samples can become quite sophisticated and time consuming. This in turn could add significant cost to the analyses being performed. In the present method, a "deficit reduction approach" has been taken to keep costs low, but at the same time provide defensible data. In order to measure the accuracy of a particular method, reference samples are measured over the time period that the actual samples are being analyzed. Using a Lotus spreadsheet, data are compiled and an average accuracy is computed. If pairs of reference samples are analyzed, then precision can also be evaluated from the duplicate data sets. The standard deviation can be calculated if the reference concentrations of the duplicates are all in the same general range. Laboratory blanks are used to estimate the lower detection limits. The lower detection limit is calculated as 4.65 times the standard deviation of a set of blank determinations made over a given period of time. A Lotus spreadsheet is again used to compile data and LDLs over different periods of time can be compared.

2208 (FEMP-2334) Characterization of the vadose zone (Glacial tills). Bishop, P. (Cincinnati Univ., OH (United States)); Allmon, L.A.; Broberg, K.A.; Hiestand, R.J. Westinghouse Environmental Management Co. of Ohio, Cincinnati, OH (United States). Fernald Environmental Management Project. Mar 1994. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-92OR21972. (CONF-9304242-Summ.: Fernald Environmental Management Project (FEMP) industrial workshop on characterization of the Vados Zone (Glacial Tills), Cincinnati, OH (United States), 15-16 Apr 1993). Order Number DE94009569. Source: OSTI; NTIS; GPO Dep.

The objectives of the workshop were to understand and assess the principles governing contaminant transport in glacial till, a medium that is strongly heterogeneous and anisotropic. The workshop acquainted the participants with the state of the art in understanding physical and chemical processes associated with contaminant transport in the

vadose zone. While the scope of the workshop was comprehensive, the emphasis was placed on the role of sediment heterogeneity and anisotropy flow and transport processes. Each process was discussed in detail and was illustrated with case studies whenever possible so that the Fernald staff could benefit from the knowledge gained from earlier work. The intent of the workshop was to exchange new ideas and technologies. The strengths and weaknesses of current approaches and remedial techniques in dealing with glacial tills were explored. The workshop was structured to provide both theoretical and practical benefit to participants with diverse professional background.

2209 (GRI-91/0046) Pipeline corridors through wetlands—impacts on plant and avian diversity: Boreal wetlands, Oconto County, Wisconsin: Topical report, February 1990–November 1991. Zimmerman, R.E. (Argonne National Lab., IL (United States)); Pentecost, E.D.; Van Dyke, G.D.; Hackney, C.T. Gas Research Inst., Chicago, IL (United States); Argonne National Lab., IL (United States). Nov 1991. 55p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE92006556. Source: OSTI; NTIS; GPO Dep.

A study was conducted to quantify the impacts of a 20-year-old pipeline right-of-way (ROW) through a boreal forest wetland in Oconto County, Wisconsin. Two study sites were selected where the wetland extended more than 1000 m (3300 ft) along the pipeline, was at least 100 m (330 ft) wide, and extended at least 50 m (165 ft) in both directions from the center of the ROW. Study-specific methodologies were developed to collect and analyze soil, topographic, hydrologic, vegetative, and avian data. The study showed the following: (1) the types of natural wetland areas adjacent to the ROW were not altered; (2) the restriction of water sheet flow that occurred at one site has been reversed by nature; (3) none of the nonnative plant species found on the ROW have invaded the adjacent natural areas; (4) the ROW has provided edges and open water typically lacking in boreal forest wetland that increase both plant and animal species diversity and provide habitat for two sensitive species – the sandhill crane and the showy ladyslipper; (5) three-quarters of the ROW area sampled has been and continues to be wetland, while one-quarter of the ROW area sampled is upland, which increases the diversity of the area; and (6) the permit requirement to provide free access to the public has had a detrimental effect on the vegetative cover on the ROW.

2210 (IS-5082) Technology projects for characterization—monitoring of volatile organic compounds (VOCs). Junk, G.A.; Haas, W.J. Jr. Ames Lab., IA (United States). Jul 1992. 99p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-82. Order Number DE93040933. Source: OSTI; NTIS; INIS; GPO Dep.

One hundred thirty technology project titles related to the characterization of volatile organic compounds (VOCs) at an arid site are listed alphabetically by first contact person in a master compilation that includes phone numbers, addresses, keywords, and short descriptions. Separate tables are presented for 62 field-demonstrated, 36 laboratory-demonstrated, and 35 developing technology projects. The technology projects in each of these three categories are also prioritized in separate summary tables. Additional tables are presented for a number of other categorizations of

the technology projects: In Situ; Fiberoptic; Mass Spectrometer; Optical Spectroscopy; Raman or SERS; Ion Mobility or Acoustic; Associated; and Commercial. Four lists of contact person names are provided so details concerning the projects that deal with sampling, and VOCs in gases, waters, and soils (sediments) can be obtained. Finally, seven wide-ranging conclusions based on observations and experiences during this work are presented.

2211 (IS-5085) Application of non-radiometric methods to the determination of plutonium: Literature review conducted for the Buried Waste Integrated Program. Edelson, M.C. Ames Lab., IA (United States). 5 Mar 1992. 39p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-82. Order Number DE94005568. Source: OSTI; NTIS; INIS; GPO Dep.

This literature review was motivated by discussions that took place during a review of contamination control technologies proposed for INEL (buried waste). It should be a useful tool in identifying non-radiation measurement techniques for Pu and Am such as ICP-MS, which should fulfill the following criteria: apparatus must be field deployable; up to 100 samples per day; and lower levels of detection and required time must be listed. The sensitivity of ICP and RIMS is compared against that needed for contamination monitoring at INEL. Only Pu-241, with a required detection limit of 400 ppt, would challenge the sensitivity of ICP-MS; Pu-238 would be easily determined. The need to determine Pu-238 and Am-241 in the presence of U-238 and Pu-241 seems to preclude the possibility of using laser ablation ICP-MS for Pu monitoring. ICP-AES and -LEAFS methods may not have enough sensitivity to determine Pu-238 at 2 ppb level with confidence, but RIMS (resonance ionization mass spectroscopy) should be adequate. 47 refs, figs.

2212 (IS-5093) Chemical sensors technology development planning workshop. Bastiaans, G.J.; Haas, W.J. Jr.; Junk, G.A. (eds.). Ames Lab., IA (United States). Mar 1993. 55p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-82. (CONF-9206424-; Chemical sensors technology development planning workshop, Dallas, TX (United States), 15-16 Jun 1992). Order Number DE94005569. Source: OSTI; NTIS; INIS; GPO Dep.

The workshop participants were asked to: (1) Assess the current capabilities of chemical sensor technologies for addressing US Department of Energy (DOE) Environmental Restoration and Waste Management (EM) needs; (2) Estimate potential near term (one to two years) and intermediate term (three to five years) capabilities for addressing those needs; and (3) Generate a ranked list of specific recommendations on what research and development (R&D) should be funded to provide the necessary capabilities. The needs were described in terms of two pervasive EM problems, the in situ determination of chlorinated volatile organic compounds (VOCs), and selected metals in various matrices at DOE sites. The R&D recommendations were to be ranked according to the estimated likelihood that the product technology will be ready for application within the time frame it is needed and the estimated return on investment. The principal conclusions and recommendations of the workshop are as follows: Chemical sensors capable of in situ determinations can significantly reduce analytical costs; Chemical sensors have been developed for certain VOCs in gases and water but none are currently capable of in situ determination of VOCs in soils; The DOE need for in situ determination of metals in soils cannot be addressed with existing chemical sensors and the prospects for their availability in three to

five years are uncertain; Adaptation, if necessary, and field application of laboratory analytical instruments and those few chemical sensors that are already in field testing is the best approach for the near term; The chemical sensor technology development plan should include balanced support for near- and intermediate-term efforts.

2213 (IS-5096) Characterization, Monitoring and Sensor Technology Integrated Program. Ames Lab., IA (United States); USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). Office of Technology Development. [1993]. 77p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-82. (DOE/EM-0107P). Order Number DE93011563. Source: OSTI; NTIS; INIS; GPO Dep.

This booklet contains summary sheets that describe FY 1993 characterization, monitoring, and sensor technology (CMST) development projects. Currently, 32 projects are funded, 22 through the OTD Characterization, Monitoring, and Sensor Technology Integrated Program (CMST-IP), 8 through the OTD Program Research and Development Announcement (PRDA) activity managed by the Morgantown Energy Technology Center (METC), and 2 through Interagency Agreements (IAGs). This booklet is not inclusive of those CMST projects which are funded through Integrated Demonstrations (IDs) and other Integrated Programs (IPs). The projects are in six areas: Expedited Site Characterization; Contaminants in Soils and Groundwater; Geophysical and Hydrogeological Measurements; Mixed Wastes in Drums, Burial Grounds, and USTs; Remediation, D&D, and Waste Process Monitoring; and Performance Specifications and Program Support. A task description, technology needs, accomplishments and technology transfer information is given for each project.

2214 (K/ER-56) Electromagnetic survey of the K1070A burial ground at the Oak Ridge K-25 Site, Oak Ridge, Tennessee: Environmental Restoration Program. Nyquist, J.E.; Emery, M.S. Oak Ridge K-25 Site, TN (United States). Jan 1993. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OT21400. Order Number DE93008690. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental Sciences Division Publication 3988.

The K1070A burial ground, located at the K-25 Site on the Oak Ridge Reservation, received chemical and radioactive wastes from the late 1940s until 1975. Analysis of water samples collected from nearby monitoring wells indicates that contamination is migrating offsite. In November 1991, Oak Ridge National Laboratory (ORNL) personnel collected high-resolution electrical terrain conductivity data at the K1070A burial ground. A Model EM31 terrain conductivity meter manufactured by Geonics Limited was used in conjunction with the ORNL-developed Ultrasonic Ranging and Data System (USRADS) to perform the survey. The purpose of the survey was to provide Environmental Restoration (ER) staff with a detailed map of the spatial variation of the apparent electrical conductivity of the shallow subsurface (upper 3 m) to assist them in siting future monitoring wells closer to the waste area without drilling into the buried waste.

2215 (LA-11941-MS) Sigma Mesa: Background elemental concentrations in soil and vegetation, 1979. Ferenbaugh, R.W.; Gladney, E.S.; Brooks, G.H. Jr. Los Alamos National Lab., NM (United States). Oct 1990. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number

CHARACTERIZATION

DE91000018. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In 1979, soil and vegetation samples were collected on Sigma Mesa to provide background data before construction on the mesa. Elemental data are presented for soil, grass, juniper, pinon pine, and oak. None of the data looks out of the ordinary. The purpose of the sampling program was to acquire, before any disturbance, a set of data to be used as background for future impact analysis. 6 refs., 2 figs., 7 tabs.

2216 (LA-12195-MS) Determination of 100-year floodplain elevations at Los Alamos National Laboratory. McLin, S.G. Los Alamos National Lab., NM (United States). Aug 1992. 83p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93001895. Source: OSTI; NTIS; GPO Dep.

Includes MOSS source codes and data files on two 3.5 inch diskettes.

Under existing permit requirements, the US Environmental Protection Agency stipulates that facilities regulated by the Resource Conservation and Recovery Act must delineate all 100-yr floodplain elevations within their boundaries. At Los Alamos these floodplains are located within ungaged watersheds that drain Pajarito Plateau. This report documents the floodplain computational mapping procedure and, along with supporting maps, is intended to satisfy this permit requirement.

2217 (LA-12332-MS) Nuclear borehole logging applied to environmental restoration. Pickrell, M.M.; Conaway, J.G. Los Alamos National Lab., NM (United States). Jun 1992. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE92014273. Source: OSTI; NTIS; INIS; GPO Dep.

We have surveyed the spectrum of existing radiation-based borehole logging instruments that have been developed primarily for measuring subsurface geophysical properties for the petroleum industry. We have also surveyed the instruments used for uranium exploration. Many of these instruments share the same technology as nuclear instruments used for radiation monitoring and safeguards assay. We examined the possibility of using these instruments to measure environmental contaminants for the Los Alamos Environmental Restoration Program. Borehole logging can be used in environmental restoration (ER) to determine routinely needed parameters such as lithology, water content, formation density, fracturing, and so forth. We concentrated on more advanced borehole analysis techniques that can be used to identify and map contaminants. We found three applications in ER for which such techniques are particularly well suited. Long-term monitoring of wastes capped in place. Logs runs at regular time intervals should be effective for detecting and analyzing changes in the borehole contaminant concentrations. Reducing the number of samples required to be analyzed in the laboratory. Using borehole analytical techniques to augment sampling could allow the required number of samples to be reduced. This should result in substantial cost savings for some operable units because laboratory analysis of samples is generally costly. Improving confidence in contaminant assessments. Borehole logs present essentially a continuous record of parameters such as contaminant concentrations, greatly reducing the risk of significant error posed by taking small discrete samples. 58 refs.

2218 (LA-12572-ENV) Environmental surveillance at Los Alamos during 1991: Environmental protection

group. Dewart, J.; Kohen, K.L. (comps.). Los Alamos National Lab., NM (United States). Aug 1993. 363p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93019549. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes the environmental surveillance program conducted by Los Alamos National Laboratory during 1991. Routine monitoring for radiation and for radioactive and chemical materials is conducted on the Laboratory site as well as in the surrounding region. Monitoring results are used to determine compliance with appropriate standards and to permit early identification of potentially undesirable trends. Results and interpretation of data for 1991 cover external penetrating radiation; quantities of airborne emissions and effluents; concentrations of chemicals and radionuclides in ambient air, surface waters and groundwaters, municipal water supply, soils and sediments, and foodstuffs; and environmental compliance. Comparisons with appropriate standards, regulations, and background levels provide the basis for concluding that environmental effects from Laboratory operations are small and do not pose a threat to the public, Laboratory employees, or the environment.

2219 (LA-12650-MS) Data analysis of the 1984 and 1986 soil sampling programs at Materials Disposal Area T in the Los Alamos National Laboratory. Nyhan, J.W.; Drennon, B.J. Los Alamos National Lab., NM (United States). Sep 1993. 52p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE94002499. Source: OSTI; NTIS; INIS; GPO Dep.

An environmental surveillance program for Materials Disposal Area T (MDA-T) at Los Alamos, New Mexico is described. The waste-use history of this disposal site is described, followed by a description of the materials and methods used to analyze data from two surface soil radionuclide sampling programs performed at this disposal site. The disposal site's physical features are related to the spatial distribution of radionuclide concentration contours in an attempt to evaluate radionuclide migration mechanisms in and around the site. The usefulness of the data analysis efforts is evaluated and recommendations are made for future studies.

2220 (LA-12742-MS) LRAD-based airflow monitors. Caress, R.W.; MacArthur, D.W.; Allander, K.S.; Bounds, J.A.; Catlett, M.M.; Garner, S.E.; Johnson, J.D.; Johnson, J.P.; Rutherford, D.A. Los Alamos National Lab., NM (United States). Mar 1994. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE94007727. Source: OSTI; NTIS; GPO Dep.

Conventional alpha detectors depend upon detecting the alpha particle directly. This is often difficult because typical alpha particles generated by uranium or plutonium travel less than 3 cm in air. In contrast, the long-range alpha detector (LRAD) technology relies on detecting the ions generated by alpha particles as they lose their energy in air, rather than detecting the alpha particles themselves. We have designed, built, and used LRAD-based airflow monitors to detect alpha contamination. The airflow monitor is composed of a sample chamber with air and ion filters at one end and an ion detector at the opposite end. A set of small fans is located just outside the ion detector to provide an airflow that transports the ions into the ion detector. Ambient air enters through the particulate and ion filters, passes over and through an object located in the sample chamber, through the ion detector, then leaves the system through the fans. The number of ions present is proportional

to the amount of contamination on the object's surface. This work describes the design, construction, and testing of the LRAD-based airflow monitors.

2221 (LA-SUB-93-48) Development of an operational tool for biomonitoring using constant pressure respirometry: [Final report]. Zachritz, W.H. II (New Mexico State Univ., Las Cruces, NM (United States)); Morrow, J. Los Alamos National Lab., NM (United States); New Mexico State Univ., Las Cruces, NM (United States). 29 Jun 1992. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93008674. Source: OSTI; NTIS; INIS; GPO Dep.

The United States Environmental Protection Agency (US EPA) policy statement (FR 49, 9016, 9 March 1984) for the development of water quality based permit limitations includes toxicity testing of effluents as an important part of a water quality approach to controlling toxics (Pickering, 1988). To assure that state waters are free of toxics, both chemical and biological methods were recommended for assessing effluent quality. The US EPA validated bioassay procedures for toxicity testing of wastewater discharges use three distinctive organisms groups: vertebrates, invertebrates, and algae (Weber, 1989). The specific species for these three groups are fathead minnow, *Pimephales promelas*; water tea, *Ceriodaphnia dubia*; and the green algae, *Selenastrum capricornum*, respectively. Definitive testing estimates the concentration at which a certain percentage of organisms exhibit a certain response. The definitive test exposes several replicate groups of organisms to the target substrate for a predetermined time period effluent concentration. The overall goal of this study is to develop an acceptable protocol for operational biomonitoring based on constant pressure respirometry for LANL. The specific objectives include: Development an appropriate toxicity testing protocol based on constant pressure respirometry for whole effluent toxicity testing, and evaluate the protocol based on factors such as sensitivity, response time, cost of analysis, and simplicity of operation.

2222 (LA-SUB-93-83) Characterization of flow in fractured tuff using computerized tomography. Felice, C.W. (Terra Tek, Inc., Salt Lake City, UT (United States)); Sharer, J.C. Los Alamos National Lab., NM (United States); Terra Tek, Inc., Salt Lake City, UT (United States). Sep 1991. 40p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (TR-92-27). Order Number DE93008910. Source: OSTI; NTIS; INIS; GPO Dep.

The objective of this effort was to demonstrate TerraTek's capability to use X-ray computerized tomography (CT) to observe fluid flow down a fracture and rock matrix imbibition in a sample of Bandelier tuff. To accomplish the objective, a tuff sample 152.4 mm long and 50.8 mm in diameter was prepared. A portion of the sample was artificially fractured and coupled to a section of matrix material so that the fracture was not exposed. Water was flowed through the sample at five flow rates and CT scanning performed at set intervals during the flow. Cross sectional images and longitudinal reconstructions were built and saturation profiles calculated for the sample at each time interval at each flow rate. The results showed that for the test conditions, the fracture was not a primary pathway of fluid flow down the sample. Fluid flow was governed by the high imbibition capability of the rock matrix material.

2223 (LA-SUB-93-118) Laboratory analysis of hydraulic properties of volcanic tuff samples. Los Alamos

National Lab., NM (United States); Stephens (Daniel B.) and Associates, Inc., Albuquerque, NM (United States). 4 Dec 1991. 82p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93012082. Source: OSTI; NTIS; GPO Dep.

Daniel B. Stephens and Associates, Inc. (DBS&A) was requested by LANL to perform laboratory analysis for properties of Tuff samples, as outlined in Subcontract No. 9-XT1-X1785-1. The scope of work included conducting the following tasks Sample preparation; Dry bulk density and calculated porosity; Saturated hydraulic conductivity; Moisture characteristics; Air permeability; and Particle density.

2224 (LA-SUB-93-138) Late Quaternary paleoclimates and sources of paleoenvironmental data in the vicinity of Los Alamos National Laboratory: Final report. Spaulding, W.G. (Dames and Moore, Las Vegas, NV (United States)). Los Alamos National Lab., NM (United States); Dames and Moore, Las Vegas, NV (United States). Jan 1992. 61p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93010814. Source: OSTI; NTIS; INIS; GPO Dep.

This report identifies sources of paleoenvironmental data that can be used to reconstruct climatic variability in the Los Alamos area, and discusses their potential applicability to studies of geomorphic and hydrologic processes. Packrat middens were collected from the Los Alamos area, and radiocarbon dating of these deposits demonstrated that they are of late-Holocene age. Comparison of the age distribution of these samples with those from other localities leads to the conclusion that middle-Holocene age middens may be recovered from the same area. The regional pollen-stratigraphic and packrat midden records are also assessed, and implications for synoptic-scale paleoclimates over the last 20,000 years discussed.

2225 (LA-SUB-93-200) Comparison of INMARSAT and ATS3 satellite communication. Val Comm, Inc., Albuquerque, NM (United States). 29 Mar 1993. 69p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93040586. Source: OSTI; NTIS; INIS; GPO Dep.

There exists a need to provide communication through a satellite-based network which allows a user to communicate from a remote site to a fixed site. This discussion provides a comparison, both technical and financial, between the existing ATS3 satellite system and the commercial INMARSAT system. This comparison identified the limitations of each system to provide various types of communication.

2226 (LA-UR-91-4069) RCRA facility investigation for the townsite of Los Alamos, New Mexico. Dorries, A.M.; Conrad, R.C.; Nonno, L.M. Los Alamos National Lab., NM (United States). [1992]. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-920251-1: HMC-SOUTH '92: Hazardous Materials Control Research Institute meeting, New Orleans, LA (United States), 26-28 Feb 1992). Order Number DE92005054. Source: OSTI; NTIS; INIS; GPO Dep.

During World War II, Los Alamos, New Mexico was established as an ideal location for the secrecy and safety needed for the research and development required to design a nuclear fission bomb. Experiments carried out in the 1940s generated both radioactive and hazardous waste constituents on what is presently part of the Los Alamos townsite. Under the RCRA permit issued to Los Alamos National Laboratory in 1990, the Laboratory is scheduled for

investigation of its solid waste management units (SWMUs). The existing information on levels of radioactivity on the townsite is principally data from soil samples taken during the last site decontamination in 1976, little information on the presence of hazardous constituents exists today. This paper addresses pathway analysis and a preliminary risk assessment for current residents of the Los Alamos townsite. The estimated dose levels, in mrem per year, show that the previously decontaminated SWMU areas on the Los Alamos townsite will not contribute a radiation dose of any concern to the current residents.

2227 (LA-UR-92-283) **Quantification of uranium transport away from firing sites at Los Alamos National Laboratory: A mass balance approach.** Becker, N.M. Los Alamos National Lab., NM (United States). [1992]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-920307-12: Waste management '92, Tucson, AZ (United States), 1-5 Mar 1992). Order Number DE92007582. Source: OSTI; NTIS; GPO Dep.

Investigations were conducted at Los Alamos National Laboratory to quantify the extent of migration of depleted uranium away from firing sites. Extensive sampling of air particles, soil, sediment, and water was conducted to establish the magnitude of uranium contamination throughout one watershed. The uranium source term was estimated, and mass balance calculations were performed to compare the percentage of migrated uranium with original expenditures. Mass balance calculations can be powerful in identification of the extent of waste migration and used as an aid in planning future waste investigations.

2228 (LA-UR-92-1948) **Characterization of site geochemistry in support of environmental restoration.** Morris, D.E.; Conradson, S.D.; Tait, C.D.; Chisholm-Brause, C.J.; Berg, J.M.; Musgrave, J. Los Alamos National Lab., NM (United States). [1992]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-920791-4: Information exchange meeting on characterization sensors and monitoring technologies, Dallas, TX (United States), 15-16 Jul 1992). Order Number DE92017512. Source: OSTI; NTIS; INIS; GPO Dep.

The objective of this analytical support task is to characterize the chemical speciation and physical properties of actinides and other toxic metals together with organic co-contaminants in contaminated soils at DOE facilities. The target information for chemical speciation will be the oxidation state of the metal, the chemical structure and stoichiometry of the metal complexes, and the binding mechanism(s) of the metal complexes to the soil substrates. The physical state of the metal complexes in the soils is also important. We will determine if they exist as surface precipitates, mineral coatings, and/or clay adsorbates. The chemical speciation and physical state of the actinides and toxic metal define the chemistry of these contaminants as they presently exist at the DOE sites. This information is made available to parties involved in devising and implementing remediation strategies so that appropriate, efficient, timely, and cost-effective remediation technologies will be brought to bear on the problem. Speciation characterization is also undertaken following the application of remediation technologies. This information is made available to parties involved with risk assessment so that judgments concerning the extent of decontamination and the long-term stability of any remaining contamination can be made and documented on the basis of sound chemical data.

2229 (LA-UR-93-2673) **LRAD, semiconductor, and other radiation detectors applied to environmental monitoring for alpha and beta contamination.** MacArthur, D.W.; Bower, K.E. Los Alamos National Lab., NM (United States). [1993]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-940436-2: 4. international meeting on nuclear thermal hydraulics, operations and safety, Taipei (Taiwan, Province of China), 3-6 Apr. 1994). Order Number DE93018462. Source: OSTI; NTIS; INIS; GPO Dep.

The very short range of alpha particles in air (typically 2 to 3 cm) has severely limited the utility of traditional alpha monitors for detecting and identifying small amounts of alpha-producing contamination in soil, water, and other materials. Monitors based on the traditional alpha detector technology are often hard-pressed to meet continually increasing sensitivity requirements. The long-range alpha detector (LRAD) avoids the distance restriction by detecting the ions produced by the interaction of alpha particles with air, rather than the alpha particles directly. The ions are swept into an ion detector either by a moving air current (generated by a fan) or a weak electric field. The LRAD is limited by the distance the ions can travel in the ~ 5 -s ion lifetime (1 to 100 m), rather than by the several-centimeter range of the alpha particles. The LRAD can be used to perform sensitive (less than 10 disintegrations per minute per 100 cm²) field scans of large surface areas (ranging from hundreds of square meters of concrete floor to thousands of square meters of soil). Since the "active" element in a LRAD is a solid-metal ion collection plate, the detector is relatively inexpensive, easy to service, and quite rugged. However, the LRAD cannot supply any spectroscopic information to help identify the contaminant. Semiconductor, ionization chamber, and other types of particle detector can generate clean spectra from small samples of material and identify trace amounts of surface contamination. These detectors are rugged enough to use routinely in a mobile laboratory for isotope identification of "hot spots" located by the LRAD system. This detector combination has applications to field beta-particle monitoring (such as would result from tritium contamination) as well as alpha particle detection.

2230 (LA-UR-93-2934) **Uranium speciation in Fernald soils: Progress report, October 1, 1992-May 31, 1993: Revision 1.** Donohoe, R.J.; Morris, D.E.; Musgrave, J.A.; Tait, C.D.; Conradson, S.D. Los Alamos National Lab., NM (United States). 16 Jul 1993. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93040098. Source: OSTI; NTIS; INIS; GPO Dep.

This interim progress report describes new experimental data collected from October 1, 1992 through May 31, 1993 as part of the Characterization Task of the Uranium in Soils Integrated Demonstration of the Office of Technology Development, Office of Environmental Restoration and Waste Management of the United States Department of Energy. X-ray absorption and optical luminescence spectroscopies have been used to analyze the uranium remaining in contaminated soils from the Fernald site after these samples were treated by various decontamination technologies under development within this Integrated Demonstration. The treatment technologies included soil washes with carbonate, citrate, Tiron, and Tiron/dithionite mixtures. The effectiveness of these procedures is discussed in a separate report from the Decontamination Task group. The characterization results indicate that following the application of all of these

treatment strategies the uranium remaining in the soil is still best characterized as being primarily in the hexavalent oxidation state. However, for the A-series soils from the Incinerator Area, the speciation of this remaining uranium is different than seen previously based on the x-ray absorption data. The luminescence data for these treated soils also demonstrate that there is a decrease in size and quantity of the particulate hexavalent uranium that gives rise to the structured green emission. Thus, all treatment technologies do seem to generate a more dispersed, finer-grained form of uranium. For several treated samples a characteristic luminescence signal was found indicative of a schoepite phase of uranium. New results are also reported for untreated Fernald soil samples and reference uranium mineral phases.

2231 (LA-UR-93-2935) Uranium speciation in Fernald soils: Progress report, January 1-May 31, 1992. Morris, D.E.; Conradson, S.D.; Tait, C.D.; Chisholm-Brause, C.J.; Berg, J.; Musgrave, J. Los Alamos National Lab., NM (United States). 31 May 1992. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93040097. Source: OSTI; NTIS; INIS; GPO Dep.

This report details progress made from January 1 to May 31, 1992 in this analytical support task to determine the speciation of uranium in contaminated soil samples from the Fernald Environmental Management Project site under the auspices of the Uranium in Soils Integrated Demonstration funded through the US DOE's Office of Technology Development. The authors' efforts have focused on characterization of soil samples collected by S.Y. Lee (Oak Ridge National Laboratory) from five locales at the Fernald site. These were chosen to sample a broad range of uranium source terms. On the basis of x-ray absorption spectroscopy data, they have determined that the majority of uranium (> 80-90%) exists in the hexavalent oxidation state for all samples examined. This is a beneficial finding from the perspective of remediation, because U(VI) species are more soluble in general than uranium species in other oxidation states. Optical luminescence data from many of the samples show the characteristic structured yellow-green emission from the uranyl (UO_2^{2+}) moiety. The luminescence data also suggest that much of the uranium in these soils is present as well-crystallized UO_2^{2+} species. Some clear spectroscopic distinctions have been noted for several samples that illustrate significant differences in the speciation (1) from site to site, (2) within different horizons at the same site, and (3) within different size fractions of the soils in the same horizon at the same site. This marked heterogeneity in uranyl speciation suggests that several soil washing strategies may be necessary to reduce the total uranium concentrations within these soils to regulatory limits.

2232 (LA-UR-94-0130) Development of a real-time monitor for airborne alpha emissions: First quarter report, TTP AL 142003. Gritz, R.E.; Fowler, M.M. Los Alamos National Lab., NM (United States). [1994]. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE94006246. Source: OSTI; NTIS; GPO Dep.

This is the first quarterly report for Fiscal Year (FY) 1994 for TTP AL 142003, Development of a Real-Time Monitor for Airborne Alpha Emissions. Los Alamos National Laboratory (LANL) is developing a new technology for on-line, real-time monitoring of incinerator stacks for low levels of airborne alpha activity. While initially developed for incinerators, this

new technology may well find other applications in continuous air monitoring, process monitoring, and monitoring during remediation activities. Referred to as the Large-Volume Flow Thru Detector System (LVFTDS), this technology responds directly to the need for fast responding, high sensitivity effluent monitoring systems. With DOE EM-50 funding, LANL has fabricated a bench-top proof of concept detector system and is conducting tests to evaluate its performance. A second-generation prototype is being designed, based on requirements driven by potential field test sites. An industrial partner is being solicited to license the technology. Field trials of a full-scale detector system are planned for FY 95. Accomplishments during the first quarter of FY 94 are chronicled in this report, including budgetary data. A schedule for the remainder of the fiscal year is also provided.

2233 (LA-UR-94-186) LRAD radon test results. Johnson, J.P. (Los Alamos National Lab., NM (United States)); Bolton, R.D.; Garner, S.E.; Benham, K.L.; Langer, G.L. Jr. Los Alamos National Lab., NM (United States). [1994]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-940211-1: 27. midyear topical meeting of the Health Physics Society: managing radioactive and mixed waste, Albany, NY (United States), 13-17 Feb 1994). Order Number DE94006263. Source: OSTI; NTIS; INIS; GPO Dep.

Los Alamos National Laboratory (LANL) personnel recently tested Long-Range Alpha Detection (LRAD) technology for radon and radon daughter response in the calibration chamber at DOE Grand Junction Project Office (GJPO), Colorado. Radon concentrations ranged over almost four decades, from 0.1 to 320 pCi/L. Particulate levels were also varied, from almost 0 to > 2,000 particles per cc. The data indicate LRAD based detectors have an almost immediate and linear response to radon gas concentration over this entire test range. These data indicate LRAD based detectors have potential as fast, rugged, sensitive radon gas and working level monitors. The authors will present technological improvements in LRAD based radon and working level detectors currently being tested at LANL.

2234 (LA-UR-94-0337) Applications of the long-range alpha detector for site-characterization technology. Vu, T.Q.; Allander, K.S.; Bolton, R.D.; Bounds, J.A.; Garner, S.E.; Johnson, J.D.; Johnson, J.P.; MacArthur, D.W. Los Alamos National Lab., NM (United States). [1994]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-940225-8: Waste management '94, Tucson, AZ (United States), 27 Feb - 3 Mar 1994). Order Number DE94006147. Source: OSTI; NTIS; INIS; GPO Dep.

Traditional alpha-particle detectors are limited by relatively poor sensitivity, small size, and difficulty of operation. These factors result in laborious effort and imprecise results. In addition, it is difficult for these detectors to monitor the inside of pipes and large areas having nonuniform surfaces. To be effective, traditional monitors require the probe to be held less than 1 cm from the surface while scanning with a slow, steady, and continuous motion. Long-range alpha detector (LRAD) technology overcomes the limitations imposed by the short range of alpha particles and provides a detailed analysis of alpha contamination in a cost-effective manner. Using a combination of LRAD airflow and electrostatic methods, we have developed several monitors for the detection of alpha contamination on hands and arms, in surface soil, and for radon gas.

2235 (LA-UR-94-557) Determining uranium speciation in contaminated soils by molecular spectroscopic methods: Examples from the Uranium in Soils Integrated Demonstration. Allen, P.G.; Berg, J.M.; Chisholm-Brause, C.J.; Conradson, S.D.; Donohoe, R.J.; Morris, D.E.; Musgrave, J.A.; Tait, C.D. Los Alamos National Lab., NM (United States). [1994]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-940225-57: Waste management '94, Tucson, AZ (United States), 27 Feb - 3 mar 1994). Order Number DE94007578. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy's former uranium production facility located at Fernald, OH (18 mi NW of Cincinnati) is the host site for an Integrated Demonstration for remediation of uranium-contaminated soils. A wide variety of source terms for uranium contamination have been identified reflecting the diversity of operations at the facility. Most of the uranium contamination is contained in the top ~1/2 m of soil, but uranium has been found in perched waters indicating substantial migration. In support of the development of remediation technologies and risk assessment, we are conducting uranium speciation studies on untreated and treated soils using molecular spectroscopies. Untreated soils from five discrete sites have been analyzed. We have found that ~80-90% of the uranium exists as hexavalent UO_2^{2+} species even though many source terms consisted of tetravalent uranium species such as UO_2 . Much of the uranium exists as microcrystalline precipitates (secondary minerals). There is also clear evidence for variations in uranium species from the microscopic to the macroscopic scale. However, similarities in speciation at sites having different source terms suggest that soil and groundwater chemistry may be as important as source term in defining the uranium speciation in these soils. Characterization of treated soils has focused on materials from two sites that have undergone leaching using conventional extractants (e.g., carbonate, citrate) or novel chelators such as Tiron. Redox reagents have also been used to facilitate the leaching process. Three different classes of treated soils have been identified based on the speciation of uranium remaining in the soils. In general, the effective treatments decrease the total uranium while increasing the ratio of U(IV) to U(VI) species.

2236 (LA-UR-94-572) Mexico City ozone concentrations as a function of readily-available meteorological parameters. Brown, M.J. Los Alamos National Lab., NM (United States). [1994]. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-940266-1: Institute of Mexican Petroleum (IMP) conference, Mexico City (Mexico), Feb 1994). Order Number DE94007576. Source: OSTI; NTIS; INIS; GPO Dep.

Daily maximum ozone concentrations measured at four sites within the Mexico City basin during the winter months are plotted as functions of different meteorological parameters that are routinely measured at surface stations. We found that ozone concentrations are most strongly correlated to the increase in daytime temperature and the maximum daytime wind speed. We also discovered that high ozone values at the sites in the southern end of the basin occur when winds come out of the northeast. In contrast, wind direction was found to be uncorrelated with high ozone values at the northern sites. From straightforward combinations of the meteorological variables, we derived some simple rules for estimating lower and upper bounds on the ozone concentration. Scatter in the data was too long to

give significance to best-fit equations and statistics. Additionally, a small rawinsonde data set was used to investigate ozone's dependence on boundary-layer height and near-surface temperature gradient. Results were inconclusive, however, due to the small size of the data set.

2237 (LA-UR-94-739) Application of scientific core drilling to geothermal exploration: Platanares, Honduras and Tecuamburro Volcano, Guatemala, Central America. Goff, S.J. (Los Alamos National Lab., NM (United States)); Goff, F.E.; Heiken, G.H.; Duffield, W.A.; Janik, C.J. Los Alamos National Lab., NM (United States). [1994]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-940490-1: 7. international symposium on the observation of the continental crust through drilling: continental processes - a decade of drilling discoveries, Santa Fe, NM (United States), 25-30 Apr 1994). Order Number DE94009295. Source: OSTI; NTIS; GPO Dep.

Our efforts in Honduras and Guatemala were part of the Central America Energy Resource Project (CAERP) funded by the United States Agency for International Development (AID). Exploration core drilling operations at the Platanares, Honduras and Tecuamburro Volcano, Guatemala sites were part of a geothermal assessment for the national utility companies of these countries to locate and evaluate their geothermal resources for electrical power generation. In Honduras, country-wide assessment of all thermal areas determined that Platanares was the site with the greatest geothermal potential. In late 1986 to middle 1987, three slim core holes were drilled at Platanares to a maximum depth of 680 m and a maximum temperature of 165°C. The objectives were to obtain information on the geothermal gradient, hydrothermal alterations, fracturing, and possible inflows of hydrothermal fluids. Two holes produced copious amounts of water under artesian conditions and a total of 8 MW(t) of energy. Geothermal investigations in Guatemala focused on the Tecuamburro Volcano geothermal site. The results of surface geological, volcanological, hydrogeochemical, and geophysical studies at Tecuamburro Volcano indicated a substantial shallow heat source. In early 1990 we drilled one core hole, TCB-1, to 808 m depth. The measured bottom hole temperature was 238°C. Although the borehole did not flow, in-situ samples indicate the hole is completed in a vapor-zone above a probable 300°C geothermal reservoir.

2238 (LBL-32418) Analysis of flow processes during TCE infiltration in heterogeneous soils at the Savannah River Site, Aiken, South Carolina. Pruess, K. Lawrence Berkeley Lab., CA (United States). Jun 1992. 41p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE93015266. Source: OSTI; NTIS; GPO Dep.

Contamination of soils and groundwater from volatile organic compounds (VOCs), such as organic solvents and hydrocarbon fuels, is a problem at many industrial facilities. Key to successfully characterizing, containing, and eventually remediating the contamination is a thorough understanding, based on sound scientific principles, of the complex interplay of physical, chemical, and biological processes in geologic media, which affect the migration and distribution of the contaminants, and their response to remediation operations. This report focusses on physical mechanisms that affect contaminant behavior under the conditions encountered at the Savannah River site (SRS). Although other contaminants are present at the site, for the purpose of this discussion we will restrict ourselves to the

processes following a spill and infiltration of trichloroethylene (TCE), which is the main contaminant at the location of the Integrated Demonstration Project. We begin by briefly describing the main physical processes following release of TCE into the subsurface. Subsequently we will present simple engineering models that can help to evaluate contaminant migration processes in a semi-quantitative way. Finally, we will discuss results of detailed numerical simulations of TCE infiltration into a heterogeneous medium consisting of sands and clays. These simulations attempt to shed light on the initial distribution of contaminants at the site prior to the start of remediation operations. We also point out limitations of present numerical modeling capabilities, and identify issues that require further research in order that a realistic description of contaminant behavior in the subsurface may be achieved.

2239 (LBL-32529) The method of Laplace Transform MultiQuadratics (LTMQ) for the solution of the groundwater flow equation. Moridis, G.J. (Lawrence Berkeley Lab., CA (United States)); Kansa, E. Lawrence Berkeley Lab., CA (United States). Jun 1992. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-9306153-1: 7. International Association for Mathematical and Computers in Simulation (IMACS) conference on computer methods for partial differential equations, New Brunswick, NJ (United States), 22-24 Jun 1993). Order Number DE93010408. Source: OSTI; NTIS; GPO Dep.

This paper presents a new numerical method, the Laplace Transform MultiQuadratics (LTMQ) method, developed for the solution of the diffusion-type parabolic Partial Differential Equation (PDE) of fluid flow through porous media. LTMQ combines a MultiQuadratics (MQ) approximation scheme with a Laplace transform formulation. The use of MQ in the spatial approximations allows the accurate description of problems in complex porous media with a very limited number of nodes. The Laplace transform formulation eliminates the need for time discretization, thus allowing an unlimited time step size without any loss of accuracy. LTMQ is tested against results from three test problems of groundwater flow obtained from a standard Finite Difference (FD) model, as well as from analytical solutions. An excellent agreement between the LTMQ and the analytical and FD solutions is observed, while significant reductions in computer execution times may be achieved.

2240 (LBL-33957) Applicability of petroleum horizontal drilling technology to hazardous waste site characterization and remediation. Goranson, C. Lawrence Berkeley Lab., CA (United States). Sep 1992. 90p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE93015270. Source: OSTI; NTIS; INIS; GPO Dep.

Horizontal wells have the potential to become an important tool for use in characterization, remediation and monitoring operations at hazardous waste disposal, chemical manufacturing, refining and other sites where subsurface pollution may develop from operations or spills. Subsurface pollution of groundwater aquifers can occur at these sites by leakage of surface disposal ponds, surface storage tanks, underground storage tanks (UST), subsurface pipelines or leakage from surface operations. Characterization and remediation of aquifers at or near these sites requires drilling operations that are typically shallow, less than 500-feet in depth. Due to the shallow nature of polluted aquifers, waste

site subsurface geologic formations frequently consist of unconsolidated materials. Fractured, jointed and/or layered high compressive strength formations or compacted caliche type formations can also be encountered. Some formations are unsaturated and have pore spaces that are only partially filled with water. Completely saturated underpressured aquifers may be encountered in areas where the static ground water levels are well below the ground surface. Each of these subsurface conditions can complicate the drilling and completion of wells needed for monitoring, characterization and remediation activities. This report describes some of the equipment that is available from petroleum drilling operations that has direct application to groundwater characterization and remediation activities. A brief discussion of petroleum directional and horizontal well drilling methodologies is given to allow the reader to gain an understanding of the equipment needed to drill and complete horizontal wells. Equipment used in river crossing drilling technology is also discussed. The final portion of this report is a description of the drilling equipment available and how it can be applied to groundwater characterization and remediation activities.

2241 (ORISE-92/E-41) Verification survey of the Baker and Williams Warehouses, Building 521-527, New York, New York: Final report. Berger, J.D.; Cotten, P.R.; Payne, J.L. Oak Ridge Inst. for Science and Education, TN (United States). May 1992. 40p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-76OR00033. Order Number DE92016386. Source: OSTI; NTIS; INIS; GPO Dep.

During the early 1940's, the Manhattan Engineer District (MED), predecessor to the Atomic Energy Commission (AEC) and the Department of Energy (DOE), shipped uranium concentrates to the former Baker and Williams Warehouses on West 20th Street, in New York, New York. The warehouses were used for short-term storage of the uranium that was later distributed to various US Government facilities. According to historical information, approximately 99,430 kg (219,000 lbs) of orange and yellow sodium uranate was delivered in 1942, and approximately 39,000 kg (86,000 lbs) of orange and yellow sodium uranate, 10,000 kg (22,000 lbs) of sodium uranyl carbonate, and 9,080 kg (20,000 lbs) of black uranium oxide were delivered to the Baker and Williams Warehouses in 1943. In 1989, DOE reviewed available historical documentation, describing MED/AEC activities conducted at this facility, and, based on this information, determined that the potential for radioactive material to be present as a result of the past activities was low. However, the available information was not sufficient to demonstrate that radiological conditions of the site, following termination of MED/AEC activities, satisfied current criteria for use without restrictions. DOE decided that a radiological survey should be performed to determine whether additional investigations were warranted under the Formerly Utilized Sites Remedial Action Program (FUSRAP). The purpose of the radiological survey was to obtain sufficient radiological measurements such that DOE Headquarters could determine whether the site should be included for remedial action or eliminated from FUSRAP. A preliminary site visit was performed by the Environmental Survey and Site Assessment Program (ESSAP) of Oak Ridge Associated Universities and it was determined that Building 521-527 would be included in the survey, based on visual inspections and accessibility to the adjoining 529-535 building.

2242 (ORNL-6638) Results of the radiological survey at the Sacandaga site Glenville, New York: Waste

Management Research and Development Programs. Foley, R.D.; Cottrell, W.D.; Carrier, R.F. Oak Ridge National Lab., TN (United States). Aug 1992. 73p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93000503. Source: OSTI; NTIS; INIS; GPO Dep.

The Sacandaga site, located on Sacandaga Road, Glenville, New York, was operated by the General Electric Company for the Atomic Energy Commission (AEC) between 1947 and 1951. Originally used for the study and development of radar during World War II, the facilities housed later operations involving physics studies and sodium technology development in support of breeder reactor design and other AEC programs. Though not in use since the original equipment was dismantled and removed in the early 1950s, portions of the 51-acre site are known to contain buried rubble from demolished structures used in former operations. At the request of the Office of Naval Reactors through the Office of Remedial Action and Waste Technology, a characterization of current radiological conditions over the site was performed between August and October 1989. The survey included the measurement of direct radiation levels (gamma, alpha, and beta-gamma) over all surfaces both inside and outside the building and tunnel, radionuclide analysis of systematic, biased, and auger hole soil samples, and analysis of sediments from underground structures. Gamma logging of auger holes was conducted and removable contamination levels inside the tunnel were determined. Samples of soil and structural materials from within and around an excavated concrete bunker were analyzed to determine concentrations of radionuclides and nonradioactive elemental beryllium.

2243 (ORNL/ER-7) Transport and accumulation of cesium-137 and mercury in the Clinch River and Watts Bar Reservoir system: Environmental Restoration Program. Olsen, C.R.; Larsen, I.L.; Lowry, P.D.; Moriones, C.R.; Ford, C.J.; Dearstone, K.C.; Turner, R.R.; Kimmel, B.L.; Brandt, C.C. Oak Ridge National Lab., TN (United States). Jun 1992. 56p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92018071. Source: OSTI; NTIS; INIS; GPO Dep. Environmental Sciences Division Publication 3471.

Operations and waste disposal activities at the Oak Ridge Y-12 Plant, the Oak Ridge National Laboratory (ORNL), and the Oak Ridge K-25 Site (formerly the Oak Ridge Gaseous Diffusion Plant) on the US Department of Energy (DOE) Oak Ridge Reservation (ORR) have introduced a variety of airborne, liquid, and solid wastes into the surrounding environment. Some of these wastes may affect off-site areas by entering local streams, which ultimately drain into the Clinch and Tennessee river system. Previously reported concentrations of radionuclides, metals and organic compounds in water, sediment, and biota of the Clinch River and Watts Bar Reservoir suggest the presence of a variety of contaminants of possible concern to the protection of human health and the environment. The work reported here represents part of the initial scoping phase for the Clinch River RCRA Facility Investigation. In this work, the distribution of ¹³⁷Cs is used to identify contaminant accumulation patterns and potential problem, or "hot-spot," areas with regard to environmental hazard or human health. Radiocesium was chosen for this scoping effort because (1) its history of release into the Clinch River is reasonably well documented, (2) it is easy and inexpensive to measure by gamma spectrometry, and (3) it is rapidly sorbed to particulate matter

and thus serves as a cost-effective tracer for identifying the transport and accumulation patterns of many other particle-reactive contaminants, such as mercury (Hg), lead (Pb), and plutonium (Pu), and polychlorinated biphenyls (PCBs).

2244 (ORNL/ER-8) Screening level risk assessment for offsite ecological effects in surface waters downstream from the US Department of Energy Oak Ridge Reservation. Suter, G.W. II. Oak Ridge National Lab., TN (United States). May 1991. 176p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE91014948. Source: OSTI; NTIS; GPO Dep.

This assessment provides guidance for monitoring the environment off the Department of Energy (DOE) Oak Ridge Reservation for the purpose of estimating risks to the nonhuman environment. The approach taken in both assessments was to screen contaminant chemicals into categories that reflect the need for monitoring. In this ecological assessment, the upper screening criterion is a level that indicates acute lethality or other severe effects. The intermediate screening criterion indicates a level of exposure that would be expected to cause low levels of effect in chronic exposures. The lower screening criterion is a "safe" concentration that is based on the intermediate criterion divided by a safety factor. The safety factors are based on consideration of the distribution of sensitivity among species, population and ecosystem process that can amplify organism-level effects, and the appropriateness of the measures of exposure. Screening criteria were developed for aquatic organisms, benthic organisms, and piscivorous wildlife and were applied to contaminant concentrations in water, sediment, and fish flesh. The exposure data were categorized into ten reaches: Melton Hill Reservoir (MHR), the portion of the Clinch River most influenced by White Oak Creek (WOK), the Poplar Creek embayment (PCE), the portion of the Clinch River most influenced by Poplar Creek (PC), Watts Bar Reservoir (WBR), Norris Reservoir (RN), Poplar Creek (PC), East Fork Poplar Creek (EF), Tennessee River (TR), and White Oak Lake (WOL). 88 refs., 2 tabs.

2245 (ORNL/ER-9) Preliminary screening of contaminants in the off-site surface water environment downstream of the US Department of Energy Oak Ridge Reservation: Environmental Restoration Program. Hoffman, F.O. (Oak Ridge National Lab., TN (United States)); Blaylock, B.G.; Frank, M.L.; Etnier, E.L.; Talmage, S.S.; Hook, L.A. Oak Ridge National Lab., TN (United States). Nov 1991. 165p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92010371. Source: OSTI; NTIS; GPO Dep.

Environmental Sciences Division Publication 3485.

Previously reported concentrations of radionuclides and of inorganic and organic compounds in the surface water environment off-site of the US Department of Energy/Oak Ridge Reservation (DOE/ORR) suggest the presence of a large number of substances of possible concern to the protection of human health and the ecosystem. Screening of these data, as part of the initial scoping phase of the Clinch River Resource Conservation and Recovery Act Facility Investigation, is necessary to develop a field sampling plan for the acquisition of additional data through the identification of potential contaminants of concern for further evaluation and investigation. The results of this report are based on human health risk end points. For the purposes of screening, conservative and nonconservative estimates of potential

maximum exposures were used to identify, respectively, definitely low- and definitely high-priority pollutants. Because of relatively high concentrations of contaminants in sediment, the presence of industrial and agricultural wastes not related to DOE/ORR operations, and the use of a lifetime risk for carcinogens of 10^{-6} as a lower screening criterion, no surface water reach considered in this study was identified as low priority. In contrast to this result, three contaminants, arsenic in water and thallium in fish of McCoy Branch and ^{137}Cs in the sediment of the White Oak Creek embayment downstream from White Oak Lake, were tentatively identified as definitely high-priority substances. These locations are within the boundaries of ORR. Nonconservative estimates of exposure identified arsenic, antimony, thallium, uranium, polychlorinated biphenyls 1254 and 1260, chlordane, ^{60}Co , and ^{234}Pa as potentially high-priority contaminants in at least one or more locations. These are the contaminants that should receive the most scrutiny in future investigations.

2246 (ORNL/ER-35) Surface radiological investigation of Trench 5 in Waste Area Grouping 7 at Oak Ridge National Laboratory, Oak Ridge, Tennessee: Environmental Restoration Program. Goff, D.D. Oak Ridge National Lab., TN (United States). Environmental Restoration Div. Aug 1991. 66p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92008580. Source: OSTI; NTIS; INIS; GPO Dep.

A surface radiological investigation of areas encompassing Trench 5 on the Oak Ridge Reservation (ORR) was conducted from May 1990 through November 1990. This survey was led by the author, assisted by various members of the Measurement Applications and Development (MAD) group of the Health and Safety Research Division (HASRD) of Oak Ridge National Laboratory (ORNL) in Oak Ridge, Tennessee. The purpose of the investigation was to determine the presence, nature, and extent of surface radiological contamination at Trench 5, the Homogeneous Reactor Experiment fuel wells, and surrounding areas. Based on the data obtained in the field, interim corrective measures were recommended to limit human exposure to radioactivity and to minimize insult to the environment. It should be stressed that this project was not intended to be a complete site characterization but rather to be a preliminary investigation into the potential contamination problem that might exist as a result of past operations at Trench 5.

2247 (ORNL/ER-37) Surface radiological investigations of Trench 6 and low-level waste Line Leak Site 7.4b at the Oak Ridge National Laboratory, Oak Ridge, Tennessee. Uziel, M.S.; Tiner, P.F.; Williams, J.K. Oak Ridge National Lab., TN (United States). Aug 1991. 36p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92000108. Source: OSTI; NTIS; INIS; GPO Dep.

A surface radiological investigation of Trench 6 and low-level radioactive waste (LLW) Line Leak Site 7.4b was conducted in July and August 1989 and January 1990 by the Measurement Applications and Development Group, Oak Ridge National Laboratory. The purposes of this survey were (1) to determine the presence, nature, and extent of surface radiological contamination and (2) to recommend interim corrective action to limit human exposures to radioactivity and minimize the potential for contaminant dispersion. Highest surface gamma levels encountered during the survey (39 mR/h) were found just south of the asphalt covering LLW Line Leak Site 7.4b. Elevated surface gamma

levels (measuring 28 to 560 $\mu\text{R/h}$) extended from this area to a width of 100 ft, westward 250 ft, and beyond the survey boundary. Beta-gamma levels up to 17 mrad/h measured on contact with the trunks of trees growing in the area southwest of Trench 6 suggest that three roots are reaching contamination deep within the ground. Since no gamma activity is associated with the trees or their leaves, the elevated beta levels are probably due to the uptake of residual ^{90}Sr originating from the documented seepage at the Trench 6/Leak Site 7.4b area. Beta activity present in the leaf litter and surface soil indicate that decaying leaves are depositing measurable contaminants on the ground surface. Recommendations for corrective actions are included. 7 refs., 20 figs., 3 tabs.

2248 (ORNL/ER-45) Hydrograph analysis in a fractured rock terrane near Oak Ridge, Tennessee. Moore, G.K. (Tennessee Univ., Knoxville, TN (United States)). Oak Ridge National Lab., TN (United States). Jun 1991. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92003734. Source: OSTI; NTIS; GPO Dep.

A typical watershed near Oak Ridge, Tennessee, is underlain by a storm-flow zone, which approximately corresponds with the root zone of vegetation, and by a groundwater zone. Analysis of the streamflow hydrograph and water-level hydrographs during the nongrowing season shows that discharge from the storm-flow zone constitutes nearly all streamflow after the end of overland runoff but that discharge from the groundwater zone is dominant after about 8 to 10 d of recession. Simple equations that express the relationship between streamflow recession and storage depletion can be used to calculate storage volumes and average values of specific yield, transmissivity, and hydraulic conductivity in both the storm-flow and groundwater zones. The calculated values are reasonable and are nearly the same as those obtained by other methods. 18 refs., 4 figs.

2249 (ORNL/ER-53) Risk assessment calculations using MEPAS, an accepted screening methodology, and an uncertainty analysis for the reranking of Waste Area Groupings at Oak Ridge National Laboratory, Oak Ridge, Tennessee: Environmental Restoration Program. Shevenell, L.; Hoffman, F.O.; MacIntosh, D. Oak Ridge National Lab., TN (United States). Mar 1992. 70p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92010266. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental Sciences Division Publication No. 3751.

The Waste Area Groupings (WAGs) at the Oak Ridge National Laboratory (ORNL) were reranked with respect to on- and off-site human health risks using two different methods. Risks associated with selected contaminants from each WAG for occupants of WAG 2 or an off-site area were calculated using a modified formulation of the Multimedia Environmental Pollutant Assessment System (MEPAS) and a method suitable for screening, referred to as the ORNL/ESD method (the method developed by the Environmental Sciences Division at ORNL) in this report. Each method resulted in a different ranking of the WAGs. The rankings from the two methods are compared in this report. All risk assessment calculations, except the original MEPAS calculations, indicated that WAGs 1; 2, 6, 7 (WAGs 2, 6 and 7 as one combined WAG); and 4 pose the greatest potential threat to human health. However, the overall rankings of the WAGs using constant parameter values in the different

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methods were inconclusive because uncertainty in parameter values can change the calculated risk associated with particular pathways, and hence, the final rankings. Uncertainty analysis using uncertainties about all model parameters were used to reduce biases associated with parameter selection and to more reliably rank waste sites according to potential risks associated with site contaminants. Uncertainty analysis indicates that the WAGs should be considered for further investigation, or remediation, in the following order: (1) WAG 1; (2) WAGs 2, 6, and 7 (combined); and (3) WAGs 3, 5, and 9; and, (4) WAG 8.

2250 (ORNL/ER-81) White Oak Creek Embayment site characterization and contaminant screening analysis: Environmental Restoration Program. Blaylock, B.G.; Ford, C.J.; Frank, M.L.; Hoffman, F.O.; Hook, L.A. Oak Ridge National Lab., TN (United States). Jan 1993. 139p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93006364. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental Sciences Division Publication No. 3821.

Analyses of sediment samples collected near the mouth of White Oak Creek during the summer of 1990 revealed ^{137}Cs concentrations [$> 10^6$ Bq/kg dry wt ($> 10^4$ pCi/g dry wt)] near the sediment surface. Available evidence indicates that these relatively high concentrations of ^{137}Cs now at the sediment surface were released from White Oak Dam in the mid-1950s and had accumulated at depositional sites in the embayment. These accumulated sediments are being eroded and transported downstream primarily during winter low-water levels by flood events and by a combination of normal downstream flow and the water turbulence created by the release of water from Melton Hill Dam during hydropower generation cycles. This report provides a more thorough characterization of the extent of contamination in WOCE than was previously available. Environmental samples collected from WOCE were analyzed for organic, inorganic, and radiological contaminants in fish, water, and sediment. These results were used to conduct a human health effects screening analysis. Walkover radiation surveys conducted inside the fenced area surrounding the WOCE at summer-pool (741 ft MSL) and at winter-pool (733 ft MSL) level, indicated a maximum exposure rate of 3 mR h⁻¹ 1 m above the soil surface.

2251 (ORNL/ER-91) Identification of groundwater-producing fractures by using an electromagnetic borehole flowmeter in monitoring wells on the Oak Ridge Reservation, Oak Ridge, Tennessee: Environmental Restoration Program. Moore, G.K.; Young, S.C. Oak Ridge National Lab., TN (United States). Mar 1992. 54p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92010873. Source: OSTI; NTIS; GPO Dep.

This report describes the results of electromagnetic borehole flowmeter surveys taken on the Oak Ridge Reservation (ORR) with an instrument developed by the Engineering Laboratory of Tennessee Valley Authority (TVA). The borehole flowmeter can be used during water injection or pumping to determine the depth, vertical extent, and relative permeability of fractures that are intercepted by the wells. The flowmeter can also be used to measure any natural water flows, up or down an openhole interval, from one permeable fracture to another. These and other data have been used to select screen intervals or sampling ports in newly constructed wells on the ORR, to evaluate the potential for cross-contamination (the flow dissolved pollutants from one

level to another in a well or corehole), and to characterize permeable fractures and permeable intervals in wells.

2252 (ORNL/ER-93) Comprehensive work plan and health and safety plan for the 7500 Area Contamination Site sampling at Oak Ridge National Laboratory, Oak Ridge, Tennessee: Environmental Restoration Program. Burman, S.N.; Landguth, D.C.; Uziel, M.S.; Hatmaker, T.L.; Tiner, P.F. Oak Ridge National Lab., TN (United States). May 1992. 147p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92018072. Source: OSTI; NTIS; INIS; GPO Dep.

As part of the Environmental Restoration Program sponsored by the US Department of Energy's Office of Environmental Restoration and Waste Management, this plan has been developed for the environmental sampling efforts at the 7500 Area Contamination Site, Oak Ridge National Laboratory (ORNL), Oak Ridge, Tennessee. This plan was developed by the Measurement Applications and Development Group (MAD) of the Health and Safety Research Division of ORNL and will be implemented by ORNL/MAD. Major components of the plan include (1) a quality assurance project plan that describes the scope and objectives of ORNL/MAD activities at the 7500 Area Contamination Site, assigns responsibilities, and provides emergency information for contingencies that may arise during field operations; (2) sampling and analysis sections; (3) a site-specific health and safety section that describes general site hazards, hazards associated with specific tasks, personnel protection requirements, and mandatory safety procedures; (4) procedures and requirements for equipment decontamination and responsibilities for generated wastes, waste management, and contamination control; and (5) a discussion of form completion and reporting required to document activities at the 7500 Area Contamination Site.

2253 (ORNL/ER-123) Hydrologic data summary for the White Oak Watershed at Oak Ridge National Laboratory, Oak Ridge, Tennessee, October 1990-December 1991. Borders, D.M.; Gregory, S.M.; Clapp, R.B.; Frederick, B.J.; Watts, J.A. Oak Ridge National Lab., TN (United States). Environmental Restoration Div. Jun 1992. 230p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92018073. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental Restoration Program.

This report summarizes for the 15-month period of October 1990-December 1991 the available dynamic hydrologic data collected, primarily on the White Oak Creek (WOC) watershed, along with information collected on the surface flow systems that affect the quality or quantity of surface water. The collection of hydrologic data is one component of numerous, ongoing Oak Ridge National Laboratory (ORNL) environmental studies and monitoring programs and is intended to: (1) characterize the quantity and quality of water in the flow systems; (2) assist with the planning and assessment of remedial action activities; and, (3) provide long-term availability of data and quality assurance. Characterization of the hydrology of the WOC watershed is critical for understanding the processes that drive contaminant transport in the watershed. Identification of spatial and temporal trends in hydrologic parameters and mechanisms that affect the movement of contaminants supports the development of interim corrective measures and remedial restoration alternatives. In addition, hydrologic monitoring supports long-term assessment of the effectiveness of remedial actions in limiting the transport of contaminants across Waste

Area Grouping (WAG) boundaries and ultimately to the off-site environment. For these reasons, it is of paramount importance to the Environmental Restoration Program (ERP) to collect and report hydrologic data activities that contribute to the Site Investigations component of the ERP. (White Oak Creek is also referred to as "Whiteoak" Creek).

2254 (ORNL/ER-124) Annual report of the Environmental Restoration Monitoring and Assessment Program at Oak Ridge National Laboratory for FY 1992: Environmental Restoration Program. Clapp, R.B. (ed.). Oak Ridge National Lab., TN (United States). Sep 1992. 211p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93000588. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental Sciences Division 3945.

This report summarizes the salient features of the annual efforts of the investigations and monitoring, conducted to support the Environmental Restoration (ER) Program at Oak Ridge National Laboratory (ORNL). The results presented can be used to develop a conceptual understanding of the key contaminants and the sources, fluxes, and processes affecting their distribution and movement. This information forms a basis for prioritizing sites and for selecting, implementing, and evaluating remedial actions. Groundwater, soils, sediments, and surface water monitoring results are described.

2255 (ORNL/ER-135) Surface debris inventory at White Wing Scrap Yard, Oak Ridge Reservation, Oak Ridge, Tennessee: Environmental Restoration Program. Rodriguez, R.E.; Tiner, P.F.; Williams, J.K. Oak Ridge National Lab., TN (United States). Aug 1992. 72p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93001787. Source: OSTI; NTIS; GPO Dep.

An inventory of surface debris in designated grid blocks at the White Wing Scrap Yard [Waste Area Grouping 11 (WAG 11)] was conducted intermittently from February through June 1992 by members of the Measurement Applications and Development Group, Health and Safety Research Division, Oak Ridge National Laboratory (ORNL) at the request of ORNL Environmental Restoration (ER) Program personnel. The objectives of this project are outlined in the following four phases: (1) estimate the amount (volume) and type (e.g., glass, metal and plastics) of surface waste material in 30 designated grid blocks (100- by 100-ft grids); (2) conduct limited air sampling for organic chemical pollutants at selected locations (e.g., near drums, in holes, or other potentially contaminated areas); (3) conduct a walkover gamma radiation scan extending outward (approximately 50 ft) beyond the proposed location of the WAG 11 perimeter fence; and (4) recommend one grid block as a waste staging area. This recommendation is based on location and accessibility for debris staging/transport activities and on low levels of gamma radiation in the grid block.

2256 (ORNL/ER-137) Preliminary report on the ecological assessment of Waste Area Grouping 5 at Oak Ridge National Laboratory, Oak Ridge, Tennessee: Environmental Restoration Program. Ashwood, T.L.; Suter, G.W. II; Stewart, A.J. Oak Ridge National Lab., TN (United States). Sep 1992. 36p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93000547. Source: OSTI; NTIS; GPO Dep.

In support of the remedial investigation for Waste Area Grouping (WAG) 5, staff of the Environmental Sciences Division of Oak Ridge National Laboratory have conducted preliminary ecological assessment activities. A screening level ecological risk assessment has been completed, ambient toxicity tests have been conducted on streams and seeps within WAG 5, WAG 5 has been surveyed for rare and endangered species and wetlands, and wild turkeys that may feed on contaminated vegetation and insects in WAG 5 have been screened for beta-emitting isotopes and ^{137}Cs . The screening-level ecological risk assessment identified some data gaps that were addressed in the ecological assessment plan. These include gaps in data on the toxicity of surface water and soil within WAG 5 and on the status of rare and endangered species. In addition, the screening-level risk assessment identified the need for data on the level of contaminants in wild turkeys that may be consumed by predatory wildlife and humans. Three rounds of ambient toxicity tests on six streams and seeps, using the microcrustacean *Ceriodaphnia*, have identified potential toxicity in three of the sample sites. Further tests are required to identify the toxicant. No rare or endangered animal species have been identified in the WAG 5 area.

2257 (ORNL/ER-138) Surface radiological investigations at environmental research area 11, ^{137}Cs - and ^{60}Co -contaminated plots at Oak Ridge National Laboratory, Oak Ridge, Tennessee: Environmental Restoration Program. Uziel, M.S.; Tiner, P.F.; Williams, J.K. Oak Ridge National Lab., TN (United States). Feb 1993. 42p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93010256. Source: OSTI; NTIS; INIS; GPO Dep.

A surface radiological investigation at the ^{137}Cs - and ^{60}Co -contaminated forest area (Chestnut Ridge east and west plots) was conducted from January 1992 through August 1992. Results of the survey revealed numerous spots and small areas of surface contamination that followed the original placement of feeders used for ^{60}Co - and ^{137}Cs -labeled seeds in a 1969-1970 study. Surface gamma exposure rates reached $380\ \mu\text{R/h}$ at the east plot and $400\ \mu\text{R/h}$ at the west plot, but approximately one-half and one-third, respectively, of the identified anomalies did not exceed $39\ \mu\text{R/h}$. Results of soil sample analyses demonstrated that ^{137}Cs and ^{60}Co were responsible for the elevated radiation levels. Radionuclides were found below the surface at soil sample locations, in some cases at depths below 18 in. The same pattern of subsurface contamination may be present at other elevated surface spots at both plots. These survey results show that current radiological conditions at the site remain an environmental problem. Recommendations for corrective actions are included.

2258 (ORNL/ER-139) Toxicological benchmark for screening of potential contaminants of concern for effects on aquatic biota on the Oak Ridge Reservation, Oak Ridge, Tennessee: Environmental Restoration Program. Suter, G.W. II; Futrell, M.A.; Kerchner, G.A. Oak Ridge National Lab., TN (United States). Environmental Restoration Div. Sep 1992. 86p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93000719. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental Sciences Division Publication 3940.

One of the initial stages in ecological risk assessment of hazardous waste sites is the screening of contaminants to

determine which of them are worthy of further consideration. This report presents potential screening benchmarks for protection of aquatic life from contaminants in water. Because there is no guidance for screening benchmarks, a set of alternative benchmarks is presented here. The alternative benchmarks are based on different conceptual approaches to estimating concentrations causing significant effects. To the extent that toxicity data are available, this report presents the alternative benchmarks for chemicals that have been detected on the Oak Ridge Reservation. It also presents the data used to calculate the benchmarks, and the sources of the data. It compares the benchmarks and discusses their relative conservatism and utility.

2259 (ORNL/ER-146) Annual summary report on the surveillance and maintenance plan for Waste Area Groupings at Oak Ridge National Laboratory for period ending September 30, 1992: Environmental Restoration Program. Ford, M.K.; Holder, L. Jr.; Jones, R.G. Oak Ridge National Lab., TN (United States). Nov 1992. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93003366. Source: OSTI; NTIS; INIS; GPO Dep.

Surveillance and maintenance (S&M) of 75 sites was conducted by the Remedial Action Section for the Environmental Restoration Program for surplus facilities and sites contaminated with radioactive materials and/or hazardous chemicals at Oak Ridge National Laboratory. S&M activities on these facilities and sites was started at the end of their operating life and will continue until final facility disposal or site stabilization. The objectives of the Waste Area Grouping S&M Program are met by maintaining a program of routine S&M as well as by implementing interim corrective maintenance when deemed necessary as a result of site surveillance. This report briefly presents this program's activities and includes tables indicating tank levels and dry well data for FY 1992.

2260 (ORNL/ER-172) Results of the radiological characterization survey of the Building 7819 Decontamination Facility at Oak Ridge National Laboratory, Oak Ridge, Tennessee. Rodriguez, R.E.; Brown, K.S.; Rice, D.E.; Gosslee, R.C.; Patania, V.P. Oak Ridge National Lab., TN (United States). Dec 1993. 44p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94008061. Source: OSTI; NTIS; INIS; GPO Dep.

A radiological characterization survey of the interior of the Building 7819 Decontamination Facility at Oak Ridge National Laboratory (ORNL) was conducted during July 1993. The interior of Building 7819 is grossly contaminated, and the contamination is highly transferable. Levels of alpha and beta contamination inside the building exceed ORNL guidelines for zoning as a Contamination Area. Gamma whole-body exposure rates generally ranged from 0.1 to 20 mR/h. Total beta-gamma surface contamination ranged from 1,000 to 520,000 dpm/100 cm², and transferable beta-gamma contamination ranged from 200 to 174,000 dpm/100 cm². A pump and a metal table near the pit exhibited beta dose rates of 3 rad/h and 300 mrad/h, respectively, and gamma exposure rates of 250 mR/h and 25 mR/h at contact, respectively. Total alpha contamination levels ranged from 100 to 110,000 dpm/100 cm², and transferable contamination ranged from 21 to 440 dpm/100 cm². The ledge at the north end of the pit above the sink demonstrated alpha contamination of approximately 100,000 dpm/100 cm².

Radionuclide analysis of 11 smear samples showed the primary beta emitters to be ⁹⁰Sr and ¹³⁷Cs with trace amounts of ⁶⁰Co. The Building 7819 Decontamination Facility was zoned as a Contamination Area and Radiation Area at the time of this survey, and the zoning is justified by the results of the survey. The building will also be zoned as an Airborne Radioactivity Area, based on the results of air sampling. Recommendations for corrective actions are included.

2261 (ORNL/ER-180) Second annual report of the Environmental Restoration Monitoring and Assessment Program at Oak Ridge National Laboratory. Clapp, R.B.; Watts, J.A. (eds.). Oak Ridge National Lab., TN (United States). Sep 1993. 144p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94001153. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental Sciences Division ESD Publication 4108.

This report summarizes the salient features of the annual efforts of environmental monitoring and field investigations conducted to support the Environmental Restoration (ER) Program at the Oak Ridge National Laboratory (ORNL). This report focuses on the watershed scale, striving to provide an ORNL site-wide perspective on types, distribution, and transport of contamination. Results are used to enhance the conceptual understanding of the key contaminants and the sources, fluxes, and processes affecting their distribution and movement. This report summarizes the efforts of the Waste Area Grouping (WAG) 2 and Site Investigations (SI) program. WAG 2 is the lower portion of the White Oak Creek (WOC) system which drains the major contaminated sites at ORNL and discharges to the Clinch River where public access is allowed. The remedial investigation for WAG 2 includes a long-term multimedia environmental monitoring effort that takes advantage of WAG 2's role as an integrator and conduit of contaminants from the ORNL site. This report also includes information from other site-specific remedial investigations and feasibility studies (RI/FS) for contaminated sites at ORNL and data from other ongoing monitoring programs conducted by other organizations [e.g., the National Pollutant Discharge Elimination System (NPDES) compliance monitoring conducted by the Environmental Surveillance and Protection Section]. This information is included to provide an integrated basis to support ER decision making. This report summarizes information gathered through early 1993. Annual data, such as annual discharges of contaminants, are reported for calendar year 1992.

2262 (ORNL/ER-192) Waste management plan for environmental monitoring in Waste Area Grouping 6 at Oak Ridge National Laboratory, Oak Ridge, Tennessee. Oak Ridge National Lab., TN (United States). Environmental Restoration Div.; H and R Technical Associates, Oak Ridge, TN (United States). Mar 1994. 52p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94010028. Source: OSTI; NTIS; INIS; GPO Dep.

The main purpose of this Waste Management Plan is to identify the waste that is expected to be generated in connection with the surface and groundwater monitoring at Waste Area Grouping 6 and to indicate the method of disposal. Another purpose of this plan is to identify the organization, responsibilities, and administrative controls that will be followed to ensure proper handling of the waste. The WAG 6 environmental monitoring project consists of a preparation phase and a monitoring phase. During the preparation phase, 6 new wells and 9 piezometers will be

installed, 15 wells that have not been used recently will be redeveloped, and a surface water monitoring station will be constructed. The monitoring phase will include sampling of groundwater and surface water. The groundwater monitoring program will include 19 downgradient wells, 11 upgradient wells, and 15 wells located in the interior of the WAG 6 area. The current program calls for upgradient wells to be sampled semiannually for the contaminants of concern listed in Table 1 and geochemical parameters. The downgradient and interior wells will be sampled and analyzed quarterly for contaminants of concern and geochemical parameters. The surface water monitoring program will include samples from 12 monitoring sites. Samples will be taken following storm events and analyzed for radionuclides, total suspended solids, volatiles, and geochemical parameters.

2263 (ORNL/ER-203) Groundwater quality sampling and analysis plan for environmental monitoring in Waste Area Grouping 6 at Oak Ridge National Laboratory, Oak Ridge, Tennessee. Oak Ridge National Lab., TN (United States). Environmental Restoration Div.; CDM Federal Programs Corp., Oak Ridge, TN (United States). Mar 1994. 112p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94010029. Source: OSTI; NTIS; INIS; GPO Dep.

This Sampling and Analysis Plan addresses groundwater quality sampling and analysis activities that will be conducted in support of the Environmental Monitoring Plan for Waste Area Grouping (WAG) 6. WAG 6 is a shallow-burial land disposal facility for low-level radioactive waste at the Oak Ridge National Laboratory, a research facility owned by the US Department of energy and managed by Martin Marietta Energy Systems, Inc. (Energy Systems). Groundwater sampling will be conducted by Energy Systems at 45 wells within WAG 6. The samples will be analyzed for various organic, inorganic, and radiological parameters. The information derived from the groundwater quality monitoring, sampling, and analysis will aid in evaluating relative risk associated with contaminants migrating off-WAG, and also will fulfill Resource Conservation and Recovery Act (RCRA) interim permit monitoring requirements. The sampling steps described in this plan are consistent with the steps that have previously been followed by Energy Systems when conducting RCRA sampling.

2264 (ORNL/ER-204) Field Operations Procedures Manual for environmental monitoring in Waste Area Grouping 6 at Oak Ridge National Laboratory, Oak Ridge, Tennessee. Oak Ridge National Lab., TN (United States); CDM Federal Programs Corp., Oak Ridge, TN (United States). Dec 1993. 70p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94008062. Source: OSTI; NTIS; INIS; GPO Dep.

This Sampling and Analysis Plan addresses meteorological monitoring activities that will be conducted in support of the Environmental Monitoring Plan for Waste Area Grouping (WAG) 6. WAG 6 is a shallow-burial land disposal facility for low-level radioactive waste at the Oak Ridge National Laboratory, a research facility owned by the US Department of Energy and managed by Martin Marietta Energy Systems, Inc. Meteorological monitoring of various climatological parameters (e.g., temperature, wind speed, humidity) will be collected by instruments installed at WAG 6. Data will be recorded electronically at frequencies varying from 5-min intervals to 1-h intervals, dependent upon parameter. The data will be downloaded every 2 weeks, evaluated, compressed,

and uploaded into a WAG 6 data base for subsequent use. The meteorological data will be used in water balance calculations in support of the WAG 6 hydrogeological model.

2265 (ORNL/ER-220) Geophysical survey work plan for White Wing Scrap Yard (Waste Area Grouping 11) at Oak Ridge National Laboratory, Oak Ridge, Tennessee. Oak Ridge National Lab., TN (United States); CDM Federal Programs Corp., Oak Ridge, TN (United States). Feb 1994. 33p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94009491. Source: OSTI; NTIS; INIS; GPO Dep.

The White Wing Scrap Yard, located on the U.S. Department of Energy's Oak Ridge Reservation, served as an aboveground storage and disposal area for contaminated debris and scrap from the Oak Ridge K-25 Site, the Oak Ridge Y-12 Plant, and the Oak Ridge National laboratory. The site is believed to have been active from the early 1950s until the mid-1960s. A variety of materials were disposed of at the site, including contaminated steel tanks and vehicles. As an interim corrective action, a surface debris removal effort was initiated in November 1993 to reduce the potential threat to human health and the environment from the radionuclide-contaminated debris. Following this removal effort, a geophysical survey will be conducted across the site to locate and determine the lateral extent of buried non-indigenous materials. This survey will provide the data necessary to prepare a map showing areas of conductivity and magnetic intensity that vary from measured background values. These anomalies represent potential buried materials and therefore can be targeted for further evaluation. This work plan outlines the activities necessary to conduct the geophysical survey.

2266 (ORNL/ER-223) Characterization of Secondary Solid Wastes in Trench Water in Waste Area Grouping 6 at Oak Ridge National Laboratory, Oak Ridge, Tennessee. Taylor, P.A.; Kent, T.E. Oak Ridge National Lab., TN (United States). Feb 1994. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94009494. Source: OSTI; NTIS; INIS; GPO Dep.

This project was undertaken to demonstrate that new liquid waste streams, generated as a consequence of closure activities at Waste Area Grouping (WAG) 6 and other sites, can be treated at the existing wastewater treatment facilities at Oak Ridge National Laboratory (ORNL) to meet discharge requirements without producing hazardous secondary solid wastes. Previous bench and pilot-scale treatability studies have shown that ORNL treatment operations will adequately remove the contaminants and that the secondary solid wastes produced were not hazardous when treating water from two trenches in WAG 6. This study used WAG 6 trench water spiked with the minimum concentration of Toxicity Characteristics Leaching Procedure (TCLP) constituents (chemicals that can make a waste hazardous) found in any groundwater samples at ORNL. The Wastewater Treatment Test Facility (WTF), a 0.5 L/min pilot plant that simulates the treatment capabilities of the Process Waste Treatment Plant (PWTP) and Nonradiological Wastewater Treatment Plant (NRWTP), was used for this test. This test system, which is able to produce secondary wastes in the quantities necessary for TCLP testing, was operated for a 59-d test period with a minimum of problems and downtime. The pilot plant operating data verified that WAG 6 trench waters, spiked with the minimum concentration of TCLP contaminants measured to date, can be

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treated at the PWTP and NRWTP to meet current discharge limits. The results of the TCLP analysis indicated that none of the secondary solid wastes produced during the treatment of these wastewaters will be considered hazardous as defined by the Resource Conservation and Recovery Act.

2267 (ORNL/ER/Sub-87-99053/50) Data Base Management Plan for the remedial investigation of Waste Area Grouping 5 at Oak Ridge National Laboratory, Oak Ridge, Tennessee. Oak Ridge National Lab., TN (United States); Bechtel National, Inc., Oak Ridge, TN (United States). Jul 1992. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92019492. Source: OSTI; NTIS; INIS; GPO Dep.

The remedial investigation (RI) for Waste Area Grouping (WAG) 5 will involve gathering, verifying, analyzing, reporting, and archiving numerous types of field and analytical data. Field investigations will produce data documenting surficial and geophysical surveys, geologic and hydrogeologic logs, aquifer tests, water level measurements, geophysical logs, and stream and seepage flow measurements. Laboratory analyses will be performed on soil, surface water, groundwater, and sediment samples collected during field investigations. All data resulting from these activities will be contained in the Bechtel RI/feasibility study (FS) project data base and will be managed in accordance with the RI/FS Data Base Management Plan and this WAG-specific plan. This Data Base Management Plan describes the gathering, verifying, analyzing, reporting, and archiving of data generated during Bechtel's remedial investigation of Waste Area Grouping 5. This investigation will produce data documenting surficial surveys, geophysical surveys, geologic and hydrologic logs, aquifer tests, water level measurements, geophysical logs, and stream and seep flow measurements. Also, laboratory analyses will be performed on soil, surface water, groundwater, and sediment samples. The 1500 series of Bechtel project procedures, "Data Base Management," and the project Data Base Management Plan will be used to ensure that data are handled properly.

2268 (ORNL/ER/Sub-87-99053/62) Data Base Management Plan for the remedial investigation of Waste Area Grouping 10, Operable Unit 3, at Oak Ridge National Laboratory, Oak Ridge, Tennessee: Environmental Restoration Program. Bechtel National, Inc., Oak Ridge, TN (United States); Oak Ridge National Lab., TN (United States). Oct 1993. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94003517. Source: OSTI; NTIS; INIS; GPO Dep.

This Data Base Management Plan describes the gathering, verifying, analyzing, reporting, and archiving of data generated during the remedial investigation of Waste Area Grouping 10, Operable Unit 3. This investigation will produce data documenting wellhead surveys, well headspace gas pressure measurements, geophysical surveys, water level measurements, and borehole geophysical logs. Close Support Laboratory analyses will be performed on well headspace gas and well water samples.

2269 (ORNL/ER/Sub-87-99053/69) Site Characterization Plan for decontamination and decommissioning of Buildings 3506 and 3515 at Oak Ridge National Laboratory, Oak Ridge, Tennessee. Oak Ridge National Lab., TN (United States); Bechtel National, Inc., Oak Ridge, TN (United States). Sep 1993. 114p. Sponsored by USDOE,

Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94002537. Source: OSTI; NTIS; INIS; GPO Dep.

Buildings 3506, the Waste Evaporator Facility, and 3515, the Fission Product Pilot Plant, at Oak Ridge National Laboratory (ORNL), are scheduled for decontamination and decommissioning (D&D). This Site Characterization Plan (SCP) presents the strategy and techniques to be used to characterize Buildings 3506/3515 for the purpose of planning D&D activities. The elements of the site characterization for Buildings 3506/3515 are planning and preparation, field investigation, and characterization reporting. Other level of effort activities will include management and oversight, project controls, meetings, and progress reporting. The objective of the site characterization is to determine the nature and extent of radioactive and hazardous materials and other industrial hazards in and around the buildings. This information will be used in subsequent planning to develop a detailed approach for final decommissioning of the facilities: (1) to evaluate decommissioning alternatives and design the most cost-effective D&D approach; (2) to determine the level and type of protection necessary for D&D workers; and (3) to estimate the types and volumes of wastes generated during D&D activities. The current D&D characterization scope includes the entire building, including the foundation and equipment or materials within the building. To estimate potential worker exposure from the soil during D&D, some subfoundation soil sample collection is planned. Buildings 3506/3515 are located in the ORNL main plant area, to the west and east, respectively, of the South Tank Farm. Building 3506 was built in 1949 to house a liquid waste evaporator and was subsequently used for an incinerator experiment. Partial D&D was done prior to abandonment, and most equipment has been removed. Building 3515 was built in 1948 to house fission product separation equipment. In about 1960, all entrances were sealed with concrete block and mortar. Building 3515 is expected to be highly contaminated.

2270 (ORNL/ER/Sub-87-99053/70) Site Characterization Plan for the Old Hydrofracture Facility at Oak Ridge National Laboratory, Oak Ridge, Tennessee: Environmental Restoration Program. Oak Ridge National Lab., TN (United States); Bechtel National, Inc., Oak Ridge, TN (United States). Jan 1994. 122p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94009179. Source: OSTI; NTIS; INIS; GPO Dep.

The aboveground structures of the Old Hydrofracture Facility (OHF) at Oak Ridge National Laboratory (ORNL) are scheduled for decontamination and decommissioning (D&D). This Site Characterization Plan presents the strategy and techniques to be used to characterize the OHF D&D structures in support of D&D planning, design, and implementation. OHF is located approximately 1 mile southwest of the main ORNL complex. From 1964 to 1979, OHF was used in the development and full-scale application of hydrofracture operations in which 969,000 gal of liquid low-level waste (LLLW) was mixed with grout and then injected under high pressure into a low-permeability shale formation approximately 1/6 mile underground.

2271 (ORNL/ER/Sub-90-LJ068/1) Risk characterization data manual for inactive liquid low-level waste tank systems at Oak Ridge National Laboratory, Oak Ridge, Tennessee. Oak Ridge National Lab., TN (United States).

Environmental Restoration Div.; H and R Technical Associates, Inc., Oak Ridge, TN (United States). Sep 1992. 52p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92041218. Source: OSTI; NTIS; INIS; GPO Dep.

This manual reports the results of a risk characterization of inactive liquid low-level radioactive waste (LLLW) underground storage tanks (USTs) at the Oak Ridge National Laboratory (ORNL). Of the 39 tanks at ORNL that have been accepted into the Environmental Restoration Program, the 29 LLLW USTs that have been sampled for preliminary characterization were considered. Each tank was scored on a scale of 1 to 5 on the basis of three criteria: (1) leak characteristics, (2) location, and (3) toxicological characteristics of residual sludges and liquids. Each criterion was then weighted according to perceived importance. The criterion score multiplied by the weighting factor equaled the tank's total score for that criterion. The three weighted criterion scores for each tank were then summed for a total score for that tank. When the scores for all tanks had been weighted and summed, the tanks were ranked in descending order on the basis of their total scores. The highest possible score for a tank is 30. The descending rank order represents the recommended priorities for evaluation: the higher the score, the higher the priority for evaluation.

2272 (ORNL/M-1871) Ecological assessment plan for Waste Area Grouping 5. Ashwood, T.L. Oak Ridge National Lab., TN (United States). Apr 1992. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92010726. Source: OSTI; NTIS; GPO Dep.

Environmental Sciences Division Publication No. 3777.

Waste Area Grouping (WAG) 5 at Oak Ridge National Laboratory contains 13 solid waste management units (SWMUs) covering a surface area of ≈ 20 ha in Melton Valley south of the main plant area. The largest SWMUs are Solid Waste Storage Area (SWSA) 5 and SWSA 5 North. These two SWMUs also contain most of the radioactive contamination. WAG 5 contains two surface impoundments and two intermittent streams; runoff from WAG 5 enters White Oak Creek and Melton Branch. Principal contaminants include fission-product radionuclides and transuranic elements, but trace metals and some organics may also be present. This document describes the ecological assessment that will perform to determine the ecological effects of contamination from WAG 5. This document also supports the baseline risk assessment and subsequent alternatives evaluations for WAG 5. Three specific tasks are incorporated in the WAG 5 ecological assessment: (1) threatened and endangered species surveys, (2) ambient toxicity tests of seeps, stream reaches, and soil that are identified as being contaminant sources, and (3) sampling of wildlife (specifically wild turkeys) that could potentially transfer contaminants from WAG 5 to humans.

2273 (ORNL/M-2563) Biological Monitoring and Abatement Program for the Oak Ridge K-25 Site. Kszos, L.A. (Oak Ridge K-25 Site, TN (United States)); Adams, S.M.; Ashwood, T.L.; Blaylock, B.G.; Greeley, M.S.; Loar, J.M.; Peterson, M.J.; Ryon, M.G.; Smith, J.G.; Southworth, G.R.; Shoemaker, B.A.; Hinzman, R.L. Oak Ridge K-25 Site, TN (United States). Feb 1993. 51p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OT21400. (K/EM-24/R1). Order Number DE93008487. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental Sciences Division, Oak Ridge National Laboratory Publication No. 4009.

A proposed Biological Monitoring and Abatement Program (BMAP) for the Oak Ridge K-25 Site was prepared in December 1992 as required by the renewed National Pollutant Discharge Elimination System permit that was issued on October 1, 1992. The proposed BMAP consists of four tasks that reflect different but complementary approaches to evaluating the effects of K-25 Site effluents on the ecological integrity of Mitchell Branch, Poplar Creek, and the Poplar Creek embayment of the Clinch River. These tasks include (1) ambient toxicity monitoring, (2) bioaccumulation monitoring, (3) assessment of fish health, and (4) instream monitoring of biological communities. This overall BMAP plan combines established protocols with current biological monitoring techniques to assess environmental compliance and quantify ecological recovery. The BMAP will also determine whether the effluent limits established for the K-25 Site protect the designated use of the receiving streams (Mitchell Branch, Poplar Creek, and Clinch River) for growth and propagation of fish and other aquatic life. Results obtained from this biological monitoring program will also be used to document the ecological effects (and effectiveness) of remedial actions.

2274 (ORNL/RASA-89/18) Results of the Radiological Survey at Conviber, Inc., 644 Garfield Street, Springdale, Pennsylvania (CVP001). Foley, R.D.; Cottrell, W.D.; Crutcher, J.W. Oak Ridge National Lab., TN (United States). Health and Safety Research Div. Oct 1991. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92004589. Source: OSTI; NTIS; INIS; GPO Dep.

As part of the Formerly Utilized Sites Remedial Action Program (FUSRAP), the US Department of Energy (DOE) is implementing a radiological survey program to determine the radiological conditions at sites that were used by the department's predecessor agencies. During the mid-1940s, and possibly continuing until 1951, the Conviber site in Springdale, Pennsylvania, was used to machine extruded uranium in support of government efforts. In 1980 a radiological scanning survey of this site was conducted by DOE and Argonne National Laboratory (ANL) staffs. Their report noted one anomaly: elevated radiation levels over a small area inside the building where uranium had been machined. Because much of the floor was inaccessible, for surveying and because of the lack of definitive records documenting use of this site, a comprehensive radiological assessment was recommended. The radiological survey discussed in this report for the site of Conviber, Inc., Springdale, Pennsylvania, was conducted by members of the Measurement Applications and Development Group of Oak Ridge National Laboratory in June of 1989. The survey included a surface gamma scan, collection of concrete and soil samples, and measurement of direct and removable alpha and beta-gamma contamination. One indoor location with a gamma measurement of $20 \mu\text{R/h}$ was found. In June of 1990 ORNL staff returned to investigate the location with elevated gamma. A hole was drilled through the concrete, gamma measurements were taken, and soil samples were obtained for analyses. In these eight indoor soil samples, concentrations of ^{238}U ranged from 90 to 20,000 pCi/g. However, under current site use, residual uranium covered by concrete does not pose a health risk.

2275 (ORNL/RASA-90/7) Results of mobile gamma scanning activities in St. Louis, Missouri. Rodriguez,

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R.E.; Witt, D.A.; Cottrell, W.D.; Carrier, R.F. Oak Ridge National Lab., TN (United States). Jun 1991. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE91017778. Source: OSTI; NTIS; INIS; GPO Dep.

From 1942 through approximately 1966, the Mallinckrodt Chemical Works operated four plants in St. Louis, Missouri, for the Manhattan Engineer District and the Atomic Energy Commission. A variety of production processes using uranium- and radium-bearing ore materials were performed at the plants. It is the policy of the DOE to verify that radiological conditions at such sites or facilities comply with current DOE guidelines. Guidelines for release and use of such sites have become more stringent as research has provided more information since previous cleanups. The Formerly Utilized Sites Remedial Action Program (FUSRAP) was established as part of that effort to confirm the closeout status of facilities under contract to agencies preceding DOE during early nuclear energy development. Under the FUSRAP program, the Mallinckrodt properties have been previously investigated to determine the extent of on-site radiological contamination. At the request of DOE, Oak Ridge National Laboratory (ORNL) conducted a survey in May, 1990, of public roadways and suspected haul routes between the Mallinckrodt plant and storage sites in St. Louis to ensure that no residual radioactive materials were conveyed off-site. A mobile gamma scanning van with an on-board computer system was used to identify possible anomalies. Suspect areas are those displaying measurements deviating from gamma exposure rates identified as typical for radiologically unenhanced areas in the vicinity of the areas of interest. The instrumentation highlighted three anomaly locations each of which measured less than 1m² in size. None of the slightly elevated radiation levels originated from material associated with former AEC-related processing operations in the area. The anomalies resulted from elevated concentrations of radionuclides present in phosphate fertilizers, increased thorium in road-base gravel, and emanations from the radioactive storage site near the Latty Avenue airport. 9 refs., 3 figs.

2276 (ORNL/RASA-91/7) Results of the radiological survey at the former McKinney Tool and Manufacturing Company, 1688 Arabella Road, Cleveland, Ohio (MTC001 and MTC002). Foley, R.D.; Uziel, M.S. Oak Ridge National Lab., TN (United States). Nov 1991. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92006590. Source: OSTI; NTIS; INIS; GPO Dep.

At the request of the US Department of Energy (DOE), a team from Oak Ridge National Laboratory conducted a radiological survey at the site of the former McKinney Tool and Manufacturing Company, 1688, Arabella Road, Cleveland, Ohio. The survey was performed on November 17 and 18, 1990. The purpose of the survey was to determine whether the property was contaminated with radioactive residues, principally ²³⁸U, as a result of work done for the Manhattan Engineer District in 1944. The survey included a gamma scan, a beta-gamma scan, and measurement of alpha level; measurements of direct and removable alpha and beta-gamma levels; and the collection of soil and sediment, dust, and air samples for radionuclide analyses. The survey and sampling covered accessible areas of buildings currently occupied by Parker Rust-Proof and Meistertmatic, Inc., and exterior areas immediately adjacent to these buildings.

2277 (ORNL/RASA-91/8) Results of the radiological survey at the New Betatron Building, Granite City Steel facility, Granite City, Illinois (GSG002). Murray, M.E.; Uziel, M.S. Oak Ridge National Lab., TN (United States). Jan 1992. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92008212. Source: OSTI; NTIS; INIS; GPO Dep.

At the request of the US Department of Energy (DOE), a team from Oak Ridge National Laboratory conducted a radiological survey at the New Betatron Building, located in the South Plant facility of Granite City Steel Division, 1417 State Street, Granite City, Illinois. The survey was performed in August 1991. The purpose of the survey was to determine whether the property was contaminated with radioactive residues, principally ²³⁸U, as a result of work done for the Atomic Energy Commission (AEC) from 1958 to 1966. The survey included a surface gamma scan of the ground surface outdoors near the building, the floor and walls in all accessible areas inside the building, and the roof; measurement of beta-gamma dose rates, alpha radiation levels, and removable alpha and beta-gamma activity levels at selected locations inside the building and on the roof; and radionuclide analysis of outdoor soil samples and indoor samples of shield-wall fill material land debris. Analysis of soil, shield-wall fill material, debris, and smear samples showed no residual ²³⁸U attributable to former AEC-supported operations at this site. None of the indoor or outdoor gamma exposure rate measurements were elevated above DOE guidelines. The slight elevations in gamma levels found outdoors and on the roof over the shield wall are typical of naturally occurring radioactive substances present in coal ash and cinders in the fill material surrounding the building and in concrete and cinders used in construction of the shield wall. The slightly elevated gamma levels measured at soil sampling locations can be attributed to the presence of naturally occurring radionuclides. In all samples, ²²⁶Ra and ²³⁸U appeared to be in equilibrium, indicating that these radionuclides were of natural origin and not derived from former AEC activities at this site.

2278 (ORNL/RASA-91/9) Radiological survey results at 34 School Street, Beverly, Massachusetts (VB023). Foley, R.D.; Johnson, C.A. Oak Ridge National Lab., TN (United States). Jul 1992. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92041365. Source: OSTI; NTIS; INIS; GPO Dep.

At the request of the US Department of Energy (DOE), a team from Oak Ridge National Laboratory conducted a radiological survey at 34 School Street, Beverly, Massachusetts. The survey was performed in May 1991. The purpose of the survey was to determine if uranium from work performed under government contract at the former Ventron facility had migrated off-site to neighboring areas. The survey included a surface gamma scan and the collection of soil samples for radionuclide analyses. Results of the survey demonstrated no radionuclide concentrations or radiation measurements in excess of the DOE Formerly Utilized Sites Remedial Action Program guidelines.

2279 (ORNL/RASA-91/10) Radiological survey results at 19 Wellman Street, Beverly, Massachusetts (VB024). Foley, R.D.; Johnson, C.A. Oak Ridge National Lab., TN (United States). Jul 1992. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92018955. Source: OSTI; NTIS; INIS; GPO Dep.

At the request of the US Department of Energy (DOE), a team from Oak Ridge National Laboratory conducted a radiological survey at 19 Wellman Street, Beverly, Massachusetts. The survey was performed in May 1991. The Purpose of the survey was to determine if uranium work performed under government contract at the former Ventron facility had migrated off-site to neighboring areas. The survey included a surface gamma scan, a beta-gamma scan of paved areas, and the collection of soil samples for radionuclide analyses. Results of the survey demonstrated no radionuclide concentrations or radiation measurements in excess of the DOE Formerly Utilized Site Action Program guidelines.

2280 (ORNL/RASA-91/11) Radiological survey results at 30 Cliff Street, Beverly, Massachusetts (VB022). Foley, R.D.; Johnson, C.A. Oak Ridge National Lab., TN (United States). Jul 1992. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92019484. Source: OSTI; NTIS; INIS; GPO Dep.

At the request of the US Department of Energy (DOE), a team from Oak Ridge National Laboratory conducted a radiological survey at 30 Cliff Street, Beverly, Massachusetts. The survey was performed in May 1991. The purpose of the survey was to determine if uranium from work performed under government contract at the former Ventron facility had migrated off-site to neighboring areas. The survey included a surface gamma scan, a beta-gamma scan of paved areas, and the collection of soil samples for radionuclide analyses. Results of the survey demonstrated no radionuclide concentrations or radiation measurements in excess of the DOE Formerly Utilized Sites Remedial Action Program guidelines. The radionuclide distributions were not significantly different from typical background levels in the Beverly, Massachusetts, area.

2281 (ORNL/RASA-91/12) Radiological survey results at Porter Street City Park, Beverly, Massachusetts (VB026). Foley, R.D.; Johnson, C.A. Oak Ridge National Lab., TN (United States). Aug 1992. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92041349. Source: OSTI; NTIS; INIS; GPO Dep.

At the request of the US Department of Energy (DOE), a team from Oak Ridge National Laboratory conducted a radiological survey at the Porter Street City Park, Beverly, Massachusetts. The survey was performed in May 1991. The purpose of the survey was to determine if uranium from work performed under government contract at the former Ventron facility had migrated off-site to neighboring areas. The survey included a surface gamma scan and the collection of soil samples for radionuclide analyses. Results of the survey demonstrated no radionuclide concentrations or radiation measurements in excess of the DOE Formerly Utilized Sites Remedial Action Program guidelines.

2282 (ORNL/RASA-91/13) Radiological survey results at 9 and 11 Congress Street, Beverly, Massachusetts (VB002). Foley, R.D.; Uziel, M.S. Oak Ridge National Lab., TN (United States). May 1992. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92017804. Source: OSTI; NTIS; INIS; GPO Dep.

At the request of the US Department of Energy (DOE), a team from Oak Ridge National Laboratory conducted a radiological survey at 9 and 11 Congress Street, Beverly,

Massachusetts. The survey was performed in May 1991. The purpose of the survey was to determine if uranium from work performed under government contract at the former Ventron facility had migrated off-site to neighboring areas. The survey included a surface gamma scan, a beta-gamma scan of paved areas, and the collection of soil samples for radionuclide analyses. Results of the survey demonstrated no radionuclide concentrations or radiation measurements in excess of the DOE Formerly Utilized Sites Remedial Action Program guidelines.

2283 (ORNL/RASA-91/14) Radiological survey results at 10 Cliff Street, Beverly, Massachusetts (VB021). Foley, R.D.; Johnson, C.A. Oak Ridge National Lab., TN (United States). Jul 1992. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92041366. Source: OSTI; NTIS; INIS; GPO Dep.

At the request of the US Department of Energy (DOE), a team from Oak Ridge National Laboratory conducted a radiological survey at 10 Cliff Street, Beverly, Massachusetts. The survey was performed in May 1991. The purpose of the survey was to determine if uranium from work performed under government contract at the former Ventron facility had migrated off-site to neighboring areas. The survey included a surface gamma scan, a beta-gamma scan of paved areas, and the collection of soil samples for radionuclide analyses. Results of the survey demonstrated no radionuclide concentrations or radiation measurements in excess of the DOE Formerly Utilized Sites Remedial Action Program guidelines.

2284 (ORNL/RASA-91/15) Radiological survey results at 9 Porter Street, Beverly, Massachusetts (VB020). Foley, R.D.; Johnson, C.A. Oak Ridge National Lab., TN (United States). Jul 1992. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92041351. Source: OSTI; NTIS; INIS; GPO Dep.

At the request of the US Department of Energy (DOE), a team from Oak Ridge National Laboratory conducted a radiological survey at 9 Porter Street, Beverly, Massachusetts. The survey was performed in May 1991. The purpose of the survey was to determine if uranium from work performed under government contract at the former Ventron facility had migrated off-site to neighboring areas. The survey included a surface gamma scan and the collection of soil samples for radionuclide analyses. Results of the survey demonstrated no radionuclide concentrations or radiation measurements in excess of the DOE Formerly Utilized Sites Remedial Action Program guidelines.

2285 (ORNL/RASA-91/16) Radiological survey results at 5 Porter Street, Beverly, Massachusetts (VB019). Foley, R.D.; Johnson, C.A. Oak Ridge National Lab., TN (United States). Jul 1992. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92018517. Source: OSTI; NTIS; INIS; GPO Dep.

At the request of the US Department of Energy (DOE), a team from Oak Ridge National Laboratory conducted a radiological survey at 5 Porter Street, Beverly, Massachusetts. The survey was performed in May 1991. The purpose of the survey was to determine if uranium from work performed under government contract at the former Ventron facility had migrated off-site to neighboring areas. The survey included a surface gamma scan and the collection of soil samples for

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radionuclide analyses. Results of the survey demonstrated no radionuclide concentrations or radiation measurements in excess of the DOE Formerly Utilized Site Remedial Action Program guidelines.

2286 (ORNL/RASA-91/17) Radiological survey results at 5 Cliff Street, Beverly, Massachusetts (VB018). Foley, R.D.; Johnson, C.A. Oak Ridge National Lab., TN (United States). Aug 1992. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92041348. Source: OSTI; NTIS; INIS; GPO Dep.

At the request of the US Department of Energy (DOE), a team from Oak Ridge National Laboratory conducted a radiological survey at 5 Cliff Street, Beverly, Massachusetts. The survey was performed in May 1991. The purpose of the survey was to determine if uranium from work performed under government contract at the former Ventron facility had migrated off-site to neighboring areas. The survey included a surface gamma scan and the collection of soil samples for radionuclide analyses. Results of the survey demonstrated no radionuclide concentrations or radiation measurements in excess of the DOE Formerly Utilized Sites Remedial Action Program guidelines.

2287 (ORNL/RASA-91/18) Radiological survey results at 9 Cliff Street, Beverly, Massachusetts (VB017). Foley, R.D.; Johnson, C.A. Oak Ridge National Lab., TN (United States). Jul 1992. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92041369. Source: OSTI; NTIS; INIS; GPO Dep.

At the request of the US Department of Energy (DOE), a team from Oak Ridge National Laboratory conducted a radiological survey at 9 Cliff Street, Beverly, Massachusetts. The survey was performed in May 1991. The purpose of the survey was to determine if uranium from work performed under government contract at the former Ventron facility had migrated off-site to neighboring areas. The survey included a surface gamma scan and the collection of soil samples for radionuclide analyses. Results of the survey demonstrated no radionuclide concentrations or radiation measurements in excess of the DOE Formerly Utilized Sites Remedial Action Program guidelines.

2288 (ORNL/RASA-91/19) Radiological survey results at 13 Cliff Street, Beverly, Massachusetts (VB015). Foley, R.D.; Johnson, C.A. Oak Ridge National Lab., TN (United States). Jul 1992. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92041368. Source: OSTI; NTIS; INIS; GPO Dep.

At the request of the US Department of Energy (DOE), a team from Oak Ridge National Laboratory conducted a radiological survey at 13 Cliff Street, Beverly, Massachusetts. The survey was performed in May 1991. The purpose of the survey was to determine if uranium from work performed under government contract at the former Ventron facility had migrated off-site to neighboring areas. The survey included a surface gamma scan, a beta-gamma scan of paved areas, and the collection of soil samples for radionuclide analyses. Results of the survey demonstrated no radionuclide concentrations or radiation measurements in excess of the DOE Formerly Utilized Sites Remedial Action Program guidelines.

2289 (ORNL/RASA-91/20) Radiological survey results at 13 Congress Street, Beverly, Massachusetts (VB003). Foley, R.D.; Uziel, M.S. Oak Ridge National Lab.,

TN (United States). Jul 1992. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92019071. Source: OSTI; NTIS; INIS; GPO Dep.

At the request of the US Department of Energy (DOE), a team from Oak Ridge National Laboratory conducted a radiological survey at 13 Congress Street, Beverly, Massachusetts. The survey was performed in May 1991. The purpose of the survey was to determine if uranium from work performed under government contract at the former Ventron facility had migrated off-site to neighboring areas. The survey included a surface gamma scan, a beta-gamma scan of paved areas, and the collection of soil samples for radionuclide analyses. Results of the survey demonstrated no radionuclide concentrations or radiation measurements in excess of the DOE Formerly Utilized Sites Remedial Action Program guidelines.

2290 (ORNL/RASA-91/21) Radiological survey results at 15 Congress Street, Beverly, Massachusetts (VB004). Foley, R.D.; Uziel, M.S. Oak Ridge National Lab., TN (United States). Jul 1992. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92019072. Source: OSTI; NTIS; INIS; GPO Dep.

At the request of the US Department of Energy (DOE), a team from Oak Ridge National Laboratory conducted a radiological survey at 15 Congress Street, Beverly, Massachusetts. The survey was to determine if uranium from work performed under government contract at the former Ventron facility had migrated off-site to neighboring areas. The survey included a surface gamma scan, a beta-gamma scan of paved areas, and the collection of soil samples for radionuclide analyses. Results of the survey demonstrated no radionuclide concentrations or radiation measurements in excess of the DOE Formerly Utilized Sites Remedial Action Program guidelines.

2291 (ORNL/RASA-91/22) Radiological survey results at 2 Porter Street, Beverly, Massachusetts (VB005). Foley, R.D.; Carrier, R.F. Oak Ridge National Lab., TN (United States). Aug 1992. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93000556. Source: OSTI; NTIS; INIS; GPO Dep.

At the request of the US Department of Energy (DOE), a team from Oak Ridge National Laboratory conducted a radiological survey at 2 Porter Street, Beverly, Massachusetts. The survey was performed in May 1991. The purpose of the survey was to determine if uranium dust from work performed under government contract at the former Ventron facility had migrated off-site to neighboring areas. The survey included a surface gamma scan and the collection of soil samples for radionuclide analyses. Results of the survey demonstrated no radionuclide concentrations or radiation measurements in excess of the DOE Formerly Utilized Sites Remedial Action Program guidelines.

2292 (ORNL/RASA-91/23) Radiological survey results at 2 Cliff Street, Beverly, Massachusetts (VB007). Foley, R.D.; Carrier, R.F. Oak Ridge National Lab., TN (United States). Aug 1992. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93000559. Source: OSTI; NTIS; INIS; GPO Dep.

At the request of the US Department of Energy (DOE), a team from Oak Ridge National Laboratory conducted a radiological survey at 2 Cliff Street, Beverly, Massachusetts. The survey was performed in May 1991. The purpose of the survey was to determine if uranium dust from work performed under government contract at the former Ventron facility had migrated off-site to neighboring areas. The survey included a surface gamma scan and the collection of soil samples for radionuclide analyses. Results of the survey demonstrated no radionuclide concentrations or radiation measurements in excess of the DOE Formerly Utilized Sites Remedial Action Program guidelines.

2293 (ORNL/RASA-91/24) Radiological survey results at 12 Cliff Street, Beverly, Massachusetts (VB010). Foley, R.D.; Carrier, R.F. Oak Ridge National Lab., TN (United States). Aug 1992. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93000557. Source: OSTI; NTIS; INIS; GPO Dep.

At the request of the US Department of Energy (DOE), a team from Oak Ridge National Laboratory conducted a radiological survey at 12 Cliff Street, Beverly, Massachusetts. The survey was performed in May 1991. The purpose of the survey was to determine if uranium dust from work performed under government contract at the former Ventron facility had migrated off-site to neighboring areas. The survey included a surface gamma scan and the collection of soil samples for radionuclide analyses. Results of the survey demonstrated no radionuclide concentrations or radiation measurements in excess of the DOE Formerly Utilized Sites Remedial Action Program guidelines.

2294 (ORNL/RASA-91/25) Radiological survey results at 14 Cliff Street, Beverly, Massachusetts (VB011). Foley, R.D.; Carrier, R.F. Oak Ridge National Lab., TN (United States). Aug 1992. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93000550. Source: OSTI; NTIS; INIS; GPO Dep.

At the request of the US Department of Energy (DOE), a team from Oak Ridge National Laboratory conducted a radiological survey at 14 Cliff Street, Beverly, Massachusetts. The survey was performed in May 1991. The purpose of the survey was to determine if uranium dust from work performed under government contract at the former Ventron facility had migrated off-site to neighboring areas. The survey included a surface gamma scan and the collection of soil samples for radionuclide analyses. Results of the survey demonstrated no radionuclide concentrations or radiation measurements in excess of the DOE Formerly Utilized Sites Remedial Action Program guidelines.

2295 (ORNL/RASA-91/26) Radiological survey results at 18 Cliff Street, Beverly, Massachusetts (VB012). Foley, R.D.; Carrier, R.F. Oak Ridge National Lab., TN (United States). Aug 1992. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93000555. Source: OSTI; NTIS; INIS; GPO Dep.

At the request of the US Department of Energy (DOE), a team from Oak Ridge National Laboratory conducted a radiological survey at 18 Cliff Street, Beverly, Massachusetts. The survey was performed in May 1991. The purpose of the survey was to determine if uranium dust from work performed under government contract at the former Ventron

facility had migrated off-site to neighboring areas. The survey included a surface gamma scan and the collection of soil samples for radionuclide analyses. Results of the survey demonstrated no radionuclide concentrations or radiation measurements in excess of the DOE Formerly Utilized Sites Remedial Action Program guidelines.

2296 (ORNL/RASA-91/27) Radiological survey results at 20 Cliff Street, Beverly, Massachusetts (VB013). Foley, R.D.; Carrier, R.F. Oak Ridge National Lab., TN (United States). Aug 1992. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93000552. Source: OSTI; NTIS; INIS; GPO Dep.

At the request of the US Department of Energy (DOE), a team from Oak Ridge National Laboratory conducted a radiological survey at 20 Cliff Street, Beverly, Massachusetts. The survey was performed in May 1991. The purpose of the survey was to determine if uranium dust from work performed under government contract at the former Ventron facility had migrated off-site to neighboring areas. The survey included a surface gamma scan and the collection of soil samples for radionuclide analyses. Results of the survey demonstrated no radionuclide concentrations or radiation measurements in excess of the DOE Formerly Utilized Sites Remedial Action Program guidelines.

2297 (ORNL/RASA-91/28) Radiological survey results at 15 Cliff Street, Beverly, Massachusetts (VB014). Foley, R.D.; Carrier, R.F. Oak Ridge National Lab., TN (United States). Aug 1992. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93000558. Source: OSTI; NTIS; INIS; GPO Dep.

At the request of the US Department of Energy (DOE), a team from Oak Ridge National Laboratory conducted a radiological survey at 15 Cliff Street, Beverly, Massachusetts. The survey was performed in May 1991. The purpose of the survey was to determine if uranium dust from work performed under government contract at the former Ventron facility had migrated off-site to neighboring areas. The survey included a surface gamma scan and the collection of soil samples for radionuclide analyses. Results of the survey demonstrated no radionuclide concentrations or radiation measurements in excess of the DOE Formerly Utilized Sites Remedial Action Program guidelines.

2298 (ORNL/RASA-91/29) Radiological survey results at Beverly Harbor, Beverly, Massachusetts (VB025). Foley, R.D.; Johnson, C.A. Oak Ridge National Lab., TN (United States). Aug 1992. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93000420. Source: OSTI; NTIS; GPO Dep.

At the request of the US Department of Energy (DOE), a team from Oak Ridge National Laboratory conducted a radiological survey at Beverly Harbor, Beverly, Massachusetts. The survey was performed in May 1991. The purpose of the survey was to determine if uranium from work performed under government contract at the former Ventron facility had migrated off-site to the harbor and neighboring areas. The survey included a surface gamma scan and the collection of soil and biological samples for radionuclide analyses.

2299 (ORNL/RASA-91/30) Radiological survey results at 17 Congress Street, Beverly, Massachusetts (VB006). Foley, R.D.; Uziel, M.S. Oak Ridge National Lab., TN (United States). Jul 1992. 13p. Sponsored by USDOE,

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Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92041370. Source: OSTI; NTIS; INIS; GPO Dep.

At the request of the US Department of Energy (DOE), a team from Oak Ridge National Laboratory conducted a radiological survey at 17 Congress Street, Beverly, Massachusetts. The survey was performed in May 1991. The purpose of the survey was to determine if uranium from work performed under government contract at the former Ventron facility had migrated off-site to neighboring areas. The survey included a surface gamma scan, a beta-gamma scan of selected hard surfaces, and the collection of soil samples for radionuclide analyses. Results of the survey demonstrated no radionuclide concentrations or radiation measurements in excess of the DOE Formerly Utilized Sites Remedial Action Program guidelines.

2300 (ORNL/RASA-92/1) Results of the radiological survey at the former Chapman Valve Manufacturing Company, Indian Orchard, Massachusetts (CIO001). Foley, R.D.; Uziel, M.S. Oak Ridge National Lab., TN (United States). Jul 1992. 43p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92019302. Source: OSTI; NTIS; INIS; GPO Dep.

Radiological survey was conducted at Building 23 (Department No. 40) at the former Chapman Valve Manufacturing Company, Indian Orchard, Massachusetts. The survey was performed in August 1991. The purpose of the survey was to determine whether the property was contaminated with radioactive residues, principally ^{238}U , as a result of work done for the Atomic Energy Commission (AEC) during the 1940s. The survey included a gamma scan, a beta-gamma scan, and measurement of alpha activity; measurement of direct and removable alpha and beta-gamma levels; and the collection of soil, dust, debris, and smear samples for radionuclide analyses. Survey emphasis was on interior floors, walls, and overhead beams. Radionuclide analysis of soil, dust, and debris, and analysis of smear samples indicate that residual ^{238}U attributable to former AEC-supported operations is present at this site. Elevated levels of radioactivity were particularly evident on the floors and walls in the western part of the central area of the building (grid blocks A1 through A6). Concentrations of ^{238}U in dust samples collected from overhead beams exceeded DOE guidelines in grid blocks A1 through A14 and remained elevated in grid blocks A15 through A19. Dust on a movable overhead crane in grid block A23 was well above the guideline, probably because the crane had at some time been located further west. Some contamination was evident in grid blocks B1 through B5, but clutter and debris in this area prevented a thorough survey.

2301 (ORNL/RASA-92/2) Radiological survey results at 6 Cliff Street, Beverly, Massachusetts (VB008). Foley, R.D.; Carrier, R.F. Oak Ridge National Lab., TN (United States). Aug 1992. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92040695. Source: OSTI; NTIS; INIS; GPO Dep.

At the request of the US Department of Energy (DOE), a team from Oak Ridge National Laboratory conducted a radiological survey at 6 Cliff Street, Beverly, Massachusetts. The survey was performed in May 1991. The purpose of the survey was to determine if uranium dust from work performed under government contract at the former Ventron facility had migrated off-site to neighboring areas. The survey included a surface gamma scan and the collection of soil samples for radionuclide analyses. Results of the survey demonstrated

no radionuclide concentrations or radiation measurements in excess of the DOE Formerly Utilized Sites Remedial Action Program guidelines.

2302 (ORNL/RASA-92/3) Radiological survey results at 8 Cliff Street, Beverly, Massachusetts (VB009). Foley, R.D.; Carrier, R.F. Oak Ridge National Lab., TN (United States). Aug 1992. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93000551. Source: OSTI; NTIS; INIS; GPO Dep.

At the request of the US Department of Energy (DOE), a team from Oak Ridge National Laboratory conducted a radiological survey at 8 Cliff Street, Beverly, Massachusetts. The survey was performed in May 1991. The purpose of the survey was to determine if uranium dust from work performed under government contract at the former Ventron facility had migrated off-site to neighboring areas. The survey included a surface gamma scan and the collection of soil samples for radionuclide analyses. Results of the survey demonstrated no radionuclide concentrations or radiation measurements in excess of the DOE Formerly Utilized Sites Remedial Action Program guidelines.

2303 (ORNL/RASA-92/4) Results of the radiological survey at the ALCOA Research Laboratory, 600 Freeport Road, New Kensington, Pennsylvania (ANK001): Environmental Restoration and Waste Management Non-Defense Programs. Foley, R.D.; Brown, K.S. Oak Ridge National Lab., TN (United States). Oct 1992. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93004612. Source: OSTI; NTIS; INIS; GPO Dep.

At the request of the US Department of Energy (DOE), a team from Oak Ridge National Laboratory conducted a radiological survey at the ALCOA Research Laboratory, 600 Freeport Road, New Kensington, Pennsylvania. The survey was performed on November 12, 1991. The purpose of the survey was to determine whether the property was contaminated with radioactive residues, principally ^{238}U , as a result of work done for the Manhattan Engineer District in 1944. The survey included measurement of direct alpha and beta-gamma levels in the northeast corner of the basement of Building 29, and the collection of a debris sample from a floor drain for radionuclide analysis. The survey area was used for experimental canning of uranium slugs prior to production activities at the former New Kensington Works nearby.

2304 (ORNL/RASA-92/5) Results of the radiological survey at the former ALCOA New Kensington Works, Pine and Ninth Streets, New Kensington, Pennsylvania (ANK002). Foley, R.D.; Brown, K.S. Oak Ridge National Lab., TN (United States). Oct 1992. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93003758. Source: OSTI; NTIS; INIS; GPO Dep.

At the request of the US Department of Energy (DOE), a team from Oak Ridge National Laboratory conducted a radiological survey at the former ALCOA New Kensington Works, Pine and Ninth Streets, New Kensington, Pennsylvania. The survey was performed on November 12, 1991. The purpose of the survey was to determine whether the property was contaminated with radioactive residues, principally, as a result of work done for the Manhattan Engineer District in 1944. The survey included a gamma scan of three bays inside Building 18; measurement of direct alpha and beta-gamma levels in the same area; and collection of a dust

sample for radionuclide analysis from the center of each bay. Results of the survey demonstrated no radionuclide concentrations or radiation measurements in excess of the DOE Formerly Utilized Sites Remedial Action Program guidelines for uranium. The radionuclide distributions were not significantly different from typical background levels in the Pittsburgh, Pennsylvania area.

2305 (ORNL/RASA-92/6) Results of the radiological survey at 48 Schlosser Drive, Rochelle Park, New Jersey (RJ005). Foley, R.D.; Brown, K.S. Oak Ridge National Lab., TN (United States). Oct 1992. 17p. Sponsored by US-DOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93003759. Source: OSTI; NTIS; INIS; GPO Dep.

Maywood Chemical Works (MCW) of Maywood, New Jersey, generated process wastes and residues associated with the production and refining of thorium and thorium compounds from monazite ores from 1916 to 1956. MCW supplied rare earth metals and thorium compounds to the Atomic Energy Commission and various other government agencies from the late 1940s to the mid-1950s. Area residents used the sandlike waste from this thorium extraction process mixed with tea and cocoa leaves as mulch in their yards. Some of these contaminated wastes were also eroded from the site into Lodi Brook. At the request of the US Department of Energy (DOE), a group from Oak Ridge National Laboratory conducts investigative radiological surveys of properties in the vicinity of MCW to determine whether a property is contaminated with radioactive residues, principally ^{232}Tb , derived from the MCW site. The survey typically includes direct measurement of gamma radiation levels and soil sampling for radionuclide analyses. The survey of this site, 48 Schlosser Drive, Rochelle Park, New Jersey (RJ005), was conducted on July 14, 1991. Results of the survey demonstrated no radionuclide concentrations in excess of the DOE Formerly Utilized Sites Remedial Action Program criteria. The radionuclide distributions were not significantly different from normal background levels in the northern New Jersey area.

2306 (ORNL/RASA-92/7) Results of the radiological survey at 27 Schlosser Drive, Rochelle Park, New Jersey (RJ004). Foley, R.D.; Brown, K.S. Oak Ridge National Lab., TN (United States). Oct 1992. 16p. Sponsored by US-DOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93003760. Source: OSTI; NTIS; INIS; GPO Dep.

Maywood Chemical Works (MCW) of Maywood, New Jersey, generated process wastes and residues associated with the production and refining of thorium and thorium compounds from monazite ores from 1916 to 1956. MCW supplied rare earth metals and thorium compounds to the Atomic Energy Commission and various other government agencies from the late 1940s to the mid-1950s. Area residents used the sandlike waste from this thorium extraction process mixed with tea and cocoa leaves as mulch in their yards. Some of these contaminated wastes were also eroded from the site into Lodi Brook. At the request of the US Department of Energy (DOE), a group from Oak Ridge National Laboratory conducts investigative radiological surveys of properties in the vicinity of MCW to determine whether a property is contaminated with radioactive residues, principally ^{232}Tb , derived from the MCW site. The survey typically includes direct measurement of gamma radiation levels and soil sampling for radionuclide analyses. The survey of this site, 27 Schlosser Drive, Rochelle Park,

New Jersey (RJ004), was conducted on July 14, 1991. Results of the survey demonstrated no radionuclide concentrations in excess of the DOE Formerly Utilized Sites Remedial Action Program criteria. The radionuclide distributions were not significantly different from normal background levels in the northern New Jersey area.

2307 (ORNL/RASA-92/8) Results of the radiological survey at 31 Schlosser Drive, Rochelle Park, New Jersey (RJ003). Foley, R.D.; Brown, K.S. Oak Ridge National Lab., TN (United States). Oct 1992. 16p. Sponsored by US-DOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93003761. Source: OSTI; NTIS; INIS; GPO Dep.

Maywood Chemical Works (MCW) of Maywood, New Jersey, generated process wastes and residues associated with the production and refining of thorium and thorium compounds from monazite ores from 1916 to 1956. MCW supplied rare earth metals and thorium compounds to the Atomic Energy Commission and various other government agencies from the late 1940s to the mid-1950s. Area residents used the sandlike waste from this thorium extraction process mixed with tea and cocoa leaves as mulch in their yards. Some of these contaminated wastes were also eroded from the site into Lodi Brook. At the request of the US Department of Energy (DOE), a group from Oak Ridge National Laboratory conducts investigative radiological surveys of properties in the vicinity of MCW to determine whether a property is contaminated with radioactive residues, principally ^{232}Tb , derived from the MCW site. The survey typically includes direct measurement of gamma radiation levels and soil sampling for radionuclide analyses. The survey of this site, 31 Schlosser Drive, Rochelle Park, New Jersey (RJ003), was conducted on July 14, 1991. Results of the survey demonstrated no radionuclide concentrations in excess of the DOE Formerly Utilized Sites Remedial Action Program criteria. The radionuclide distributions were not significantly different from normal background levels in the northern New Jersey area.

2308 (ORNL/RASA-92/9) Results of the radiological survey at 37 Schlosser Drive, Rochelle Park, New Jersey (RJ002). Foley, R.D.; Brown, K.S. Oak Ridge National Lab., TN (United States). Oct 1992. 16p. Sponsored by US-DOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93003762. Source: OSTI; NTIS; INIS; GPO Dep.

Maywood Chemical Works (MCW) of Maywood, New Jersey, generated process wastes and residues associated with the production and refining of thorium and thorium compounds from monazite ores from 1916 to 1956. MCW supplied rare earth metals and thorium compounds to the Atomic Energy Commission and various other government agencies from the late 1940s to the mid-1950s. Area residents used the sandlike waste from this thorium extraction process mixed with tea and cocoa leaves as mulch in their yards. Some of these contaminated wastes were also eroded from the site into Lodi Brook. At the request of the US Department of Energy (DOE), a group from Oak Ridge National Laboratory conducts investigative radiological surveys of properties in the vicinity of MCW to determine whether a property is contaminated with radioactive residues, principally ^{232}Th derived from the MCW site. The survey typically includes direct measurement of gamma radiation levels and soil sampling for radionuclide analyses. The survey of this site, 37 Schlosser Drive, Rochelle Park, New Jersey (RJ002), was conducted on July 14, 1991.

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Results of the survey demonstrated no radionuclide concentrations in excess of the DOE Formerly Utilized Sites Remedial Action Program criteria. The radionuclide distributions were not significantly different from normal background levels in the northern New Jersey area.

2309 (ORNL/RASA-92/12) Results of the radiological survey at the Town of Tonawanda Landfill, Tonawanda, New York (TNY001). Rodriguez, R.E.; Murray, M.E.; Uziel, M.S. Oak Ridge National Lab., TN (United States). Oct 1992. 39p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93003672. Source: OSTI; NTIS; INIS; GPO Dep.

At the request of the US Department of Energy (DOE), a team from Oak Ridge National Laboratory conducted a radiological survey at the Town of Tonawanda Landfill, Tonawanda, New York. The survey was performed in September 1991. The purpose of the survey was to determine if radioactive materials from work performed under government contract at the Linde Air Products Division of Union Carbide Corporation, Tonawanda, New York, had been deposited in the landfill. The survey included a surface gamma scan and the collection of soil samples for radionuclide analyses. Results of the survey suggest that material originating at the Linde plant may have been deposited in the landfill. Soil samples S54 and B12 contained technologically enhanced levels of ^{238}U not unlike the product formerly produced by the Linde plant. In contrast, samples B4A, B5A and B7B, containing elevated concentrations of ^{226}Ra and ^{230}Th with much lower concentrations of ^{238}U , were similar to the residue or byproduct of the refinery operation conducted at the Linde plant. In 24 instances, soil samples from the Town of Tonawanda Landfill exceeded DOE guideline values for ^{238}U , ^{226}Ra , and/or ^{230}Th in surface or subsurface soil. Nine of these samples contained radionuclide concentrations more than 30 times the guideline value.

2310 (ORNL/RASA-92/14) Results of the radiological survey at the former Alba Craft Laboratory site properties, Oxford, Ohio (OXO001). Murray, M.E.; Brown, K.S.; Mathis, R.A. Oak Ridge National Lab., TN (United States). Mar 1993. 38p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93010257. Source: OSTI; NTIS; INIS; GPO Dep.

At the request of the US Department of Energy (DOE), a team from Oak Ridge National Laboratory conducted a radiological survey at the former Alba Craft Laboratory Site Properties, Oxford, Ohio. The survey was performed in July and September of 1992. The purpose of the survey was to determine whether the property was contaminated with radioactive residues, primarily ^{238}U , from uranium machining operations conducted for National Lead of Ohio, a prime Atomic Energy Commission contractor. The survey included scan measurement of direct radiation levels inside and outside the former laboratory, outdoors on eight properties adjoining the former laboratory, and the city right-of-way adjacent to the surveyed properties. Radionuclide concentrations were determined in outdoor surface and subsurface soil samples taken from each property and the exterior of the laboratory. Fixed surface residual radioactivity was measured inside the laboratory and outside the building. Air samples were collected, direct exposure was measured, and samples were collected to measure transferable radioactivity inside the building. Results of the survey indicate areas where surface and soil contamination levels are above the DOE guidelines for uncontrolled areas.

2311 (ORNL/RASA-93/1) Radiological survey results at 4400 Piehl Road, Ottawa Lake, Michigan. Foley, R.D.; Johnson, C.A. Oak Ridge National Lab., TN (United States). Apr 1993. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93012241. Source: OSTI; NTIS; INIS; GPO Dep.

At the request of the US Department of Energy (DOE), a team from Oak Ridge National Laboratory conducted a radiological survey at 4400 Piehl Road in Ottawa Lake, Michigan. The survey was performed in September, 1992. The purpose of the survey was to determine if materials containing uranium from work performed under government contract at the former Baker Brothers facility in Toledo, Ohio had been transported off-site to this neighboring area. The radiological survey included surface gamma scans indoors and outdoors, alpha and beta scans inside the house and attached garage, beta-gamma scans of the hard surfaces outside, and the collection of soil, water, and dust samples for radionuclide analyses. Results of the survey demonstrated that the majority of the measurements on the property were within DOE guidelines. However, the presence of isolated spots of uranium contamination were found in two areas where materials were allegedly transported to the property from the former Baker Brothers site. Uranium uptake by persons on the property by ingestion is fairly unlikely, but inhalation is a possibility. Based on these findings, it is recommended that the residential property at 4400 Piehl Road in Ottawa Lake, Michigan be considered for inclusion under FUSRAP.

2312 (ORNL/RASA-93/3) Results of the radiological survey at 77 Sinniger Street, Maywood, New Jersey (MJ052). Foley, R.D.; Brown, K.S. Oak Ridge National Lab., TN (United States). Jun 1993. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93017380. Source: OSTI; NTIS; INIS; GPO Dep.

Maywood Chemical Works (MCW) of Maywood, New Jersey, generated process wastes and residues associated with the production and refining of thorium and thorium compounds from monazite ores from 1916 to 1956. MCW supplied rare earth metals and thorium compounds to the Atomic Energy Commission and various other government agencies from the late 1940s to the mid-1950s. Area residents used the sandlike waste from this thorium extraction process mixed with tea and cocoa leaves as mulch in their yards. Some of these contaminated wastes were also eroded from the site into Lodi Brook. At the request of the US Department of Energy (DOE), a group from Oak Ridge National Laboratory conducts investigative radiological surveys of properties in the vicinity of MCW to determine whether a property is contaminated with radioactive residues, principally ^{232}Th , derived from the MCW site. The survey typically includes direct measurement of gamma radiation levels and soil sampling for radionuclide analyses. The survey of this site, 77 Sinniger Street, Maywood, New Jersey (MJ052), was conducted on December 17, 1992. Results of the survey demonstrated no radionuclide concentrations in excess of the DOE Formerly Utilized Sites Remedial Action Program criteria. The radionuclide distributions were not significantly different from normal background levels in the northern New Jersey area.

2313 (ORNL/RASA-93/4) Results of the radiological verification survey of the partial remediation at 90 Avenue C, Lodi, New Jersey (LJ079V). Foley, R.D.; Johnson, C.A. Oak Ridge National Lab., TN (United States). Feb

1994. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94008867. Source: OSTI; NTIS; INIS; GPO Dep.

The property at 90 Avenue C, Lodi, New Jersey is one of the vicinity properties of the former Maywood Chemical Works, Maywood, New Jersey designated for remedial action by the US Department of Energy (DOE). In July 1991, Bechtel National, Inc. performed a partial remedial action on this property. At the request of DOE, a team from Oak Ridge National Laboratory conducted an independent radiological verification survey in July, 1991 at this site. The purpose of the verification survey was to ensure the effectiveness of remedial actions performed within FUSRAP and to confirm the site's compliance with DOE guidelines. The radiological survey included surface gamma scans indoors and outdoors, ground-level beta-gamma measurements, and systematic and biased soil and material sampling. Results of the verification survey demonstrated that all radiological measurements on the portions of the property that had been remediated were within DOE guidelines. However, there still remains a portion of the property to be remediated that is not covered by this verification survey.

2314 (ORNL/RASA-93/5) Results of the mobile gamma scanning activities in Wayne and Pequannock Townships, New Jersey. Johnson, C.A.; Roberts, D.A.; Patania, V.P.; Foley, R.D. Oak Ridge National Lab., TN (United States). Jan 1994. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94006186. Source: OSTI; NTIS; INIS; GPO Dep.

During the early 1980s the W. R. Grace site and the adjacent area were the focus of several radiological investigations. Radiological surveys revealed surface radionuclide concentrations greater than those acceptable under US Department of Energy (DOE) remedial action guidelines. In 1984, Congress assigned responsibility for cleanup of the W.R. Grace site to the Department of Energy. The property was redesignated as the Wayne Interim Storage Site (WISS) and in 1985 DOE began plans for survey/monitoring, and remedial action of nearby vicinity properties and the interim storage site. Evaluations of the radiological survey data in 1986 indicated radioactive contamination above current DOE guidelines at the off-site areas of parts of Township Park southwest of WISS, and parts of the Sheffield Brook area and railroad siding in Pequannock Township. Remedial action was conducted over several years of most of these areas and independent verification of remedial action was performed. A team from Oak Ridge National Laboratory conducted a mobile radiological scanning survey of a stretch of public roadway in the immediate vicinity south of the WISS, extending northwest to the Pompton turnpike. A mobile gamma scanning van with an on-board computer system was used to identify at least 24 anomalous areas, some attributable to the naturally elevated levels in concrete, asphalt, and natural granite found in streets, driveways and landscaping materials in the area. Analyses of the biased soil samples taken in the ballpark also revealed slightly elevated thorium concentrations. However, soil concentration measurements when averaged over 100 m² fall below the limits prescribed by DOE radiological guidelines established for this site. The anomalies may result from a wide range of sources, such as ash, granite, and fertilizer as well as materials from the former Grace facility.

2315 (ORNL/RASA-93/7) Radiological re-survey results at 130 West Central Avenue, Maywood, New

Jersey (MJ029). Murray, M.E.; Johnson, C.A. Oak Ridge National Lab., TN (United States). Jan 1994. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94006421. Source: OSTI; NTIS; INIS; GPO Dep.

Maywood Chemical Works (MCW) of Maywood, New Jersey, generated process wastes and residues associated with the production and refining of thorium and thorium compounds from 1916 to 1959. During the early years of operation, MCW stored wastes and residues in low-lying areas west of the processing facilities and consequently some of the residuals containing radioactive materials migrated offsite to the surrounding area. Subsequently, the U.S. Department of Energy (DOE), designated for remedial action the old MCW property and several vicinity properties. Additionally, in 1984, the property at 130 West Central Ave., Maywood, New Jersey and properties in its vicinity were included as a decontamination research and development project under the DOE Formerly Utilized Sites Remedial Action Program. In 1987 and 1988, at the request of DOE, ORNL conducted a radiological survey on this property. A second radiological survey by ORNL was conducted on this property in May, 1993 at the request of DOE after an ad hoc radiological survey, requested by a new property owner and conducted by Bechtel National, Inc. (BNI), identified some contamination not previously found by ORNL. The purpose of the survey was to determine if residuals from the old MCW were present on the property, and if so, if any radiological elements present were above guidelines. A certified civil survey was requisitioned by ORNL to determine actual property boundaries before beginning the radiological survey. The radiological re-survey included a surface gamma scan and the collection of a large number of soil samples for radionuclide analyses.

2316 (ORNL/RASA-94/1) Results of the radiological survey at the former Herring-Hall-Marvin Safe Company (3rd floor), 1550 Grand Boulevard, Hamilton, Ohio (HO001). Murray, M.E.; Johnson, C.A. Oak Ridge National Lab., TN (United States). Mar 1994. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94009135. Source: OSTI; NTIS; GPO Dep.

At the request of the US Department of Energy (DOE), a group from the Oak Ridge National Laboratory conducted a radiological survey at the former Herring-Hall-Marvin Safe Company (third floor), 1550 Grand Boulevard, Hamilton, Ohio (HO001) in August 1993. The purpose of the survey was to determine whether the property was contaminated with radioactive residues, principally ²³⁸U, derived from the former Manhattan Engineer District project. The survey included gamma scans; direct and transferable measurements of alpha, beta, and gamma radiation levels; and debris sampling for radionuclide analyses. Results of the survey demonstrated ²³⁸U surface contamination in excess of the DOE criteria for surface contamination. The third floor was generally contaminated over 25 percent of its area with isolated spots in the remaining area. Although three isolated spots of contamination were found in areas other than on the third floor (in the same southeastern corner of the facility), they were remediated by sampling. Based on the survey results, this site is recommended for remediation.

2317 (ORNL/TM-11358) Third report on the Oak Ridge National Laboratory Biological Monitoring and Abatement Program for White Oak Creek Watershed and the Clinch River. Loar, J.M. (ed.) (and others); Adams,

S.M.; Bailey, R.D. Oak Ridge National Lab., TN (United States). Mar 1994. 313p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94011606. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental Sciences Division Publication No. 4255.

As a condition of the National Pollutant Discharge Elimination System (NPDES) permit issued to Oak Ridge National Laboratory (ORNL) on April 1, 1985, a Biological Monitoring and Abatement Program (BMAP) was developed for White Oak Creek (WOC); selected tributaries of WOC, including Fifth Creek, First Creek, Melton Branch, and Northwest Tributary; and the Clinch River. The BMAP currently consists of six major tasks that address both radiological and nonradiological contaminants in the aquatic and terrestrial environs at ORNL. These are (1) toxicity monitoring, (2) bioaccumulation monitoring of nonradiological contaminants in aquatic biota, (3) biological indicator studies, (4) instream ecological monitoring, (5) assessment of contaminants in the terrestrial environment, and (6) radioecology of WOC and White Oak Lake (WOL). The investigation of contaminant transport, distribution, and fate in the WOC embayment-Clinch River-Watts Bar Reservoir system was originally a task of the BMAP but, in 1988, was incorporated into the Resource Conservation and Recovery Act Facility Investigation for the Clinch River, a separate study to assess offsite contamination from all three Department of Energy facilities in Oak Ridge.

2318 (ORNL/TM-11360) Transport of contaminants during storms in the White Oak Creek and Melton Branch watersheds. Solomon, D.K.; Marsh, J.D.; Larsen, I.L.; Wickliff, D.S.; Clapp, R.B. Oak Ridge National Lab., TN (United States). Jan 1991. 130p. Sponsored by USDOE, Washington, DC (USA). DOE Contract AC05-84OR21400. Order Number DE91010445. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental Sciences Division Publication No. 3395.

This report documents the transport of contaminants from Solid Waste Storage Area (SWSA) 5 along two principle pathways: the saturated groundwater system and the intermittently saturated storm flow system. The results of the storm flow sampling show a ^{90}Sr anomaly in SWSA 5 that is suggested by the similar mobility of ^3H and ^{90}Sr , in spite of the reactive nature of ^{90}Sr . An empirical relationship between concentration and discharge was established for ^3H and ^{90}Sr in the Melton Branch Watershed. The relationship is of the form $C = AD^b$, where C is concentration of either ^3H or ^{90}Sr , D is discharge at MBS, and A and b are empirical constants. A model was developed and a computer program written to separate the discharge into quick-flow and base flow components. The results of the modeling, using data collected during storm flow, showed that 44% of the annual stream discharge occurred as quick flow, whereas only 16% of the ^3H and 27% of the ^{90}Sr occurred as quick flow. The data show that for SWSA 5 the saturated groundwater pathway is quite important in dry years, such as the 1988 water year. Data from other areas, such as SWSA 6 suggest that the storm flow pathway may be more important in wet years. This study has several important implications for remedial actions and site monitoring. 23 refs., 52 figs., 2 tabs.

2319 (ORNL/TM-11605) Comparative evaluation of several small mammal species as monitors of heavy metals, radionuclides, and selected organic compounds in the environment. Talmage, S.S. (Tennessee Univ.,

Knoxville, TN (USA)); Walton, B.T. Oak Ridge National Lab., TN (United States). Aug 1990. 179p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE91005647. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental Sciences Division Publication No. 3534. Thesis. Submitted by Sylvia S. Talmage to University of Tennessee, Knoxville, TN.

The primary purpose of this study was to evaluate which small mammal species are the best monitors of specific environmental contaminants. The evaluation is based on the published literature and on an analysis of small mammals trapped at several sites on the Oak Ridge National Laboratory (ORNL) Reservation in Oak Ridge, Tennessee. Studies on the uptake of heavy metals, radionuclides, and organic chemicals are reviewed in Chapter II to evaluate several small mammal species for their capacity to serve as sentinels for the presence, accumulation, and effects of various contaminants. Where several species were present at a site, a comparative evaluation was made and species are ranked for their capacity to serve as monitors of specific contaminants. Food chain accumulation and food habits of the species are used to establish a relationship with suitability as a biomonitor. Tissue-specific concentration factors were noted in order to establish target tissues. Life histories, habitat, and food habits are reviewed in order to make generalizations concerning the ability of similar taxa to serve as biomonitor. Finally, the usefulness of several small mammal species as monitors of three contaminants - benzo[a]pyrene, mercury, and strontium-90 - present on or near the ORNL facilities was investigated. 133 refs., 5 figs., 20 tabs.

2320 (ORNL/TM-11817) Radiological characterization survey of the former Diamond Magnesium Company site, 720 Fairport-Nursery Road, Painesville, Ohio (DMP001, DMP002). Foley, R.D.; Carrier, R.F. Oak Ridge National Lab., TN (United States). Dec 1991. 96p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE92007783. Source: OSTI; NTIS; GPO Dep.

Environmental Restoration and Waste Management Non-defense Programs (Activity No. EX20 20 01 0; ADS3170000).

At the request of the US Department of Energy (DOE), a group from Oak Ridge National Laboratory performed an investigative radiological survey at the former Diamond Magnesium Company (DMC) site at 720 Fairport-Nursery Road, Painesville, Ohio, in September 1990. The purpose of the survey was to determine if the site is contaminated with radioactive residues as a result of federal government operation in the development of nuclear energy for defense-related projects. The survey of the site, separate parcels of which are currently owned by the Uniroyal Chemical Company (DMP001) and the Lonza Chemical Company (DMP002), included a gamma scan over the ground surface, determination of gamma exposure rates at the surface and at 1 m above the surface at grid points, collection and radionuclide analysis of soil samples, and directly measured radiation levels inside three buildings used during original DMC processing. Results of the survey revealed widespread radiological contamination outdoors on the Uniroyal property and several isolated spots of elevated radiation levels on the Lonza property. The contaminants consisted of radium, uranium, and thorium in surface and subsurface soil in concentrations exceeding DOE guidelines for the release of property for unrestricted use.

2321 (ORNL/TM-11877) Oak Ridge National Laboratory Nonradiological Wastewater Treatment Plant optimization report. Kent, T.E.; Scott, C.B.; Maddox, J.J.; Peterson, D.J.; Barton, P.T. Oak Ridge National Lab., TN (United States). Jun 1991. 77p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE91016820. Source: OSTI; NTIS; GPO Dep.

Oak Ridge National Laboratory (ORNL), in Oak Ridge, Tennessee, is operated by Marietta Energy Systems, Inc. for the United States Department of Energy (DOE). For many years, non-radiological process wastewater streams which mainly consist of once-through cooling water underwent little or no treatment and were discharged directly to White Oak Creek (WOC). However, since the non-radiological process waste streams could potentially contain small quantities of organic and heavy metal pollutants, it was determined by the US Environmental Protection Agency (EPA) and the Tennessee Department of Health and Environment (TDHE) that the discharge of many of the process waste streams into WOC was not in compliance with state and federal environmental regulations. The Non-radiological Wastewater Treatment Project (NRWTP) was conceived as a means of collecting and treating non-radiological process wastewaters from a variety of outfalls and complying with the Clean Water Act's National Pollutant discharge elimination system (NPDES) regulations. The facility has operated under a one year evaluation period as specified in the NPDES permit. During the evaluation period, operation of the plant has been monitored and adjusted to optimize treatment performance. This report is intended to provide documentation of efforts to evaluate and optimize NRWTP performance and present the results obtained for submittal to the TDHE and EPA. 5 refs., 5 figs., 22 tabs.

2322 (ORNL/TM-12074) Status report on the geology of the Oak Ridge Reservation. Hatcher, R.D. Jr. (Tennessee Univ., Knoxville, TN (United States). Dept. of Geological Sciences); Lemiszki, P.J.; Foreman, J.L.; Dreier, R.B.; Ketelle, R.H.; Lee, R.R.; Lee, Suk Young; Lietzke, D.A.; McMaster, W.M. Oak Ridge National Lab., TN (United States). Oct 1992. 271p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93007798. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental Sciences Division Publication No. 3860.

This report provides an introduction to the present state of knowledge of the geology of the Oak Ridge Reservation (ORR) and a cursory introduction to the hydrogeology. An important element of this work is the construction of a modern detailed geologic map of the ORR (Plate 1), which remains in progress. An understanding of the geologic framework of the ORR is essential to many current and proposed activities related to land-use planning, waste management, environmental restoration, and waste remediation. Therefore, this report is also intended to convey the present state of knowledge of the geologic and geohydrologic framework of the ORR and vicinity and to present some of the available data that provide the basic framework for additional geologic mapping, subsurface geologic, and geohydrologic studies. In addition, some recently completed, detailed work on soils and other surficial materials is included because of the close relationships to bedrock geology and the need to recognize the weathered products of bedrock units. Weathering processes also have some influence on hydrologic systems and processes at depth.

2323 (ORNL/TM-12139) Groundwater flow delineation study at the Massachusetts Military Reservation using the colloidal borescope. Kearl, P.M.; Gardner, F.G.; Gunderson, M.J. Oak Ridge National Lab., Grand Junction, CO (United States). Feb 1993. 40p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93012033. Source: OSTI; NTIS; GPO Dep.

Environmental Sciences Division Publication No. 3918.

Observations of colloidal movement under natural conditions using the colloidal borescope were conducted at several sites in the vicinity of the Massachusetts Military Reservation (MM) located on Cape Cod. The purpose of the study was to assess the reliability of the colloidal borescope and provide additional hydrogeologic data for site-characterization work. Because of the variability observed in groundwater flow at other sites, a well-characterized site was needed to test the borescope. Results of this work indicate that existing hydrologic information specific to the various sites tested at the MM compares favorably with the borehole velocity data collected with the colloidal borescope. Direction measurements at the MM, however, appear to be less reliable than at other sites tested. Most significant among factors potentially affecting direction measurements is the relatively flat hydraulic gradient at the MM, which is an order of magnitude less than at other sites. This is due to the gentle topography and the relatively high permeability of the aquifer. Under these conditions, the geometric alignment of preferential flow paths could dominate flow direction. If the gradient is increased, flow will tend to parallel the hydraulic gradient. This report describes the field site and the colloidal borescope and discusses the results and conclusions of the field investigations.

2324 (ORNL/TM-12142) Comparison of three field screening techniques for delineating petroleum hydrocarbon plumes in groundwater at a site in the southern Carson Desert, Nevada. Smuin, D.R. Oak Ridge National Lab., TN (United States). Jan 1993. 134p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93012428. Source: OSTI; NTIS; INIS; GPO Dep.

Three types of field screening techniques used in the characterization of potentially contaminated sites at Naval Air Station Fallon, Nevada, are compared. The methods and results for each technique are presented. The three techniques include soil-gas surveys, electromagnetic geophysical surveys, and groundwater test hole screening. Initial screening at the first study site included two soil-gas surveys and electromagnetic geophysical studies. These screening methods identified 1 areas of contamination; however, results were inconclusive. Therefore groundwater test hole screening was performed. Groundwater screening consisted of auger drilling down to the shallow alluvial aquifer. Groundwater samples were collected from the open drill hole with a bailer. On-site head-space analyses for volatile organic compounds (VOCs) were performed using a portable gas chromatograph (GC). Five areas of floating petroleum hydrocarbon product were identified along with the overall dissolved contaminant plume boundaries. Well placement was re-evaluated, and well sites were relocated based on the screening information. The most effective technique for identification of petroleum hydrocarbon-contaminant plumes was groundwater test hole screening. Groundwater screening was subsequently performed at 19 other sites. A total of 450 test holes were analyzed resulting in the delineation of six plumes.

2325 (ORNL/TM-12191) **Supplement to a hydrologic framework for the Oak Ridge Reservation, Oak Ridge, Tennessee: Summary of groundwater modeling.** Moore, G.K. (Tennessee Univ., Knoxville, TN (United States). Dept. of Civil Engineering); Toran, L.E. Oak Ridge National Lab., TN (United States). Nov 1992. 97p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93003667. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental Sciences Division Publication No. 3982.

The information in this report should prove useful for flow and contaminant-transport modeling of groundwater and for evaluating the alternatives for remedial action. New data on porosity and permeability have been analyzed and interpreted to produce a better understanding of the relationships between unfractured rock, low permeability intervals, and relatively permeable intervals. Specifically, the dimensions, orientations, depths, and spacings of pervious fractures have been measured or calculated; the depths and directions of subsurface flow paths (Solomon et al. 1992, pp. 3-21 to 3-23) have been corroborated with new data; fractures near the water table have been shown to have different characteristics than those at deeper levels; and the relationships between groundwater flows in fractures and flows in the continuum have been described. This is the information needed for the numerical modeling of groundwater flows. Other information in this report should result in a better understanding of spatial and temporal differences in water chemistry, including changes in contaminant concentrations. Temporal changes in groundwater chemistry have been shown to occur mostly near the water table. These changes consist of a periodic dilution of chemical constituents by recharge and a slow increase in constituent concentrations between recharge events. At discharge locations, spatial differences in groundwater chemistry are integrated by mixing. The monitoring of water chemistry in streams near contaminant sources may produce a better indication of contaminant releases and trends than do the records obtained from a few upgradient and downgradient wells.

2326 (ORNL/TM-12225) **Radiological survey results at the former Bridgeport Brass Company facility, Seymour, Connecticut.** Foley, R.D.; Carrier, R.F. Oak Ridge National Lab., TN (United States). Jun 1993. 39p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93017987. Source: OSTI; NTIS; INIS; GPO Dep.

At the request of the US Department of Energy (DOE), a team from Oak Ridge National Laboratory conducted a radiological survey of the former Bridgeport Brass Company facility, Seymour, Connecticut. The survey was performed in May 1992. The purpose of the survey was to determine if the facility had become contaminated with residuals containing radioactive materials during the work performed in the Ruffert building under government contract in the 1960s. The survey included a gamma scanning over a circumscribed area around the building, and gamma and beta-gamma scanning over all indoor surfaces as well as the collection of soil and other samples for radionuclide analyses. Results of the survey demonstrated radionuclide concentrations in indoor and outdoor samples, and radiation measurements over floor and wall surfaces, in excess of the DOE Formerly Utilized Sites Remedial Action Program guidelines. Elevated uranium concentrations outdoors were limited to several small, isolated spots. Radiation measurements exceeded guidelines indoors over numerous spots

and areas inside the building, mainly in Rooms 1-6 that had been used in the early government work.

2327 (ORNL/TM-12258) **X-231B technology demonstration for in situ treatment of contaminated soil: Contaminant characterization and three dimensional spatial modeling.** West, O.R.; Siegrist, R.L.; Mitchell, T.J.; Pickering, D.A.; Muhr, C.A.; Greene, D.W.; Jenkins, R.A. Oak Ridge National Lab., TN (United States). Nov 1993. 136p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94006112. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental Sciences Division Publication No. 4170.

Fine-textured soils and sediments contaminated by trichloroethylene (TCE) and other chlorinated organics present a serious environmental restoration challenge at US Department of Energy (DOE) sites. DOE and Martin Marietta Energy Systems, Inc. initiated a research and demonstration project at Oak Ridge National Laboratory. The goal of the project was to demonstrate a process for closure and environmental restoration of the X-231B Solid Waste Management Unit at the DOE Portsmouth Gaseous Diffusion Plant. The X-231B Unit was used from 1976 to 1983 as a land disposal site for waste oils and solvents. Silt and clay deposits beneath the unit were contaminated with volatile organic compounds and low levels of radioactive substances. The shallow groundwater was also contaminated, and some contaminants were at levels well above drinking water standards. This document begins with a summary of the subsurface physical and contaminant characteristics obtained from investigative studies conducted at the X-231B Unit prior to January 1992 (Sect. 2). This is then followed by a description of the sample collection and analysis methods used during the baseline sampling conducted in January 1992 (Sect. 3). The results of this sampling event were used to develop spatial models for VOC contaminant distribution within the X-231B Unit.

2328 (ORNL/TM-12265) **Reconnaissance radiological characterization for the White Point Nike Missile Site, San Pedro, California.** Espegren, M.L. (Oak Ridge National Lab., TN (United States)); Jensen, M.K.; Pierce, G.A.; Smith, S.M. Oak Ridge National Lab., TN (United States). [1993]. 54p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93013457. Source: OSTI; NTIS; INIS; GPO Dep.

This report is the result of field work performed at the former White Point Nike Missile Site, San Pedro, California. The Hazardous Waste Remedial Actions Program tasked the Oak Ridge National Laboratory Pollutant Assessments Group in Grand Junction, Colo., with this project. The objective was to determine whether or not radioisotopes possibly associated with past Department of Defense (DOD) operations were present and within accepted background levels. The radiation survey was accomplished by performing three independent radiation surveys, both outdoors and indoors, and random soil sampling. Initially, the site was land surveyed to develop a grid block system. A background radiation investigation was performed out in the San Pedro area.

2329 (ORNL/TM-12362) **Confirmatory radiological survey of the BORAX-V turbine building Idaho National Engineering Laboratory, Idaho Falls, Idaho.** Stevens, G.H. (Oak Ridge National Lab., TN (US)); Coleman, R.L.; Jensen, M.K.; Pierce, G.A.; Egidi, P.V.; Mather, S.K. Oak

Ridge National Lab., TN (United States). [1993]. 63p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93016874. Source: OSTI; NTIS; INIS; GPO Dep.

An independent assessment of the remediation of the BORAX-V (Boiling Water Reactor Experiment) turbine building at the Idaho National Engineering Laboratory (INEL), Idaho Falls, Idaho, was accomplished by the Oak Ridge National Laboratory Pollutant Assessments Group (ORNL/PAG). The purpose of the assessment was to confirm the site's compliance with applicable Department of Energy guidelines. The assessment included reviews of both the decontamination and decommissioning Plan and data provided from the pre- and post-remedial action surveys and an independent verification survey of the facility. The independent verification survey included determination of background exposure rates and soil concentrations, beta-gamma and gamma radiation scans, smears for detection of removable contamination, and direct measurements for alpha and beta-gamma radiation activity on the basement and mezzanine floors and the building's interior and exterior walls. Soil samples were taken, and beta-gamma and gamma radiation exposure rates were measured on areas adjacent to the building. Results of measurements on building surfaces at this facility were within established contamination guidelines except for elevated beta-gamma radiation levels located on three isolated areas of the basement floor. Following remediation of these areas, ORNL/PAG reviewed the remedial action contractor's report and agreed that remediation was effective in removing the source of the elevated direct radiation. Results of all independent soil analyses for ^{60}Co were below the detection limit. The highest ^{137}Cs analysis result was 4.6 pCi/g; this value is below the INEL site-specific guideline of 10 pCi/g.

2330 (ORNL/TM-12368) Miscellaneous radioactive materials detected during uranium mill tailings surveys. Wilson, M.J. Oak Ridge National Lab., TN (United States). Oct 1993. 68p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94000731. Source: OSTI; NTIS; INIS; GPO Dep.

The Department of Energy's (DOE) Office of Environmental Restoration and Waste Management directed the Oak Ridge National Laboratory Pollutant Assessments Group in the conduct of radiological surveys on properties in Monticello, Utah, associated with the Mendocino millsite National Priority List site. During these surveys, various radioactive materials were detected that were unrelated to the Monticello millsite. The existence and descriptions of these materials were recorded in survey reports and are condensed in this report. The radioactive materials detected are either naturally occurring radioactive material, such as rock and mineral collections, uranium ore, and radioactive coal or manmade radioactive material consisting of tailings from other millsites, mining equipment, radium dials, mill building scraps, building materials, such as brick and cinderblock, and other miscellaneous sources. Awareness of the miscellaneous and naturally occurring material is essential to allow DOE to forecast the additional costs and schedule changes associated with remediation activities. Also, material that may pose a health hazard to the public should be revealed to other regulatory agencies for consideration.

2331 (ORNL/TM-12401) Solubility measurement of uranium in uranium-contaminated soils. Lee, S.Y.; Elless, M.; Hoffman, F. Oak Ridge National Lab., TN (United

States). Aug 1993. 33p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (ESD-4138). Order Number DE94005329. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental Sciences Division Publication No. 4138.

A short-term equilibration study involving two uranium-contaminated soils at the Fernald site was conducted as part of the In Situ Remediation Integrated Program. The goal of this study is to predict the behavior of uranium during on-site remediation of these soils. Geochemical modeling was performed on the aqueous species dissolved from these soils following the equilibration study to predict the on-site uranium leaching and transport processes. The soluble levels of total uranium, calcium, magnesium, and carbonate increased continually for the first four weeks. After the first four weeks, these components either reached a steady-state equilibrium or continued linearity throughout the study. Aluminum, potassium, and iron, reached a steady-state concentration within three days. Silica levels approximated the predicted solubility of quartz throughout the study. A much higher level of dissolved uranium was observed in the soil contaminated from spillage of uranium-laden solvents and process effluents than in the soil contaminated from settling of airborne uranium particles ejected from the nearby incinerator. The high levels observed for soluble calcium, magnesium, and bicarbonate are probably the result of magnesium and/or calcium carbonate minerals dissolving in these soils. Geochemical modeling confirms that the uranyl-carbonate complexes are the most stable and dominant in these solutions. The use of carbonate minerals on these soils for erosion control and road construction activities contributes to the leaching of uranium from contaminated soil particles. Dissolved carbonates promote uranium solubility, forming highly mobile anionic species. Mobile uranium species are contaminating the groundwater underlying these soils. The development of a site-specific remediation technology is urgently needed for the FEMP site.

2332 (ORNL/TM-12715) Program management plan for development, demonstration, testing, and evaluation efforts associated with Oak Ridge Reservation's Land Disposal Restrictions Federal Facility Compliance Agreement. Conley, T.B. Oak Ridge National Lab., TN (United States). Apr 1994. 76p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94010930. Source: OSTI; NTIS; INIS; GPO Dep.

This program management plan covers the development, demonstration, testing, and evaluation efforts necessary to identify treatment methods for all the waste listed in Appendix B of the ORR's LDR/FFCA as well as any new wastes which meet Appendix B criteria. To successfully identify a treatment method, at least a proof-of-principle level of understanding must be obtained: that is, the candidate processes must be demonstrated as effective in treating the wastes to the LDR; however, an optimized process is not required. Where applicable and deemed necessary and where the budgets will support them, pilot-scale demonstrations will be pursued. The overall strategy being adopted in this program will be composed of the following activities: Scoping of the study; characterization; development and screening of alternatives; treatability investigations; and detailed analysis of alternatives.

2333 (ORNL/TM-12722) Radionuclides in shallow groundwater at Solid Waste Storage Area 5 North, Oak Ridge National Laboratory. Ashwood, T.L.; Marsh, J.D. Jr.

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Oak Ridge National Lab., TN (United States). Apr 1994. 67p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94009862. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental Sciences Division Publication No. 4264.

This report presents a compilation of groundwater monitoring data from Solid Waste Storage Area (SWSA) 5 North at Oak Ridge National Laboratory (ORNL) between November 1989 and September 1993. Monitoring data were collected as part of the Active Sites Environmental Monitoring Program that was implemented in 1989 in response to DOE Order 5820.2A. SWSA 5 North was established for the retrievable storage of transuranic (TRU) wastes in 1970. Four types of storage have been used within SWSA 5 North: bunkers, vaults, wells, and trenches. The fenced portion of SWSA 5 North covers about 3.7 ha (9 acres) in the White Oak Creek watershed south of ORNL. The area is bounded by White Oak Creek and two ephemeral tributaries of White Oak Creek. Since 1989, groundwater has been monitored in wells around SWSA 5 North. During that time, elevated gross alpha contamination (reaching as high as 210 Bq/L) has consistently been detected in well 516. This well is adjacent to burial trenches in the southwest corner of the area. Water level measurements in wells 516 and 518 suggest that water periodically inundates the bottom of some of those trenches. Virtually all of the gross alpha contamination is generated by Curium 244 and Americium 241. A special geochemical investigation of well 516 suggests that nearly all of the Curium 244 and Americium 241 is dissolved or associated with dissolved organic matter. These are being transported at the rate of about 2 m/year from the burial trenches, through well 516, to White Oak Creek, where Curium 244 has been detected in a few bank seeps. Concentrations at these seeps are near detection levels (<1 Bq/L).

2334 (PNL-3777-Rev.2) Recommended environmental dose calculation methods and Hanford-specific parameters: Revision 2. Schreckhise, R.G. (Pacific Northwest Lab., Richland, WA (United States)); Rhoads, K.; Napier, B.A.; Ramsdell, J.V.; Davis, J.S. Pacific Northwest Lab., Richland, WA (United States). Mar 1993. 272p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93012832. Source: OSTI; NTIS; INIS; GPO Dep.

This document was developed to support the Hanford Environmental Dose overview Panel (HEDOP). The Panel is responsible for reviewing all assessments of potential doses received by humans and other biota resulting from the actual or possible environmental releases of radioactive and other hazardous materials from facilities and/or operations belonging to the US Department of Energy on the Hanford Site in south-central Washington. This document serves as a guide to be used for developing estimates of potential radiation doses, or other measures of risk or health impacts, to people and other biota in the environs on and around the Hanford Site. It provides information to develop technically sound estimates of exposure (i.e., potential or actual) to humans or other biotic receptors that could result from the environmental transport of potentially harmful materials that have been, or could be, released from Hanford operations or facilities. Parameter values and information that are specific to the Hanford environs as well as other supporting material are included in this document.

2335 (PNL-7692) Regulatory and institutional issues impending cleanup at US Department of Energy

sites: Perspectives gained from an office of environmental restoration workshop. Fallon, W.E.; Gephart, J.M.; Gephart, R.E.; Quinn, R.D.; Stevenson, L.A. Pacific Northwest Lab., Richland, WA (United States). May 1991. 133p. Sponsored by USDOE, Washington, DC (USA). DOE Contract AC06-76RL01830. Order Number DE91012371. Source: OSTI; NTIS; GPO Dep.

The US Department of Energy's (DOE) nuclear weapons and energy operations are conducted across a nation-wide industrial complex engaged in a variety of manufacturing, processing, testing, and research and development activities. The overall mission of DOE Office of Environmental Restoration and Waste Management (EM) is to protect workers, the public, and the environment from waste materials generated by past, current, and future DOE activities and to bring the DOE complex into compliance with all applicable laws, regulations, and agreements related to health, safety, and the environment. EM addresses this broad mandate through related and interdependent programs that include corrective actions, waste operations, environmental restoration, and technology development. The EM Office of Environmental Restoration (EM-40) recognizes the importance of implementing a complex-wide process to identify and resolve those issues that may impede progress towards site cleanup. As a first step in this process, EM-40 sponsored an exercise to identify and characterize major regulatory and institutional issues and to formulate integrated action steps towards their resolution. This report is the first product of that exercise. It is intended that the exercise described here will mark the beginning of an ongoing process of issue identification, tracking, and resolution that will benefit cleanup activities across the DOE complex.

2336 (PNL-7836) External quality control in groundwater sampling and analysis at the Hanford Site. Hall, S.H.; Juracich, S.P. Pacific Northwest Lab., Richland, WA (United States). Nov 1991. 44p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92004452. Source: OSTI; NTIS; INIS; GPO Dep.

At the US Department of Energy's Hanford Site, external Quality Control (QC) for ground-water monitoring is extensive and has included routine submittal of intra- and interlaboratory duplicate samples, blind samples, and several kinds of blank samples. Examination of the resulting QC data for nine of the constituents found in ground water at the Hanford Site shows that the quality of analysis has generally been within the expectations of precision and accuracy that have been established by the US Environmental Protection Agency (EPA). The constituents subjected to review were nitrate, chromium, sodium, fluoride, carbon tetrachloride, tritium, ammonium, trichloroethylene, and cyanide. Of these, the fluoride measurements were notable exceptions and were poor by EPA standards. The review has shown that interlaboratory analysis of duplicate samples yields the most useful QC data for evaluating laboratory performance in determining commonly encountered constituents. For rarely encountered constituents, interlaboratory comparisons may be augmented with blind samples (synthetic samples of known composition). Intralaboratory comparisons, blanks, and spikes should be generally restricted to studies of suspected or known sample contamination and to studies of the adequacy of sampling and analytical procedures.

2337 (PNL-7840-Rev.1) ReOpt™ V2.1 user documentation. White, M.K.; Bryant, J.L. Pacific Northwest Lab., Richland, WA (United States). ©Jun 1993. 67p. Sponsored

by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Source: OSTI (requests by U.S. Government Agencies and Their Contractors). Other requestors should be directed to Battelle Memorial Institute.

Cleaning up the large number of contaminated waste sites at Department of Energy (DOE) facilities in the US presents a large and complex problem. Each waste site poses a singular set of circumstances (different contaminants, environmental concerns, and regulations) that affect selection of an appropriate response. Pacific Northwest Laboratory (PNL) developed ReOpt to provide information about the remedial action technologies that are currently available. It is an easy-to-use personal computer program and database that contains data about these remedial technologies and auxiliary data about contaminants and regulations. ReOpt will enable engineers and planners involved in environmental restoration efforts to quickly identify potentially applicable environmental restoration technologies and access corresponding information required to select cleanup activities for DOE sites.

2338 (PNL-7999) Observational approach implementation guidance: Year-end report. Smyth, J.D. (CH2M Hill, Richland, WA (United States)); Kohlman, J.P.; Peffers, M.S. Pacific Northwest Lab., Richland, WA (United States). Jun 1992. 32p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92017553. Source: OSTI; NTIS; GPO Dep.

It is generally recognized that the Remedial Investigation/Feasibility Study (RI/FS) process can be time-consuming and costly. To expedite the process, the Environmental Protection Agency, through the National Contingency Plan and Office of Solid Waste and Emergency Response (OSWER) Directives, has promoted "streamlining" the RI/FS. The concept of streamlining is directly applicable to Resource Conservation and Recovery Act (RCRA) Remedial Facility Investigation/Corrective Measure Study (RF/CMS) as well. The US Department of Energy's (DOE's) environmental restoration process promises to be lengthy and expensive; therefore, the Office of Environmental Restoration (EM-40) believes that it is to incorporate streamlining into RI/FS and RF/CMS efforts across the DOE complex. The Office of Program Support (EM-43) has asked Pacific Northwest Laboratory (PNL) to provide presentations and workshops on streamlining concepts, including tenets of the "observational approach" at DOE environmental restoration sites around the complex. This report summarizes the FY91 activities that were conducted at PNL as part of this effort.

2339 (PNL-8122) Water-table elevations on the Hanford Site and outlying areas, 1991. Newcomer, D.R.; Pohlod, K.D.; McDonald, J.P. Pacific Northwest Lab., Richland, WA (United States). Aug 1992. 69p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92019704. Source: OSTI; NTIS; INIS; GPO Dep.

The Pacific Northwest Laboratory prepared water-table maps of the US Department of Energy's Hanford Site for June-August 1991 from water-level elevations measures in 359 wells across the Hanford Site and outlying areas. The greatest changes in the elevation of the water table at Hanford occurred beneath the decommissioned U Pond, the 200-East Area, B Pond, the 100-N Area, the 1100 and 3000 Areas, the Cold Creek valley, and adjacent to the Columbia River.

2340 (PNL-8144) State trends in ecological risk assessment and standard setting. Siegel, M.R.; Fowler, K.M.; Bilyard, G.R. Pacific Northwest Lab., Richland, WA (United States). Feb 1993. 32p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93008948. Source: OSTI; NTIS; INIS; GPO Dep.

The purposes of this paper are (1) to identify key states' activities and plans related to setting cleanup standards using the ecological risk assessment process, and (2) to discuss the impacts these actions may have on the US Department of Energy's (DOE's) environmental restoration program. This report is prepared as part of a larger task, the purpose of which is to identify and assess state regulatory trends and legal developments that may impact DOE's environmental restoration program. Results of this task are intended to provide DOE with advance notice of potentially significant regulatory developments so as to enhance DOE's ability to influence these developments and to incorporate possible regulatory and policy changes into its planning process.

2341 (PNL-8152) Fifth in situ vitrification engineering-scale test of simulated INEL buried waste sites. Bergsman, T.M. (Pacific Northwest Lab., Richland, WA (United States)); Shade, J.W.; Farnsworth, R.K. Pacific Northwest Lab., Richland, WA (United States). Jun 1992. 70p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92017951. Source: OSTI; NTIS; INIS; GPO Dep.

In September 1990, an engineering-scale in situ vitrification (ISV) test was conducted on sealed canisters containing a combined mixture of buried waste materials expected to be present at the Idaho National Engineering Laboratory (INEL) Subsurface Disposal Area (SDA). The test was part of a Pacific Northwest Laboratory (PNL) program to assist INEL in treatability studies of the potential application of ISV to mixed transuranic wastes at the INEL SDA. The purpose of this test was to determine the effect of a close-packed layer of sealed containers on ISV processing performance. Specific objectives included determining (1) the effect of releases from sealed containers on hood plenum pressure and temperature, (2) the release pressure and temperatures of the sealed canisters, (3) the relationships between canister depressurization and melt encapsulation, (4) the resulting glass and soil quality, (5) the potential effects of thermal transport due to a canister layer, (6) the effects on particle entrainment of differing angles of approach for the ISV melt front, and (7) the effects of these canisters on the volatilization of volatile and semivolatile contaminants into the hood plenum.

2342 (PNL-8173) Hydraulic test results for Savage Island wells: 699-32-22B, 699-42-E9A, and 699-42-E9B. Spane, F.A. Jr. Pacific Northwest Lab., Richland, WA (United States). Jun 1992. 111p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93002043. Source: OSTI; NTIS; GPO Dep.

As part of the Ground-Water Surveillance Project, Hanford Site Flow System Characterization Task, Pacific Northwest Laboratory (PNL) examines the potential for offsite migration of contamination within the upper-confined aquifer system. As part of this activity, a hydraulic characterization investigation was conducted on three newly constructed wells. The three wells are collectively referred to as the Savage Island wells, which is in reference to the location of two of the

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three wells tested during this investigation. Results of characterization tests conducted as part of this investigation will be used by PNL in its assessment of the extent of contamination within the upper-confined aquifer system, and its potential for offsite migration.

2343 (PNL-8221-Rev.1) Radionuclide concentrations in white sturgeon from the Columbia River: Revision 1. Dauble, D.D.; Price, K.R.; Poston, T.M. Pacific Northwest Lab., Richland, WA (United States). Nov 1993. 42p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94004223. Source: OSTI; NTIS; INIS; GPO Dep.

The objectives of this study were to (1) review and summarize historical data on radionuclide concentrations in white sturgeon from the Columbia River, (2) determine present-day radionuclide tissue burdens from different locations in the Columbia River, and (3) compare historical data with current data. We first reviewed and summarized the historical literature on radionuclide concentrations in white sturgeon from the Hanford Reach. Field studies were then conducted to evaluate the relationship among sample locations, age/length of white sturgeon, and present radionuclide tissue burdens. Results and comparisons are discussed in the remainder of this report.

2344 (PNL-8231) Evaluation of new concepts for in situ vitrification: Power system, melt insulation, and off-gas containment. Luey, J.; Powell, T.D.; Heath, W.O.; Richardson, R.L. Pacific Northwest Lab., Richland, WA (United States). Jul 1992. 48p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92019799. Source: OSTI; NTIS; INIS; GPO Dep.

In situ vitrification (ISV) is a thermal process that converts contaminated soil into a highly leach-resistant material resembling natural obsidian. The ISV process was developed by the Pacific Northwest Laboratory (PNL)(a) for the US Department of Energy (DOE) to treat soils contaminated with transuranics. Since 1980, ISV has grown from a concept to an innovative technology through bench-, engineering-, intermediate-, and full-scale tests. Efforts by PNL have developed ISV into a technology considered available for limited deployment to remediate contaminated soil. The technology has been transferred to a licensee for commercial application. In September 1991, PNL conducted an operational acceptance test (OAT) of the modified engineering-scale unit. The OAT provided an opportunity to conduct proof-of-principle testing of new concepts for ISV technology. This additional testing was permitted since it was determined that testing of these new concepts would have no impact on the OAT objective. In discussing the proof-of-principle portion of the engineering-scale test, this report presents conclusions from this work and also describes the conceptual bases of the tested concepts, the engineering-scale test equipment and setup, and test results.

2345 (PNL-8281) In situ vitrification of a mixed-waste contaminated soil site: The 116-B-6A crib at Hanford: CERCLA treatability test report. Luey, J.; Kogler, S.S.; Kuhn, W.L.; Lowery, P.S.; Winkelman, R.G. Pacific Northwest Lab., Richland, WA (United States). Sep 1992. 123p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93000965. Source: OSTI; NTIS; GPO Dep.

The first large-scale mixed-waste test of in situ vitrification (ISV) has been completed. The large-scale test was conducted at an actual contaminated soil site, the 116-B-6A crib, on the Department of Energy's Hanford Site. The large-scale test was a demonstration of the ISV technology and not an interim action for the 116-B-6A crib. This demonstration has provided technical data to evaluate the ISV process for its potential in the final disposition of mixed-waste contaminated soil sites at Hanford. Because of the test's successful completion, technical data on the vitrified soil are available on how well the process incorporates transuranics and heavy metals into the waste form, how well the form resists leaching of transuranics and heavy metals, how well the process handles sites with high combustible loadings, and the important site parameters which may affect the achievable process depth. This report describes the 116-B-6A crib site, the objectives of the ISV demonstration, the results in terms of the objectives, and the overall process performance.

2346 (PNL-8286) Computer-based tools for decision support at the Hanford Site. Doctor, P.G.; Mahaffey, J.A.; Cowley, P.J.; Freshley, M.D.; Hassig, N.L.; Brothers, J.W.; Glantz, C.S.; Strachan, D.M. Pacific Northwest Lab., Richland, WA (United States). Nov 1992. 187p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93005040. Source: OSTI; NTIS; INIS; GPO Dep.

To help integrate activities in the environmental restoration and waste management mission of the Hanford Site, the Hanford Integrated Planning Project (HIPP) was established and funded by the US Department of Energy. The project is divided into three key program elements, the first focusing on an explicit, defensible and comprehensive method for evaluating technical options. Based on the premise that computer technology can be used to support the decision-making process and facilitate integration among programs and activities, the Decision Support Tools Task was charged with assessing the status of computer technology for those purposes at the Site. The task addressed two types of tools: tools need to provide technical information and management support tools. Technical tools include performance and risk assessment models, information management systems, data and the computer infrastructure to support models, data, and information management systems. Management decision support tools are used to synthesize information at a high level to assist with making decisions. The major conclusions resulting from the assessment are that there is much technical information available, but it is not reaching the decision-makers in a form to be used. Many existing tools provide components that are needed to integrate site activities; however, some components are missing and, more importantly, the "glue" or connections to tie the components together to answer decision-makers questions is largely absent. Top priority should be given to decision support tools that support activities given in the TPA. Other decision tools are needed to facilitate and support the environmental restoration and waste management mission.

2347 (PNL-8539) Selected hydraulic test analysis techniques for constant-rate discharge tests. Spane, F.A. Jr. Pacific Northwest Lab., Richland, WA (United States). Mar 1993. 80p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93012240. Source: OSTI; NTIS; INIS; GPO Dep.

The constant-rate discharge test is the principal field method used in hydrogeologic investigations for characterizing the hydraulic properties of aquifers. To implement this test, the aquifer is stressed by withdrawing ground water from a well, by using a downhole pump. Discharge during the withdrawal period is regulated and maintained at a constant rate. Water-level response within the well is monitored during the active pumping phase (i.e., drawdown) and during the subsequent recovery phase following termination of pumping. The analysis of drawdown and recovery response within the stress well (and any monitored, nearby observation wells) provides a means for estimating the hydraulic properties of the tested aquifer, as well as discerning formational and nonformational flow conditions (e.g., wellbore storage, wellbore damage, presence of boundaries, etc.). Standard analytical methods that are used for constant-rate pumping tests include both log-log type-curve matching and semi-log straight-line methods. This report presents a current "state of the art" review of selected transient analysis procedures for constant-rate discharge tests. Specific topics examined include: analytical methods for constant-rate discharge tests conducted within confined and unconfined aquifers; effects of various nonideal formation factors (e.g., anisotropy, hydrologic boundaries) and well construction conditions (e.g., partial penetration, wellbore storage) on constant-rate test response; and the use of pressure derivatives in diagnostic analysis for the identification of specific formation, well construction, and boundary conditions.

2348 (PNL-8597) Refined conceptual model for the Volatile Organic Compounds-Arid Integrated Demonstration and 200 West Area Carbon Tetrachloride Expedited Response Action. Last, G.V. (Pacific Northwest Lab., Richland, WA (United States)); Rohay, V.J. Pacific Northwest Lab., Richland, WA (United States). Mar 1993. 166p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93012769. Source: OSTI; NTIS; GPO Dep.

This report presents a refined geohydrologic and geochemical conceptual model of the host site (Hanford Reservation) for the Volatile Organic Compounds - Arid Integrated Demonstration (VOC-Arid ID) and 200 West Area Carbon Tetrachloride (CCl₄) Expedited Response Action (ERA), based on the results from fiscal year 1992 site characterization activities. The ERA was initiated in December 1990 to minimize or stabilize CCl₄ migration within the unsaturated (vadose) zone in the vicinity of three CCl₄ disposal sites in the 200 West Area (216-Z-1A tile field, 216-Z-9 trench, and 216-Z-18 crib). Implementation of this ERA was based on concerns that CCl₄ residing in the soils was continuing to spread to the groundwater and, if left unchecked, would significantly increase the area of groundwater contamination. A soil-vapor-extraction system began operating at the site in February 1992.

2349 (PNL-8617) Surface and subsurface characterization of uranium contamination at the Fernald environmental management site. Schilk, A.J.; Perkins, R.W.; Abel, K.H.; Brodzinski, R.L. Pacific Northwest Lab., Richland, WA (United States). Apr 1993. 51p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93012771. Source: OSTI; NTIS; INIS; GPO Dep.

The past operations of uranium production and support facilities at several Department of Energy (DOE) sites have occasionally resulted in the local contamination of some

surface and subsurface soils, and the three-dimensional distribution of the uranium at these sites must be thoroughly characterized before any effective remedial protocols can be established. To this end, Pacific Northwest Laboratory (PNL) has been tasked by the DOE's Office of Technology Development with adapting, developing, and demonstrating technologies for the measurement of uranium in surface and subsurface soils at the Fernald Uranium in Soils Integrated Demonstration site. These studies are detailed in this report.

2350 (PNL-8653) Mollusc survey of the Hanford Site, Benton and Franklin Counties, Washington. Freest, T.J.; Johannes, E.J. Pacific Northwest Lab., Richland, WA (United States); Deixis Consultants, Seattle, WA (United States). May 1993. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93014372. Source: OSTI; NTIS; GPO Dep.

Assessment of the beneficial uses of the Columbia River and surrounding land at Hanford is enhanced by knowing the distribution of the plants and animals that live there. Deixis Consultants conducted surveys to determine the distribution of land and freshwater molluscs (malacofauna) on the US Department of Energy's Hanford Site and surrounding areas for the Pacific Northwest Laboratory. The surveys were conducted in 1992. Five species of freshwater molluscs and six species of land snails were found at 21 localities on the Site. The malacofauna of the Site is sparse in comparison to that of other areas in Washington with roughly comparable substrate and climate. Most species found at Hanford are widely distributed forms or are introduced (non-native) taxa. The Site does have a single endemic land snail, *Cryptomastix n. sp.*, found at a single location. This species likely will be considered a candidate for federal listing. Geologic factors and human modification of spring habitats are the likely causes for the depauperate malacofauna.

2351 (PNL-8662) Arid site characterization and technology assessment: Volatile Organic Compounds-Arid Integrated Demonstration. Riley, R.G. Pacific Northwest Lab., Richland, WA (United States). Jun 1993. 59p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93016708. Source: OSTI; NTIS; GPO Dep.

The US Department of Energy's (DOE's) Volatile Organic Compounds-Arid Integrated Demonstration (VOC-Arid ID) program was initiated in March 1991 to evaluate technologies for all phases of remediation of VOCs in soils and groundwater at DOE arid/semiarid sites. The primary site for field demonstrations under the VOC-Arid ID program is the Hanford Site. The purpose of this report is to describe (1) the bases for technologies currently under evaluation in the VOC-Arid ID program; (2) the types of subsurface contamination at DOE arid/semiarid sites; and (3) the areas of potential common technology interests based on perceived technology needs at other DOE sites. This report was compiled by Pacific Northwest Laboratory in response to DOE's Office of Technology Development's mission to carry out an aggressive program to accelerate the development and implementation of new and existing technologies to meet a 30-year goal set by DOE in June 1989 to clean up all of its sites and to bring all sites into compliance with current and future environmental regulations. A key component of this program is the development of technologies that are better, faster, safer, and cheaper than those technologies currently available. Included in this report are an evaluation of technologies currently (fiscal year 1993) being pursued at the

Hanford Site under the auspices of the VOC-Arid ID program, an assessment of subsurface contaminants at arid/semiarid sites, a summarization of technologies under consideration at other DOE sites, a discussion of areas of potential common technology interests, and the conclusions. Also included are a summary of the extent of contamination at the DOE arid/semiarid sites under consideration and a bibliography of source documents from which this report was prepared.

2352 (PNL-8675) A comparison of simulation models for predicting soil water dynamics in bare and vegetated lysimeters. Link, S.O.; Kickert, R.N.; Fayer, M.J.; Gee, G.W. Pacific Northwest Lab., Richland, WA (United States). Jun 1993. 31p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93016575. Source: OSTI; NTIS; GPO Dep.

This report describes the results of simulation models used to predict soil water storage dynamics at the Field Lysimeter Test Facility (FLTF) weighing lysimeters. The objectives of this research is to develop the capability to predict soil water storage dynamics with plants in support of water infiltration control studies for the Hanford Permanent Isolation Barrier Development Program. It is important to gain confidence in one's ability to simulate soil water dynamics over long time periods to assess the barrier's ability to prevent drainage. Two models were compared for their ability to simulate soil water storage dynamics with and without plants in weighing lysimeters, the soil water infiltration and movement (SWIM) and the simulation of production and utilization of rangelands (SPUR-91) models. These models adequately simulated soil water storage dynamics for the weighing lysimeters. The range of root mean square error values for the two models was 7.0 to 19.8. This compares well with the range reported by Fayer et al. (1992) for the bare soil data sets of 8.1 to 22.1. Future research will test the predictive capability of these models for longer term lysimeter data sets and for historical data sets collected in various plant community types.

2353 (PNL-8789) Investigation of exposure rates and radionuclide and trace metal distributions along the Hanford Reach of the Columbia River. Cooper, A.T.; Woodruff, R.K. Pacific Northwest Lab., Richland, WA (United States). Sep 1993. 114p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94000547. Source: OSTI; NTIS; INIS; GPO Dep.

Studies have been conducted to investigate exposure rates, and radionuclide and trace metal distributions along the Columbia River where it borders the Hanford Site. The last major field study was conducted in 1979. With recently renewed interest in various land use and resource protection alternatives, it is important to have data that represent current conditions. Radionuclides and trace metals were surveyed in Columbia River shoreline soils along the Hanford Site (Hanford Reach). The work was conducted as part of the Surface Environmental Surveillance Project, Pacific Northwest Laboratory. The survey consisted of taking exposure rate measurements and soil samples primarily at locations known or expected to have elevated exposure rates.

2354 (PNL-8797) Radiological survey of shoreline vegetation from the Hanford Reach of the Columbia River, 1990-1992. Antonio, E.J.; Poston, T.M.; Rickard, W.H. Jr. Pacific Northwest Lab., Richland, WA (United

States). Sep 1993. 72p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94000349. Source: OSTI; NTIS; INIS; GPO Dep.

A great deal of interest exists concerning the seepage of radiologically contaminated groundwater into the Columbia River where it borders the US Department of Energy's Hanford Site (Hanford Reach). Areas of particular interest include the 100-N Area, the Old Hanford Townsite, and the 300 Area springs. While the radiological character of the seeps and springs along the Hanford Site shoreline has been studied, less attention has been given to characterizing the radionuclides that may be present in shoreline vegetation. The objective of this study was to characterize radionuclide concentrations in shoreline plants along the Hanford Reach of the Columbia River that were usable by humans for food or other purposes. Vegetation in two areas was found to have elevated levels of radionuclides. Those areas were the 100-N Area and the Old Hanford Townsite. There was also some indication of uranium accumulation in milfoil and onions collected from the 300 Area. Tritium was elevated above background in all areas; ^{60}Co and ^{90}Sr were found in highest concentrations in vegetation from the 100-N Area. Technetium-99 was found in 2 of 12 plants collected from the Old Hanford Townsite and 1 of 10 samples collected upstream from the Vernita Bridge. The concentrations of ^{137}Cs , ^{239}Pu , $^{239,240}\text{Pu}$, and isotopes of uranium were just above background in all three areas (100-N Area, Old Hanford Townsite, and 300 Area).

2355 (PNL-8800) Hanford wells. Chamness, M.A.; Merz, J.K. Pacific Northwest Lab., Richland, WA (United States). Aug 1993. 451p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94003538. Source: OSTI; NTIS; INIS; GPO Dep.

Records describing wells located on or near the Hanford Site have been maintained by Pacific Northwest Laboratory and the operating contractor, Westinghouse Hanford Company. In support of the Ground-Water Surveillance Project, portions of the data contained in these records have been compiled into the following report, which is intended to be used by those needing a condensed, tabular summary of well location and basic construction information. The wells listed in this report were constructed over a period of time spanning almost 70 years. Data included in this report were retrieved from the Hanford Environmental Information System (HEIS) database and supplemented with information not yet entered into HEIS. While considerable effort has been made to obtain the most accurate and complete tabulations possible of the Hanford Site wells, omissions and errors may exist. This document does not include data on lithologic logs, ground-water analyses, or specific well completion details.

2356 (PNL-8812) Sensitivity study of six public health risk computation cases from the US Department of Energy risk- and cost-estimate process pilot study. Chamberlain, P.J. II; Droppo, J.G. Jr.; Castleton, K.J.; Esslinger, P.W. Pacific Northwest Lab., Richland, WA (United States). Sep 1993. 64p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94000903. Source: OSTI; NTIS; GPO Dep.

This report contains a description of the results from the analysis of the sensitivity of estimated public health risks to changes in model parameters relating to the contaminant source releases, contaminant transports, and human exposures contaminants from six waste sites. Estimated public

health risks associated with these and other sites at US Department of Energy (DOE) compounds were reported in a pilot study done by the Oak Ridge National Laboratory (ORNL) for the DOE (ORNL 1992). The objective of the sensitivity analysis was to identify the subset of model input parameters whose variations accounted for the majority of the variation in the computed public health risk values. All environmental modeling in this study and the pilot study done by ORNL (1992) was based on the Multimedia Environmental Pollutant Assessment System (Whelan et al. 1992). The results of the sensitivity analysis for the atmospheric case indicate that the most influential variables were emission rate and, to a lesser extent, population size. For groundwater cases, there was no consistent ordering of the influential variables. Depending on the case considered, some influential variables include the following: Equilibrium partition coefficient (K_d), size of population, pore water velocity, constituent inventory, contaminant flux rate from source, and thickness of saturated zone. For the overland transport case, the regression model fit was not adequate for a reliable identification of the influential variables.

2357 (PNL-8817) Contribution of Hanford liquid effluents to strontium-90 levels in offsite soils. Jaquish, R.E. Pacific Northwest Lab., Richland, WA (United States). Aug 1993. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93040838. Source: OSTI; NTIS; INIS; GPO Dep.

Strontium-90 is a major constituent of liquid effluents entering the Columbia River at the 100-N Area. The Columbia River also contains ^{90}Sr from world-wide fallout that enters the Columbia River upstream of Hanford. Irrigation water pumped from the Columbia River can deposit ^{90}Sr on soil where it can be taken up by farm crops. Fallout has also deposited ^{90}Sr directly on soil by atmospheric deposition. A review of the sources of ^{90}Sr in soil in the vicinity of Hanford indicates that about 2% can be attributed to Hanford liquid effluents. PNL measurements of ^{90}Sr in soil at a background location agree with predicted levels of fallout made by the Federal Radiation Council in 1964. Alfalfa is routinely monitored for ^{90}Sr and is of special interest since it has concentrations higher than other farm crops. The concentrations of ^{90}Sr in alfalfa measured in the Hanford vicinity are in the range one would expect, based on measured soil concentrations and using uptake factors from an earlier ^{90}Sr uptake study at Hanford.

2358 (PNL-8868) A quantitative method for groundwater surveillance monitoring network design at the Hanford Site. Meyer, P.D. Pacific Northwest Lab., Richland, WA (United States). Dec 1993. 54p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94005380. Source: OSTI; NTIS; INIS; GPO Dep.

As part of the Environmental Surveillance Program at the Hanford Site, mandated by the US Department of Energy, hundreds of groundwater wells are sampled each year, with each sample typically analyzed for a variety of constituents. The groundwater sampling program must satisfy several broad objectives. These objectives include an integrated assessment of the condition of groundwater and the identification and quantification of existing, emerging, or potential groundwater problems. Several quantitative network design objectives are proposed and a mathematical optimization model is developed from these objectives. The model attempts to find minimum cost network alternatives that

maximize the amount of information generated by the network. Information is measured both by the rate of change with respect to time of the contaminant concentration and the uncertainty in contaminant concentration. In an application to tritium monitoring at the Hanford Site, both information measures were derived from historical data using time series analysis.

2359 (PNL-8869) Preliminary potentiometric map and flow dynamic characteristics for the upper-basalt confined aquifer system. Spaine, F.A. Jr.; Raymond, R.G. Pacific Northwest Lab., Richland, WA (United States). Sep 1993. 63p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94001678. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents the first comprehensive Hanford Site-wide potentiometric map for the upper-basalt confined aquifer system (i.e., the upper Saddle Mountains Basalt). In constructing the potentiometric map, over forty on-site and off-site monitoring wells and boreholes were used. The potentiometric map developed for the upper-basalt confined aquifer is consistent with the areal head pattern indicated for the Mabton interbed, which is a deeper and more areally extensive confined aquifer underlying the Hanford Site. Salient features for the upper-basalt confined aquifer system potentiometric map are described.

2360 (PNL-8873) Derivation of residual radioactive material guidelines for the Laboratory for Energy-Related Health Research site. Chapman, T.E. Pacific Northwest Lab., Richland, WA (United States). Nov 1993. 32p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94003874. Source: OSTI; NTIS; INIS; GPO Dep.

Residual radioactive material guidelines were derived for the Laboratory for Energy-Related Health Research (LEHR) Environmental Restoration (ER) site in Davis, California. The guideline derivation was based on a dose limit of 100 mrem/yr. The US Department of Energy (DOE) residual radioactive material guideline computer code was used in this evaluation. This code implements the methodology described in the DOE manual for implementing residual radioactive material guidelines. Three potential site utilization scenarios were considered with the assumption that following ER action, the site will be used without radiological restrictions. The defined scenarios vary with regard to use of the site, time spent at the site, and sources of food consumed. The results of the evaluation indicate that the basic dose limit of 100 mrem/yr will not be exceeded, provided that the soil concentrations of these radionuclides at the LEHR site do not exceed the scenario-specific values calculated by this study. Except for the extent of the contaminated zone (which is very conservative), assumptions used are as site-specific as possible, given available information. The derived guidelines are single-radionuclide guidelines and are linearly proportional to the dose limit used in the calculations. In setting the actual residual soil contamination guides for the LEHR site, DOE will apply the as low as reasonably achievable policy to the decision-making process, along with other factors such as whether a particular scenario is reasonable and appropriate, as well as using site-specific inputs to computer models based on data not yet fully determined.

2361 (PNL-8884) Hanford Site Environmental Data for Calendar year 1992 - Ground water. Merz, J.K.; Dresel, P.E. Pacific Northwest Lab., Richland, WA (United

States). Oct 1993. 155p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94004300. Source: OSTI; NTIS; INIS; GPO Dep.

This report tabulates ground-water radiological and chemical data reported for calendar year 1992 by the Ground-Water Surveillance Project and other Pacific Northwest Laboratory (PNL) projects. The Ground-Water Surveillance Project is conducted by PNL and the Resource Conservation and Recovery Act (RCRA) Project is conducted by Westinghouse Hanford Company. This document supplements the reports Hanford Site Ground-Water Monitoring for 1992 (Dresel et al. 1993) and the Hanford Site Environmental Report for Calendar Year 1992 (Woodruff and Hanf 1993). The data listings provided here were generated from the Hanford Environmental Information System database.

2362 (PNL-8971) Three-dimensional conceptual model for the Hanford Site unconfined aquifer system, FY 1993 status report. Thorne, P.D.; Chamness, M.A.; Spane, F.A. Jr.; Vermeul, V.R.; Webber, W.D. Pacific Northwest Lab., Richland, WA (United States). Dec 1993. 103p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94005497. Source: OSTI; NTIS; INIS; GPO Dep.

The ground water underlying parts of the Hanford Site (Figure 1.1) contains radioactive and chemical contaminants at concentrations exceeding regulatory standards (Dresel et al. 1993). The Hanford Site Ground-Water Surveillance Project, operated by Pacific Northwest Laboratory (PNL), is responsible for monitoring the movement of these contaminants to ensure that public health and the environment are protected. To support the monitoring effort, a site-wide three-dimensional ground-water flow model is being developed. This report provides an update on the status of the conceptual model that will form the basis for constructing a numerical three-dimensional flow model for the site. Thorne and Chamness (1992) provide additional information on the initial development of the three-dimensional conceptual model.

2363 (PNL-8991) Hanford Site ground-water model: Geographic information system linkages and model enhancements, FY 1993. Wurstner, S.K.; Devary, J.L. Pacific Northwest Lab., Richland, WA (United States). Dec 1993. 71p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94005295. Source: OSTI; NTIS; INIS; GPO Dep.

Appendixes included on IBM formatted disk.

Models of the unconfined aquifer are important tools that are used to (1) identify and quantify existing, emerging, or potential ground-water quality problems, (2) predict changes in ground-water flow and contaminant transport as wastewater discharge operations change, and (3) assess the potential for contaminants to migrate from the US Department of Energy's Hanford Site through the ground water. Formerly, most of the numerical models developed at the Hanford Site were two-dimensional. However, contaminant concentrations cannot be accurately predicted with a two-dimensional model, which assumes a constant vertical distribution of contaminants in the aquifer. Development of two- and three-dimensional models of ground-water flow based on the Coupled Fluid, Energy, and Solute Transport (CFEST) code began in the mid- 1980s. The CFEST code was selected because of its ability to simulate both ground-water flow and contaminant transport. Physical processes

that can be modeled by CFEST include aquifer geometry, heterogeneity, boundary conditions, and initial conditions. The CFEST ground-water modeling library has been integrated with the commercially available geographic information system (GIS) ARC/INFO. The display and analysis capabilities of a GIS are well suited to the size and diversity of databases being generated at the Hanford Site. The ability to visually inspect large databases through a graphical analysis tool provides a stable foundation for site assessments and ground-water modeling studies. Any ground-water flow model being used by an ongoing project should be continually updated and refined to reflect the most current knowledge of the system. The two-dimensional ground-water flow model being used in support of the Ground-Water Surveillance Project has recently been updated and enhanced. One major enhancement was the extension of the model area to include North Richland.

2364 (PNL-SA-17567) Accuracy and precision of well casing surveys and water-level measurements and their impact on water-level contour maps. Schalla, R. (Pacific Northwest Lab., Richland, WA (USA)); Bates, D.J.; Lewis, A.K. Pacific Northwest Lab., Richland, WA (United States). Jun 1991. 19p. Sponsored by USDOE, Washington, DC (USA). DOE Contract AC06-76RL01830. (CONF-9006357-1: International symposium on mapping and geographic information systems (GIS), San Francisco, CA (United States), 21-22 Jun 1990). Order Number DE91014982. Source: OSTI; NTIS; GPO Dep.

Relatively stringent accuracy and precision requirements for well casing surveys and associated water-level measurements are generally difficult to achieve. Field experiments and research indicate that the achieved accuracy is commonly less than expected. Realistic accuracy expectations require that the investigator know what is achievable for a site and how to convey the proper information to the surveyor. The point-difference accuracy of vertical surveys is calculated, based on the measured inaccuracy of the vertical survey divided by the square root of the length of the survey, and therefore by the size of the study area and number of wells surveyed. The accuracy of water-level measurements and contour maps is determined primarily by the equipment and procedures used for measuring the depth to water in the well casings. When setting accuracy requirements for water-level measurements and contour maps, the investigator must consider the end use of the data. Composite error from the two primary sources of error determines how much precision and accuracy are reasonably achievable. 23 ref., 4 figs., 2 tabs.

2365 (PNL-SA-19899) A risk computation model for environmental restoration activities. Droppo, J.B. Jr.; Streng, D.L.; Buck, J.W. Pacific Northwest Lab., Richland, WA (United States). [1991]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-910981-42: Environmental remediation '91 conference, Pasco, WA (United States), 8-11 Sep 1991). Order Number DE92002742. Source: OSTI; NTIS; INIS; GPO Dep.

A risk computation model useful in environmental restoration activities was developed for the US Department of Energy (DOE). This model, the Multimedia Environmental Pollutant Assessment System (MEPAS), can be used to evaluate effects of potential exposures over a broad range of regulatory issues including radioactive carcinogenic, non-radioactive carcinogenic, and noncarcinogenic effects. MEPAS integrates risk computation components. Release,

transport, dispersion, deposition, exposure, and uptake computations are linked in a single system for evaluation of air, surface water, ground water, and overland flow transport. MEPAS uses standard computation approaches. Whenever available and appropriate, US Environmental Protection Agency guidance and models were used to facilitate compatibility and acceptance. MEPAS is a computational tool that can be used at several phases of an environmental restoration effort. At a preliminary stage in problem characterization, potential problems can be prioritized. As more data become available, MEPAS can provide an estimate of baseline risks or evaluate environmental monitoring data. In the feasibility stage, MEPAS can compute risk from alternative remedies. However, MEPAS is not designed to replace a detailed risk assessment of the selected remedy. For major problems, it will be appropriate to use a more detailed, risk computation tool for a detailed, site-specific evaluation of the selected remedy. 15 refs., 2 figs.

2366 (PNL-SA-20036) Environmental restoration and statistics: Issues and needs. Gilbert, R.O. Pacific Northwest Lab., Richland, WA (United States). Oct 1991. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9110266-1: 1991 all-Alberta applied statistics and biometrics workshop, Alberta (Canada), 21-22 Oct 1991). Order Number DE92002739. Source: OSTI; NTIS; INIS; GPO Dep.

Statisticians have a vital role to play in environmental restoration (ER) activities. One facet of that role is to point out where additional work is needed to develop statistical sampling plans and data analyses that meet the needs of ER. This paper is an attempt to show where statistics fits into the ER process. The statistician, as member of the ER planning team, works collaboratively with the team to develop the site characterization sampling design, so that data of the quality and quantity required by the specified data quality objectives (DQOs) are obtained. At the same time, the statistician works with the rest of the planning team to design and implement, when appropriate, the observational approach to streamline the ER process and reduce costs. The statistician will also provide the expertise needed to select or develop appropriate tools for statistical analysis that are suited for problems that are common to waste-site data. These data problems include highly heterogeneous waste forms, large variability in concentrations over space, correlated data, data that do not have a normal (Gaussian) distribution, and measurements below detection limits. Other problems include environmental transport and risk models that yield highly uncertain predictions, and the need to effectively communicate to the public highly technical information, such as sampling plans, site characterization data, statistical analysis results, and risk estimates. Even though some statistical analysis methods are available "off the shelf" for use in ER, these problems require the development of additional statistical tools, as discussed in this paper. 29 refs.

2367 (PNL-SA-20937) A Remote Characterization System and a fault-tolerant tracking system for subsurface mapping of buried waste sites. Sandness, G.A. (Pacific Northwest Lab., Richland, WA (United States)); Bennett, D.W.; Martinson, L.; Bingham, D.N.; Anderson, A.A. Pacific Northwest Lab., Richland, WA (United States). Aug 1992. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-920851-85: Spectrum '92: nuclear and hazardous waste management international topical meeting, Boise, ID (United

States), 23-27 Aug 1992). Order Number DE93004404. Source: OSTI; NTIS; INIS; GPO Dep.

This paper describes two closely related projects that will provide new technology for characterizing hazardous waste burial sites. The first project, a collaborative effort by five of the national laboratories, involves the development and demonstration of a remotely controlled site characterization system. The Remote Characterization System (RCS) includes a unique low-signature survey vehicle, a base station, radio telemetry data links, satellite-based vehicle tracking, stereo vision, and sensors for noninvasive inspection of the surface and subsurface. The second project, conducted by the Idaho National Engineering Laboratory (INEL), involves the development of a position sensing system that can track a survey vehicle or instrument in the field. This system can coordinate updates at a rate of 200/s with an accuracy better than 0.1% of the distance separating the target and the sensor. It can employ acoustic or electromagnetic signals in a wide range of frequencies and can be operated as a passive or active device.

2368 (PNL-SA-20978) An evaluation of slug interference tests for aquifer characterization at the Hanford Site. Spane, F.A. Jr.; Thorne, P.D. Pacific Northwest Lab., Richland, WA (United States). [1992]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-920851-78: Spectrum '92: nuclear and hazardous waste management international topical meeting, Boise, ID (United States), 23-27 Aug 1992). Order Number DE93001308. Source: OSTI; NTIS; INIS; GPO Dep.

Slug interference tests are conducted by instantaneously changing the water level in a well and monitoring the aquifer response at one or more observation wells. The applicability of this method for hydraulic characterization of a high permeability unconfined aquifer at the Hanford Site was evaluated. Analytical techniques were used to predict slug interference responses over a range of aquifer hydraulic conditions and observation well distances. This was followed by a field test of the proposed technique. The results showed that slug interference testing can be used to characterize aquifers having transmissivities up to 10^{-1} m²/s compared to a maximum transmissivity of about 10^{-3} m²/s for single-well slug tests. The amplitude of the pressure response measured at the observation well is primarily determined by aquifer storativity, while the time-lag of the pressure peak is mainly controlled by the transmissivity. Several recommendations are made optimizing the results of slug interference tests in higher permeability, unconfined to semiconfined aquifers.

2369 (PNL-SA-20991) Use of a mathematical model for prediction of optimum feeding strategies for in situ bioremediation. Shouche, M. (Washington State Univ., Pullman, WA (United States). Dept. of Chemical Engineering); Petersen, J.N.; Skeen, R.S. Pacific Northwest Lab., Richland, WA (United States). May 1992. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-920508-4: 14. symposium on biotechnology for fuels and chemicals, Gatlinburg, TN (United States), 11-15 May 1992). Order Number DE92017136. Source: OSTI; NTIS; INIS; GPO Dep.

Liquid wastes containing radioactive, hazardous, and regulated chemicals have been generated throughout the 40+ years of operations at the US Department of Energy (DOE) Hanford site. Some of these wastes were discharged to the soil column and many of the waste components, including nitrate, carbon tetrachloride (CCL₄), and several radionuclides, have been detected in the Hanford groundwater.

Current DOE policy prohibits the disposal of the contaminated liquids directly to the environment, and remediation of the existing contaminated groundwaters may be required. In-situ bioremediation is one technology currently being developed at the Hanford to meet the need for cost effective technologies to clean groundwater contaminated with CCL₄, nitrate, and other organic and inorganic contaminants. This paper focuses on the latest results of an on-going effort to develop effective in-situ remediation strategies through the use of predictive simulations. In particular, strategies for nutrient injection are developed which minimize biomass accumulation within the flow field and thus extend the life of injection wells.

2370 (PNL-SA-21033) A Remote Characterization System for subsurface mapping of buried waste sites. Sandness, G.A. (Pacific Northwest Lab., Richland, WA (United States)); Bennett, D.W.; Martinson, L. Pacific Northwest Lab., Richland, WA (United States). Jun 1992. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-920606-38: American Nuclear Society annual meeting, Boston, MA (United States), 7-12 Jun 1992). Order Number DE92019087. Source: OSTI; NTIS; INIS; GPO Dep.

This paper describes a development project that will provide new technology for characterizing hazardous waste burial sites. The project is a collaborative effort by five of the national laboratories, involving the development and demonstration of a remotely controlled site characterization system. The Remote Characterization System (RCS) includes a unique low-signature survey vehicle, a base station, radio telemetry data links, satellite-based vehicle tracking, stereo vision, and sensors for non-invasive inspection of the surface and subsurface.

2371 (PNL-SA-21471) A remote characterization system for subsurface mapping of buried waste sites. Sandness, G.A.; Bennett, D.W. Pacific Northwest Lab., Richland, WA (United States). Oct 1992. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9210194-9: International symposium on environmental contamination in Central and Eastern Europe, Budapest (Hungary), 12-16 Oct 1992). Order Number DE93004327. Source: OSTI; NTIS; INIS; GPO Dep.

Mapping of buried objects and regions of chemical and radiological contamination is required at US Department of Energy (DOE) buried waste sites. The DOE Office of Technology Development Robotics Integrated Program has initiated a project to develop and demonstrate a remotely controlled subsurface sensing system, called the Remote Characterization System (RCS). This project, a collaborative effort by five of the National Laboratories, involves the development of a unique low-signature survey vehicle, a base station, radio telemetry data links, satellite-based vehicle tracking, stereo vision, and sensors for non-invasive inspection of the surface and subsurface. To minimize interference with on-board sensors, the survey vehicle has been constructed predominately of non-metallic materials. The vehicle is self-propelled and will be guided by an operator located at a remote base station. The RCS sensors will be environmentally sealed and internally cooled to preclude contamination during use. Ground-penetrating radar, magnetometers, and conductivity devices are planned for geophysical surveys. Chemical and radiological sensors will be provided to locate hot spots and to provide isotopic concentration data.

2372 (PNL-SA-22386) Accounting for time-varying vadose-zone water fluxes caused by infiltration caps using the MEPAS transport, exposure, and risk assessment model. Streile, G.P.; Stroh, J.L. Pacific Northwest Lab., Richland, WA (United States). Oct 1993. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-931095-71: Department of Energy environmental remediation conference, Augusta, GA (United States), 24-28 Oct 1993). Order Number DE94004592. Source: OSTI; NTIS; INIS; GPO Dep.

The Multimedia Environmental Pollutant Assessment System (MEPAS) is an objective, scientific methodology to assess and prioritize hazardous chemical and radionuclide waste disposal sites based on a limited amount of site information. The vadose zone/groundwater transport module (RADCON) of MEPAS was enhanced to simulate scenarios where water-infiltration barriers (caps) have been emplaced over contaminated sites. The computer code was modified to accommodate three periods of constant water flux through the vadose zone (i.e., flux with no cap, fully functioning cap, and partially failed cap). The simulation results from test problems where the cap should have no effect essentially duplicated the simulation results from the same test problems evaluated with the earlier (baseline) version of RADCON (which requires a single constant value of water flux). Therefore, MEPAS assessments of baseline (no-cap) scenarios should be the same as they were when the baseline RADCON code was used as the vadose zone/groundwater transport module. As expected, simulations of preliminary test problems where the cap should have an effect showed that peak concentrations arrived at the receptor later and were reduced in magnitude compared to the no-cap case. Simple criteria were derived to indicate the degree to which results could be affected by violation of the assumptions of the conceptual model. However, even when assumptions are violated, errors on the nonconservative side that could occur as the cap fails should be offset by errors on the conservative side that would have already occurred as the cap was emplaced, resulting in simulations that are conservative overall.

2373 (PNL-SA-22393) Applicability of slug interference testing of hydraulic characterization of contaminated aquifer sites. Spane, F.A. (Pacific Northwest Lab., Richland, WA (United States)); Swanson, L.C. Pacific Northwest Lab., Richland, WA (United States). Oct 1993. 38p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-931095-70: Department of Energy environmental remediation conference, Augusta, GA (United States), 24-28 Oct 1993). Order Number DE94004299. Source: OSTI; NTIS; INIS; GPO Dep.

Aquifer test methods available for characterizing hazardous waste sites are sometimes restricted because of problems with disposal of contaminated groundwater. These problems, in part, have made slug tests a more desirable method of determining hydraulic properties at such sites. However, in higher permeability formations (i.e., transmissivities $\geq 1 \times 10^{-3}$ m²/s), slug test results often cannot be analyzed and give, at best, only a lower limit for transmissivity. A need clearly exists to develop test methods that can be used to characterize higher permeability aquifers without removing large amounts of contaminated groundwater. One hydrologic test method that appears to hold promise for characterizing such sites is the slug interference test. To assess the applicability of this test method for use in shallow

alluvial aquifer systems, slug interference tests have been conducted, along with more traditional aquifer testing methods, at several Hanford multiple-well sites. Transmissivity values estimated from the slug interference tests were comparable (within a factor of 2 to 3) to values calculated using traditional testing methods, and made it possible to calculate the storativity or specific yield for the intervening test formation. The corroboration of test results indicates that slug interference testing is a viable hydraulic characterization method in transmissive alluvial aquifers, and may represent one of the few test methods that can be used in sensitive areas where groundwater is contaminated.

2374 (PNL-SA-22430) Implementing and operating the Hanford Environmental Information System (HEIS). Cowley, P.J. (Pacific Northwest Lab., Richland, WA (United States)); Schwab, M.R.; Fox, R.D. Pacific Northwest Lab., Richland, WA (United States); Westinghouse Hanford Co., Richland, WA (United States). Mar 1994. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830 ; AC06-87RL10930. (CONF-940335-1: Gas supply planning, control and deliverability under Order 636, Houston, TX (United States), 7-9 Mar 1994). Order Number DE94011238. Source: OSTI; NTIS; INIS; GPO Dep.

In the process of performing environmental restoration at the 560-square mile Hanford Site in southeastern Washington State, vast amounts of scientific and technical data are being generated from sampling taking place all over the Site. This paper provides an overview of the lessons we have learned in designing, implementing, and putting into operation a computerized system named the Hanford Environmental Information System (HEIS), which is being used to manage the Site's environmental characterization sampling data. Topics discussed in this paper include helping the Site adapt to a data management culture, the advantages of electronic data over paper data, issues of data validation and defensibility, being a resource to the user community (including the regulatory community), managing and tracking data changes, integrating data from multiple programs, providing configuration control for data and software, getting priorities for software development, and developing a baseline for on-going funding to maintain the infrastructure for the information system.

2375 (PNL-SA-22431) Using the global positioning system in support of environmental characterization at the Hanford Site in Washington State. Peterson, L.B. (Pacific Northwest Lab., Richland, WA (United States)); Tzemos, S.; Dietz, L.A. Pacific Northwest Lab., Richland, WA (United States); Westinghouse Hanford Co., Richland, WA (United States). Oct 1993. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830 ; AC06-87RL10930. (CONF-931095-73: Department of Energy environmental remediation conference, Augusta, GA (United States), 24-28 Oct 1993). Order Number DE94004292. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy's 1,450 km² Hanford Site in southeastern Washington State accumulated hazardous wastes for more than 50 years. To support the Site's mission of environmental restoration and cleanup, the Global Positioning System (GPS) is being used to verify waste site locations and provide location information for field samples. Collected GPS data are stored for use in the Hanford Geographic Information System (HGIS). The NAVSTAR GPS is a space-based electronic navigation and positioning system designed and operated by the US Department of Defense (DOD). The system consists of three major components: (1)

the space segment, comprising 24 earth-orbiting satellites; (2) the control segment, made up of 5 control and monitoring stations placed around the globe; and (3) the user segment, which includes users worldwide. When declared fully operational by the DOD, the NAVSTAR GPS will allow users to identify their geographical position anywhere on earth at any time. There are no user fees for the service and anyone with a GPS receiver may use the system worldwide. The one major hindrance to the system is the DOD policy concerning a security option called Selective Availability (SA). Selective Availability affects the usability of the system by intentional manipulation of the GPS signals to degrade the accuracy of the user's positions. The period and magnitude of degradation is solely a DOD privilege. The DOD policy on SA is to vary the error in position calculated from the Standard Positioning Service code to approximately 100 m root-mean squared (RMS). With SA on and other possible errors included, users may know their location to within a few hundred meters. While this accuracy is good for many applications, it is too inaccurate for others.

2376 (PNL-SA-22530) Application of ARC/INFO to regional scale hydrogeologic modeling. Wurster, S.K.; McWethy, G.; Devary, J.L.; Foley, M.G. Pacific Northwest Lab., Richland, WA (United States). May 1993. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9305220-1: 13. ESRI annual users conference, Palm Springs, CA (United States), 24-28 May 1993). Order Number DE93015673. Source: OSTI; NTIS; INIS; GPO Dep.

Geographic Information Systems (GIS) can be a useful tool in data preparation for groundwater flow modeling, especially when studying large regional systems. ARC/INFO is being used in conjunction with GRASS to support data preparation for input to the CFEST (Coupled Fluid, Energy, and Solute Transport) groundwater modeling code. Simulations will be performed with CFEST to model three-dimensional, regional, groundwater flow in the West Siberian Basin.

2377 (PNL-SA-22677) The UFA method for site characterization and remediation. Wright, J.V. (Pacific Northwest Lab., Richland, WA (United States)); Leather, J.M.; Conca, J.L. Pacific Northwest Lab., Richland, WA (United States). Oct 1993. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-931095-68: Department of Energy environmental remediation conference, Augusta, GA (United States), 24-28 Oct 1993). Order Number DE94004291. Source: OSTI; NTIS; INIS; GPO Dep.

Direct measurement was made of the unsaturated hydraulic conductivity of soils and sediments using a new experimental method. The experimental method, which uses the Unsaturated Flow Apparatus (UFA™), employs open-flow centrifugation in a new application. Centrifugation, like gravity, has the effect on a material of a whole-body force exerting equal force at all points within the sample. The equivalent gravitational force exerted throughout the sample is from one to four orders of magnitude higher than earth gravity (from 10 to 10,000 g). The result is an increase in rate of fluid flow equally at all points throughout the sample so that hydraulic steady state is obtained in most geologic materials in a few hours, even at very unsaturated conditions. This extraordinarily short time allows direct measurement of transport parameters, such as hydraulic conductivity, diffusion coefficient, and retardation factors, in any porous media over the complete range of field moisture

contents. Traditional techniques and estimation methods require months to years to obtain these data, and cannot provide data for samples at low water contents. Predictive modeling, site restoration strategies, and remediation formulations can be rapidly tested with the UFA method prior to costly and time-consuming field demonstrations. From 8 to 14 measurements of hydraulic conductivity as a function of decreasing volumetric water content were made on each of approximately 50 aridisol samples from a former waste disposal area at Hanford Site in Washington State. This provided over 500 data points to define the characteristic behavior, with respect to Hanford Site vadose zone water for these soils and sediments. The large hydraulic conductivity data set provided information for mapping the subsurface recharge distribution below an area where disposal of large quantities of liquid wastes occurred during a half-century of government weapons research.

2378 (PNL-SA-22765) A teleoperated system for remote site characterization. Sandness, G.A. (Pacific Northwest Lab., Richland, WA (United States)); Richardson, B.S.; Pence, J. Pacific Northwest Lab., Richland, WA (United States). Aug 1993. 14p. Sponsored by USDOE, Washington, DC (United States); Department of Defense, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9308159-3; SOAR 93: space operations, applications, and research conference, Houston, TX (United States), 3-5 Aug 1993). Order Number DE94001674. Source: OSTI; NTIS; INIS; GPO Dep.

The detection and characterization of buried objects and materials is an important first step in the restoration of burial sites containing chemical and radioactive waste materials at Department of Energy (DOE) and Department of Defense (DOD) facilities. To address the need to minimize the exposure of on-site personnel to the hazards associated with such sites, the DOE Office of Technology Development and the US Army Environmental Center have jointly supported the development of the Remote Characterization System (RCS). One of the main components of the RCS is a small remotely driven survey vehicle that can transport various combinations of geophysical and radiological sensors. Currently implemented sensors include ground-penetrating radar, magnetometers, an electromagnetic induction sensor, and a sodium iodide radiation detector. The survey vehicle was constructed predominantly of non-metallic materials to minimize its effect on the operation of its geophysical sensors. The system operator controls the vehicle from a remote, truck-mounted, base station. Video images are transmitted to the base station by a radio link to give the operator necessary visual information. Vehicle control commands, tracking information, and sensor data are transmitted between the survey vehicle and the base station by means of a radio ethernet link. Precise vehicle tracking coordinates are provided by a differential Global Positioning System (GPS). The sensors are environmentally protected, internally cooled, and interchangeable based on mission requirements. To date, the RCS has been successfully tested at the Oak Ridge National Laboratory and the Idaho National Engineering Laboratory.

2379 (PNL-SA-22904) Pacific Northwest Laboratory tasks supporting the Office of Technology Development national program. Slate, S.C. Pacific Northwest Lab., Richland, WA (United States). [1993]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93040667. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this document is to provide a concise summary of the Pacific Northwest Laboratory's (PNL) tasks being conducted for the Department of Energy's (DOE) Office of Technology Development (OTD). The summaries are useful to principal investigators who want to link their work to others doing similar work, to staff in DOE operating programs who are looking for better solutions to current problems, and to private industry which may be interested in teaming with PNL to commercialize the technology. The tasks are organized within Hanford's overall Work Breakdown Structure (WBS), which is a hierarchical organization of the Hanford mission into subordinate missions. The technology development tasks are all in WBS 3.2. The first subordinate steps under WBS 3.2 are general categories of technology development, such as Soils and Groundwater Cleanup. The next level is the Integrated Program (IP) and Integrated Demonstration (ID) level. An IP is a centrally managed series of projects which explore and develop a particular technology, such as characterization, for application to a wide spectrum of problems. An ID brings multiple technology systems to bear on an actual problem; for example, a carbon tetrachloride plume migrating through the soil is being remediated with biological agents, heating the soil, and destruction of the contamination in vapor removed from the soil. IDs and IPs are identified by an alphanumeric code: GSO2 is the second ID under Groundwater and Soils Cleanup. The final step in the breakout is the Technical Task Plan (TTP). These are individual tasks which support the ID/IP. They are identified by a six-digit number in the format 3211-01. The WBS structure for Technology Development down to the ID/IP level is shown.

2380 (PNL-SA-23141) Quantitative in situ uranium contaminant mapping using high-resolution gamma-ray spectrometry and beta scintillation counting. Schilk, A.J.; Perkins, R.W.; Abel, K.H.; Brodzinski, R.L.; Brown, D.P.; Thompson, R.C.; Knopf, M.A. Pacific Northwest Lab., Richland, WA (United States). Oct 1993. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-931095-74; Department of Energy environmental remediation conference, Augusta, GA (United States), 24-28 Oct 1993). Order Number DE94004294. Source: OSTI; NTIS; INIS; GPO Dep.

Traditional means of measuring radionuclide concentrations in soils over large areas are often time-consuming, cumbersome, expensive, and non-representative. In developing new methods for the real-time characterization of large-scale uranium contamination, three original and/or adapted technologies were demonstrated at the Fernald Environmental Management Project near Cincinnati, Ohio. The use of collimated downwell gamma-ray spectrometry, in situ surface gamma-ray spectrometry, and a novel high-energy beta scintillation sensor represents significant improvements over, and largely eliminates the need for, the collection of myriad soil samples and subsequent laboratory analyses. The results from a preliminary screening of two sites within the Fernald facility are presented here, and future versions of the beta sensor and surface gamma spectrometer are discussed in some detail.

2381 (PNL-SA-23363) Technology Information profile: RL321103 - In situ gamma spectrometer. Schilk, A.J. Pacific Northwest Lab., Richland, WA (United States). Nov 1993. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE94004594. Source: OSTI; NTIS; INIS; GPO Dep.

Past operations of uranium production and support facilities at several Department of Energy (DOE) sites have occasionally resulted in the local contamination of some surface and subsurface soils. Such contamination commonly occurs within waste burial sites, cribs, pond bottom sediments, and areas surrounding waste tanks or uranium scrap, ore, tailing, and slag heaps. The thorough cleanup of these sites is a major public concern and a high priority for the DOE, but before any effective remedial protocols can be established, the three-dimensional distributions of the uranium contaminants must be adequately characterized. Unfortunately, traditional means of obtaining soil activities (e.g., grab sampling followed by laboratory analyses) are notoriously cumbersome, expensive, time-consuming, and often non-representative when very large areas are being surveyed. Hence, new technologies must be developed, or existing ones improved, to allow for the cheaper, better, faster (i.e., real-time) and safer characterization of uranium concentrations at these critical sites. The primary objective for this program is to develop, construct, and field/pilot test the in situ gamma spectrometer for the rapid measurement of uranium in surface and shallow subsurface soils at the Fernald site in Ohio.

2382 Techniques for determining probabilities of geologic events and processes. International Association for Mathematical Geology. Hunter, R.L. (ed.) (Sandia National Labs., Albuquerque, NM (United States)); Mann, C.J. (ed.). 364p. Oxford University Press, New York, NY (USA) (1992). Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789.

The primary goal of this study has been to search out and evaluate existing quantitative methods for determining probabilities of events and processes in fields that seemed to be most closely related to the majority of the events considered important to long-term performance by earlier workers. These fields are thermomechanical behavior, mining engineering, hydrology, climatology, seismicity and tectonics, seismic hazard, volcanology, geochemistry, and resource exploration. Most of these events and processes can initiate, releases of the radioactive waste from a geologic repository, although geochemical processes primarily affect transport of wastes after release. The quantitative methods for determining probabilities identified here are those that have been reported in the literature, and some that could be used but have not been reported. Merits and limitations of each method have been described, and the current availability of databases adequate for determining accurate probabilities of events and processes has been appraised. A secondary goal has been to identify phenomena for which accurate probabilities cannot be determined now and areas of research that could materially improve our ability to make better probabilistic predictions in the immediate future.

2383 (SAND-91-1988C) Developing conceptual models for performance assessment of waste management sites. Kerl, F.A. (New Mexico Univ., Albuquerque, NM (United States)). Dept. of Chemical and Nuclear Engineering; Heger, A.S.; Gallegos, D.P. Sandia National Labs., Albuquerque, NM (United States). [1991]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-910435-92: 2. annual American Nuclear Society (ANS) international high level radioactive waste management conference, Las Vegas, NV (United States), 28 Apr - 3 May 1991). Order Number DE92006765. Source: OSTI; NTIS; INIS; GPO Dep.

The conceptual model development process involves making simplifying assumptions about the description and behavior of the natural repository system. To better understand how conceptual models are developed, it is important to explicitly identify and document the process. To investigate the conceptual model development process, conceptualizations of groundwater flow systems for Avra Valley and the potential high-level radioactive waste repository site at Yucca Mountain have been reviewed to identify assumptions. Additionally, a formal expert judgment elicitation has been performed to obtain and document information about the conceptual model development process. The results from both these exercises are represented as a set of assumptions, possible choices for each assumption, and the relationships among the assumptions. From this information, the development of conceptual models can be described as the process by which, for a given site and purpose, choices are made for each of the assumptions dependent upon their established relationships. Developing a comprehensive understanding of the conceptual model development process is a step toward addressing the uncertainty associated with conceptual models developed for repository performance assessment. The information presented does provide a significant contribution toward documenting and defining the conceptual model development process.

2384 (SAND-91-7083) Multiaxial creep of natural rock salt. Mellegard, K.D. (RE/SPEC, Inc., Rapid City, SD (United States)); Callahan, G.D.; Senseny, P.E. Sandia National Labs., Albuquerque, NM (United States); RE/SPEC, Inc., Rapid City, SD (United States). Dec 1992. 92p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93007421. Source: OSTI; NTIS; GPO Dep.

Long-term multiaxial creep tests were performed on large, thin-walled cylinders of natural rock salt to investigate the relationship between the inelastic strain rate tensor and the stress tensor. The axial load, internal pressure, and external pressure on the specimens were controlled to obtain desired values of mean stress, octahedral shear stress, and Lode angle. The loads on the specimen were chosen so that the mean stress and octahedral shear stress were identical in nearly all tests, but that the Lode angle varied from 0° to 30°. Test results show that for the thin-walled cylinder tests reported here, both strain-rate direction and strain-rate magnitude are better described by a Tresca-type flow rule than by a Mises-type flow rule. This conclusion is significant because use of a Tresca-type flow rule rather than a Mises-type flow rule produces much greater creep closures of underground openings in salt where the Lode angle deviates from 30° (triaxial compression).

2385 (SAND-92-0052) Surface chemistry of MoS₂ lubricant films: 1, Effects of high humidity storage on sputtered films. Peebles, D.E.; Ohlhausen, J.A. Sandia National Labs., Albuquerque, NM (United States). May 1992. 50p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE92015392. Source: OSTI; NTIS; GPO Dep.

Many MoS₂ lubricant film formulations exhibit tribological performance degradation after extended storage in high humidity ambient environments. As a part of an extensive study of the effects of high humidity storage on a wide variety of MoS₂ lubricant film formulations, the effects of high humidity storage on sputtered MoS₂ films have been examined. The surface chemistries of a series of ten different commercially deposited MoS₂ lubricant film formulations on

440C stainless steel have been examined before and after 1 month of storage at 98% relative humidity. While the films varied greatly in film chemistry prior to high humidity storage, many smaller differences were observed after high humidity storage. Addition of Ni to the films affects the film chemistry far more dramatically than the addition of AuPd or SbO_x , facilitating oxidation of the MoS_2 and enhancing formation of sulfate species. All of the films are adequately characterized by considering only MoS_2 and MoO_3 species, with the exception of the films co-sputtered with Ni and ion implanted with N^+ , where some MoO_2 or $\text{MoS}_{2-x}\text{O}_x$ must also be present.

2386 (SAND-92-0364) Propagation of dissolution/precipitation waves in porous media. Novak, C.F. (Sandia National Labs., Albuquerque, NM (United States)); Sevougian, S.D. Sandia National Labs., Albuquerque, NM (United States). Jul 1992. 39p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9205156-1: NATO-Advanced Study Institute summer school on migration and fate of pollutants in soils and subsoils, Basilicata (Italy), 24 May - 6 Jun 1992). Order Number DE92017348. Source: OSTI; NTIS; GPO Dep.

Contaminant transposition in saturated porous media, whether advective or diffusive, occurs as propagating concentration changes. The wave interpretation of these changes provides general principles describing the ways in which concentration changes can evolve and interact during transport. If contaminants react chemically with spatially fixed phases (minerals), the transfer of the contaminants from aqueous phase to mineral phase(s) results in chemical retardation. This report focuses on the propagation of dissolution/precipitation waves and the chemical retardation produced by mineral dissolution and precipitation reactions. The assumption of local equilibrium is common for systems where transport rates can be considered slow relative to reaction rates, and results in equations for dissolution/precipitation reactions called solubility products. Because a solubility product expression is an inequality when the mineral described by it is absent, and because these expressions are independent of the amount of mineral present, mineral dissolution/precipitation waves are generally very abrupt concentration changes in the mineral and aqueous phases. These abrupt changes occur in advection- and diffusion-dominated systems. Reactions can also be described by kinetic rate expressions, resulting in a partial local equilibrium system. Unlike waves for local equilibrium dissolution/precipitation, waves controlled by dissolution kinetics can have broader widths, although these waves still propagate through the domain as a unit. Four examples are presented to focus on the wave behavior predicted for chemical transport: 1D local equilibrium advective transport, 1D local equilibrium diffusive transport, 1D partial local equilibrium advective transport, and 2D dual porosity local equilibrium transport.

2387 (SAND-92-0387C) An integrated approach to the characterization of uranium-contaminated soils. Tidwell, V.C. (Sandia National Labs., Albuquerque, NM (United States)); Lee, S.Y.; Morris, D.E.; Conradson, S.D.; Perry, D.L.; Carnahan, C.; Cunnane, J.C.; Gill, V. Sandia National Labs., Albuquerque, NM (United States). [1992]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-920851-20: Spectrum '92: nuclear and hazardous waste management international topical meeting, Boise, ID (United States), 23-27 Aug

1992). Order Number DE92014619. Source: OSTI; NTIS; GPO Dep.

An Integrated Demonstration Program, hosted by the Fernald Environmental Management Project (FEMP), has been established for investigating technologies applicable to the characterization and remediation of soils contaminated with uranium. Critical to the design of relevant treatment technologies is detailed information on the chemical and physical characteristics of the uranium waste-form. To address this need a soil sampling and characterization program was initiated which makes use of a variety of standard analytical techniques coupled with state-of-the-art microscopy and spectroscopy techniques. Sample representativeness is evaluated through the development of conceptual models in an effort to identify and understand those geochemical processes governing the behavior of uranium in FEMP soils. Many of the initial results have significant implications for the design of soil treatment technologies for application at the FEMP.

2388 (SAND-92-0426C) Sandia National Laboratories Chemical Waste Landfill: Innovative strategies towards characterization and remediation. Ardito, C.P. (INTERA, Inc., Albuquerque, NM (United States)); Parsons, A.M.; Lindgren, E.R.; Phelan, J.M.; Mattson, E.D. Sandia National Labs., Albuquerque, NM (United States). [1992]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-920307-50: Waste management '92, Tucson, AZ (United States), 1-5 Mar 1992). Order Number DE92010403. Source: OSTI; NTIS; INIS; GPO Dep.

The Chemical Waste Landfill (CWL) was used by Sandia National Laboratories (SNL), Albuquerque for disposal of hazardous chemicals from the years 1962 to 1985. Prompted by the detection of low levels of trichlorethylene (TCE) in groundwater samples from a water table aquifer approximately 146 meters below ground surface, a RCRA Site Investigation (RSI) and remediation of organic contaminants will be performed at the CWL prior to closure of this landfill. The RSI is focused on optimal characterization of the VOC and dense non-aqueous phase liquid (DNAPL) contamination at this site which will be possible through application of innovative strategies for characterization and promising new technologies. This paper provides a discussion of conceptual models of contaminant transport at the CWL, and an overview of our investigative strategy which is focused on characterizing transport of VOC and DNAPLS. Each stage of the RSI has been developed to gather information which will reduce the uncertainty in the design of each subsequent phase of the investigation. Three stages are described; a source characterization stage, unsaturated zone characterization stage, and a saturated zone characterization stage. The unsaturated zone characterization must provide all data necessary to make decisions concerning the necessity of a saturated zone characterization phase.

2389 (SAND-92-1072C) A miniaturized sensor system for in situ robotic characterization of hazardous waste. Feddema, J.T. Sandia National Labs., Albuquerque, NM (United States). [1992]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-920851-9: Spectrum '92: nuclear and hazardous waste management international topical meeting, Boise, ID (United States), 23-27 Aug 1992). Order Number DE92013662. Source: OSTI; NTIS; INIS; GPO Dep.

This paper describes current research and development on miniaturized sensing systems for use during in situ characterization of nuclear waste storage tanks, buried waste sites, and decommissioned production facilities. Each miniaturized sensor system will consist of a suite of chemical, radiological, and physical properties sensors integrated into a compact package which will be mounted on the end of a robotic arm and/or vehicle. While the specific size of this remote sensor head and the types of sensors included will depend on site needs, the supporting generic computing system may be used for other waste characterization applications. This computing system will contain all necessary hardware and software to acquire, combine, interpret, display, and archive a wide range of sensor data. This paper describes the present status of the project, the lessons learned from the first prototype, and planned future designs of the next generation system. 7 refs.

2390 (SAND-92-1303) Exact analysis of a two-dimensional model for brine flow to a borehole in a disturbed rock zone. Gelbard, F. Sandia National Labs., Albuquerque, NM (United States). Oct 1992. 105p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93005911. Source: OSTI; NTIS; INIS; GPO Dep.

An exact two-dimensional solution is derived for determining the fluid flow rates into a borehole and to the surface from which the borehole was drilled. The solution is for a single fluid phase in a disturbed rock zone (DRZ) that surrounds the borehole with a radius specified to be either finite or infinite. The solution is restricted to constant homogeneous rock and fluid properties in the DRZ, and pressures in the borehole and at the surface of the drift that are maintained constant at ambient conditions. A major objective of the work is to provide a benchmark for more detailed numerical calculations that include variable physical properties and an arbitrary DRZ geometry. However in addition, this work extends previous exact solutions for one-dimensional flow by: (1) allowing for a DRZ of finite but arbitrary extent, (2) accounting for depressurization due to mining the drift before drilling the borehole, and (3) accounting for two-dimensional variations of the fluid pressure caused by simultaneous fluid flow to the drift and to the borehole.

2391 (SAND-92-1537C) Three-dimensional finite element simulation of creep deformation in rock salt. Weatherby, J.R.; Munson, D.E.; Argueello, J.G. Sandia National Labs., Albuquerque, NM (United States). [1992]. 37p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-930889-1: 2. U.S. National Congress on Computational Mechanics meeting, Washington, DC (United States), 16-18 Aug 1993). Order Number DE93011595. Source: OSTI; NTIS; INIS; GPO Dep.

A multi-mechanism deformation (M-D) constitutive model for rock salt has been implemented in a finite element code for use in three-dimensional, finite strain simulations of creep closure in deeply-buried salt excavations. Essential details of the numerical implementation are presented. The constitutive model is exercised in a three-dimensional closure simulation of a large underground field experiment. Finally, results from the simulation are compared against actual closure measurements taken from the experiment.

2392 (SAND-92-2182C) Heat and vapor transport beneath an impermeable cap. McTigue, D.F.; Martinez, M.J.; Stein, C.L. Sandia National Labs., Albuquerque, NM (United States). [1992]. 8p. Sponsored by USDOE,

Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-930408-43: 10. international high-level radioactive waste management conference, Las Vegas, NV (United States), 25-29 Apr 1993). Order Number DE93009627. Source: OSTI; NTIS; INIS; GPO Dep.

The coupled transport of heat and fluid mass is a critical issue in modeling the response of repository rocks to thermal loading by heat-generating waste. The movement of liquids and vapors in unsaturated, porous media is also taking on increasing importance because of environmental concerns related to contaminated soils. Vadose-zone moisture transport near an impermeable barrier has been under study at a Field site near Albuquerque, NM since 1990. Moisture content and temperature have been monitored in the subsurface on a regular basis; both undergo a seasonal variation about average values. Even though the slab introduces two-dimensional effects on the scale of the slab, moisture and heat transport is predominantly vertical. Numerical simulations, based on the models developed by Philip and de Vries (1957) and de Vries (1958), indicate that the heat flow is conduction-dominated while the moisture movement is dominated by diffusive vapor distillation. Model predictions of the magnitude and extent of changes in moisture content underneath the slab are in reasonable agreement with observation.

2393 (SAND-92-2254C) Conceptual models of VOC migration in the vadose zone using soil gas sampling data collected from existing ground water monitoring wells. Mattson, E.D. (SAT-UNSAT, Inc., Albuquerque, NM (United States)); Lindgren, E.R.; Conrad, S.H.; Booher, W.F.; Ardito, C.P. Sandia National Labs., Albuquerque, NM (United States). [1992]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9210194-6: International symposium on environmental contamination in Central and Eastern Europe, Budapest (Hungary), 12-16 Oct 1992). Order Number DE93002292. Source: OSTI; NTIS; GPO Dep.

Choosing the appropriate conceptual model of contaminant transport from a hazardous waste site to the underlying aquifer will assist in designing efficient site investigation and remediation strategies. One method of collecting data to support a conceptual model is by comparing ground water sampling results to soil gas sampling results that are collected through existing monitoring wells. This underutilized data collection technique is quick, easy, and inexpensive. Comparing the soil gas results to ground water results can assist in supporting or refuting a conceptual model selection. In addition, soil gas sampling from existing monitoring wells may provide an early warning detection technique to impending ground water contamination. This approach is being implemented at the Chemical Waste Landfill at Sandia National Laboratories in Albuquerque, New Mexico.

2394 (SAND-92-2296C) Cross borehole electromagnetic imaging of chemical and mixed waste landfills. Borns, D.J. (Sandia National Labs., Albuquerque, NM (United States)); Newman, G.; Stolarczyk, L.; Mondt, W. Sandia National Labs., Albuquerque, NM (United States). [1992]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9304109-4: SAGEEP '93: symposium on the application of geophysics to environmental and engineering problems, San Diego, CA (United States), 18-21 Apr 1993). Order Number DE93011684. Source: OSTI; NTIS; INIS; GPO Dep.

CHARACTERIZATION

The Mixed Waste Landfill Integrated Demonstration (MWLID) is testing noninvasive site characterization methods at several locations, including the Chemical Waste Landfill (CWL) at Sandia National Laboratories. The CWL comprises shallow, unlined pits that were used for the disposal of acids, oils, solvents, and inorganic compounds from 1962 until the CWL was closed in 1985. The soils of the landfills are alluvial, predominantly sand, gravels and cobbles with small quantities of silts and clays. The focus of this study is an unlined chromic acid pit (UCAP). The UCAP pit is rectangular (approximately 4×10 m), which reportedly received unknown volumes of chromium in the form of chromic acid (liquid) and other hazardous materials. At this location, we have demonstrated a continuous waveform (CW) system for site characterization. During this year, we will also utilize a crossborehole pulsed radar system. Both methods are sensitive to variations in either electrical conductivity or dielectric constant in the soils or host rock at a waste site. These earth properties are some of the most responsive geophysical indicators of metallic, acidic and water-based subsurface contaminants.

2395 (SAND-92-2630C) Damage-induced nonassociated inelastic flow in rock salt. Chan, K.S. (Southwest Research Inst., San Antonio, TX (United States)); Bodner, S.R.; Brodsky, N.S.; Fossum, A.F.; Munson, D.E. Sandia National Labs., Albuquerque, NM (United States). [1993]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-930797-1: 4. international symposium on plasticity and its current applications, Baltimore, MD (United States), 19-23 Jul 1993). Order Number DE93015658. Source: OSTI; NTIS; INIS; GPO Dep.

The multi-mechanism deformation coupled fracture model recently developed by CHAN, et al. (1992), for describing time-dependent, pressure-sensitive inelastic flow and damage evolution in crystalline solids was evaluated against triaxial creep experiments on rock salt. Guided by experimental observations, the kinetic equation and the flow law for damage-induced inelastic flow in the model were modified to account for the development of damage and inelastic dilatation in the transient creep regime. The revised model was then utilized to obtain the creep response and damage evolution in rock salt as a function of confining pressure and stress difference. Comparison between model calculation and experiment revealed that damage-induced inelastic flow is nonassociated, dilatational, and contributes significantly to the macroscopic strain rate observed in rock salt deformed at low confining pressures. The inelastic strain rate and volumetric strain due to damage decrease with increasing confining pressures, and all are suppressed at sufficiently high confining pressures.

2396 (SAND-93-0070) Surface acoustic wave sensing of VOCs in harsh chemical environments. Pfeifer, K.B.; Martin, S.J.; Ricco, A.J. Sandia National Labs., Albuquerque, NM (United States). Jun 1993. 74p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93040721. Source: OSTI; NTIS; GPO Dep.

The measurement of VOC concentrations in harsh chemical and physical environments is a formidable task. A surface acoustic wave (SAW) sensor has been designed for this purpose and its construction and testing are described in this paper. Included is a detailed description of the design elements specific to operation in 300°C steam and HCl environments including temperature control, gas handling, and

signal processing component descriptions. In addition, laboratory temperature stability was studied and a minimum detection limit was defined for operation in industrial environments. Finally, a description of field tests performed on steam reforming equipment at Synthetica Technologies Inc. of Richmond, CA is given including a report on destruction efficiency of CCl_4 in the Synthetica moving bed evaporator. Design improvements based on the field tests are proposed.

2397 (SAND-93-0377C) Extension of the M-D model for treating stress drops in salt. Munson, D.E. (Sandia National Labs., Albuquerque, NM (United States)); DeVries, K.L.; Fossum, A.F.; Callahan, G.D. Sandia National Labs., Albuquerque, NM (United States). 1993. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9309205-1: 3. conference on the mechanical behavior of salt, Paliseau (France), 14-16 Sep 1993). Order Number DE93017637. Source: OSTI; NTIS; INIS; GPO Dep.

Development of the multimechanism deformation (M-D) constitutive model for steady state creep, which incorporates irreversible workhardening and recovery transient strains, was motivated by the need to predict very long term closures in underground rooms for radioactive waste repositories in salt. The multimechanism deformation model for the creep deformation of salt is extended to treat the response of salt to imposed stress drops. Stress drop tests produce a very distinctive behavior where both reversible elastic strain and reversible time dependent strain occur. These transient strains are negative compared to the positive transient strains produced by the normal creep workhardening and recovery processes. A simple micromechanical evolutionary process is defined to account for the accumulation of these reversible strains, and their subsequent release with decreases in stress. A number of experimental stress drop tests for various stress drop magnitudes and temperatures are adequately simulated with the model.

2398 (SAND-93-0489C) The accelerated testing of cements in brines. Krumhansl, J.L. Sandia National Labs., Albuquerque, NM (United States). [1993]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-930438-31: 95. annual meeting of the American Ceramic Society, Cincinnati, OH (United States), 18-22 Apr 1993). Order Number DE94006580. Source: OSTI; NTIS; GPO Dep.

Cementitious materials may be employed in settings where they face prolonged exposure to Mg-rich brines. This study evaluated the possibility of using high temperatures to accelerate brine-cement reaction rates. Class-H cement coupons were tested in Mg-K-Na-C1- SO_4 brines to 100°C. $\text{MgC}_2\text{-NaC1}$ solutions were also employed in a test sequence that extended to 200°C. It was found that accelerated testing could be used successfully to evaluate the compatibility of cementitious materials with such brines.

2399 (SAND-93-0715C) Constitutive model of creep in polycrystalline halite based on workhardening and recovery. Munson, D.E. Sandia National Labs., Albuquerque, NM (United States). 1993. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-930797-2: 4. international symposium on plasticity and its current applications, Baltimore, MD (United States), 19-23 Jul 1993). Order Number DE93016511. Source: OSTI; NTIS; INIS; GPO Dep.

A multimechanism constitutive model of creep has been developed which incorporates the workhardening and recovery transient creep behavior. This model has been applied to the creep of polycrystalline halite. The specific application of the model is in the calculation of the closure of underground rooms in layered salt deposits. Through the use of finite element calculations, this model, with appropriate laboratory material parameters and a Tresca flow potential, has predicted the measured closure of a number of large in situ experimental rooms.

2400 (SAND-93-1577C) Towards Identifying data needs for a regional hydrogeologic contamination study using multiple realization simulations. McCord, J.; Treadway, A. Sandia National Labs., Albuquerque, NM (United States). [1993]. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-940668-1: 4. international symposium on fire safety science, Ottawa (Canada), 13-17 Jun 1994). Order Number DE94002926. Source: OSTI; NTIS; INIS; GPO Dep.

This paper describes a stochastic, distributed parameter simulation approach which is being used to identify/prioritize data collection activities for a 250 km² region containing numerous potential contamination sites. The region is located in the southeast part of the Albuquerque Basin in central New Mexico, USA. The Basin is part of the Rio Grande Trough, a large graben with large vertical displacements between the central basin and the adjacent highlands. Numerous potential human receptors are located around the periphery of the region, and it is the desired to have a groundwater monitoring well network which can help provide early detection of contamination plumes as well as provide relevant data on the regional hydrogeologic framework. A 2D numerical model of the regional basin-fill aquifer is developed with explicit recognition of uncertainties in flow parameter spatial distributions. We account for uncertainty in the parameter field through Monte Carlo simulation. To reduce the computational burden of multiple realization simulation, we employ a linearized stochastic model which permits cosimulation of transmissivity and head fields, conditioning on both transmissivity and head. The locations of selected contamination sites within the region then are overlaid on the simulation results, and flow paths and groundwater travel times from the contamination sites are assessed using sensitivity analysis to identify preferred locations for collection of additional data and the types of data which should be collected (e.g., head, transmissivity, or geologic cores).

2401 (SAND-93-2090C) Probability distributions for parameters of the Munson-Dawson salt creep model. Fossum, A.F. (RE/SPEC, Inc., Rapid City, SD (United States)); Pfeifle, T.W.; Mellegard, K.D.; Munson, D.E. Sandia National Labs., Albuquerque, NM (United States). [1993]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-940642-2: 1. North American rock mechanics symposium, Austin, TX (United States), 1-3 Jun 1994). Order Number DE94006470. Source: OSTI; NTIS; INIS; GPO Dep.

Stress-related probability distribution functions are determined for the random variable material model parameters of the Munson-Dawson multi-mechanism deformation creep model for salt. These functions are obtained indirectly from experimental creep data for clean salt. The parameter distribution functions will form the basis for numerical calculations to generate an appropriate distribution function for room closure. Also included is a table that gives the values of the

parameters for individual specimens of clean salt under different stresses.

2402 (SAND-93-2250C) Evaluation of soil characterization technologies using a stochastic, value-of-information approach. Kaplan, P.G. Sandia National Labs., Albuquerque, NM (United States). [1993]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-931095-32: Department of Energy environmental remediation conference, Augusta, GA (United States), 24-28 Oct 1993). Order Number DE94001823. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy has initiated an integrated demonstration program to develop and compare new technologies for the characterization of uranium-contaminated soils. As part of this effort, a performance-assessment task was funded in February, 1993 to evaluate the field tested technologies. Performance assessment can be cleaned as the analysis that evaluates a system's, or technology's, ability to meet the criteria specified for performance. Four new technologies were field tested at the Fernald Environmental Management Restoration Co. in Ohio. In the next section, the goals of this performance assessment task are discussed. The following section discusses issues that must be resolved if the goals are to be successfully met. The author concludes with a discussion of the potential benefits to performance assessment of the approach taken. This paper is intended to be the first of a series of documentation that describes the work. Also in this proceedings is a paper on the field demonstration at the Fernald site and a description of the technologies (Tidwell et al, 1993) and a paper on the application of advanced geostatistical techniques (Rautman, 1993). The overall approach is to simply demonstrate the applicability of concepts that are well described in the literature but are not routinely applied to problems in environmental remediation, restoration, and waste management. The basic geostatistical concepts are documented in Clark (1979) and in Issaks and Srivastava (1989). Advanced concepts and applications, along with software, are discussed in Deutsch and Journel (1992). Integration of geostatistical modeling with a decision-analytic framework is discussed in Freeze et al (1992). Information-theoretic and probabilistic concepts are borrowed from the work of Shannon (1948), Jaynes (1957), and Harr (1987). The author sees the task as one of introducing and applying robust methodologies with demonstrated applicability in other fields to the problem at hand.

2403 (SAND-93-2670C) Dilation-Induced permeability changes in rock salt. Stormont, J.C. (Sandia National Labs., Albuquerque, NM (United States)); Fuenkajorn, K. Sandia National Labs., Albuquerque, NM (United States). [1993]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-940506-1: 8. international conference on computer methods and advances in geomechanics, Morgantown, WV (United States), 22-28 May 1994). Order Number DE94003098. Source: OSTI; NTIS; INIS; GPO Dep.

A model of permeability changes in rock salt is developed and implemented in a time-dependent finite element code. Model parameters are developed from laboratory tests. The model is used to predict permeability changes adjacent to excavations in rock salt.

2404 (SAND-93-3884) Interim report for SNL/NM environmental drilling project. Wemple, R.P. (Sandia National Labs., Albuquerque, NM (United States)); Meyer, R.D.; Layne, R.R. Sandia National Labs., Albuquerque, NM

(United States). Feb 1994. 101p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE94010674. Source: OSTI; NTIS; INIS; GPO Dep.

Concern for the environment and cost reduction are the driving forces for a broad effort in government and the private sector to develop new, more cost-effective technologies for characterizing, monitoring and remediating environmental sites. Secondary goals of the characterization, monitoring and remediation (CMR) activity are: minimize secondary waste generation, minimize site impact, protect water tables, and develop methods/strategies to apply new technologies. The Sandia National Laboratories (SNL) project in directional boring for CMR of waste sites with enhanced machinery from the underground utility installation industry was initiated in 1990. Preliminary activities included surveying the directional drilling access needs of various DOE sites, identifying an existing class of machinery that could be enhanced for environmental work through development, and establishing a mutually beneficial working relationship with an industry partner. Since that time the project has tested a variety of prototype machinery and hardware built by the industrial partner, and SNL. The project continues to test and develop the machinery and technique refinements needed for future applications at DOE, DOD, and private sector sites. The original goal of cost-effectiveness is being met through innovation, adaptation, and application of fundamental concepts. Secondary goals are being met via a basic philosophy of "cut/thrust and compact cuttings without adding large quantities of fluid" to an environmental problem site. Technology transfer to the private sector is ongoing and ultimately should result in commercial availability of the machinery. Education of regulatory agencies resulting in restructuring appropriate regulatory standards for specification of the horizontal drilling techniques will be a final project goal.

2405 (SAND-93-4075C) Probabilistic comparison of alternative characterization technologies at the Fernald Uranium-in-Soils Integrated Demonstration Project. Rautman, C.A.; McGraw, M.A.; Istok, J.D.; Sigda, J.M.; Kaplan, P.G. Sandia National Labs., Albuquerque, NM (United States). [1993]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-940225-16: Waste management '94, Tucson, AZ (United States), 27 Feb - 3 mar 1994). Order Number DE94006587. Source: OSTI; NTIS; INIS; GPO Dep.

The performance of four alternative characterization technologies proposed for use in characterization of surficial uranium contamination in soil at the Incinerator and Drum Baling Areas at the Fernald Environmental Management Project in southwestern Ohio has been evaluated using a probabilistic, risk-based decision-analysis methodology. The basis of comparison is to minimize a computed total cost for environmental cleanup. This total-cost-based approach provides a framework for evaluating the trade-offs among remedial investigation, the remedial design, and the risk of regulatory penalties. The approach explicitly recognizes the value of information provided by remedial investigation; additional measurements are only valuable to the extent that the information they provide reduces total cost.

2406 (SAND-94-0276C) An integrated approach to the characterization and decontamination of uranium contaminated soils. Tidwell, V. (Sandia National Labs., Albuquerque, NM (United States)); Francis, C.; Armstrong, A.; Dyer, R. Sandia National Labs., Albuquerque, NM (United States). [1994]. 9p. Sponsored by USDOE, Washington, DC

(United States). DOE Contract AC04-94AL85000. (CONF-940225-27: Waste management '94, Tucson, AZ (United States), 27 Feb - 3 mar 1994). Order Number DE94006601. Source: OSTI; NTIS; INIS; GPO Dep.

An Integrated Demonstration (ID) Program, hosted by the Fernald Environmental Restoration Management Company, has been established for investigating technologies applicable to the characterization and remediation of soils contaminated with uranium. Chemical and physical characterization of Fernald soils and the uranium wastes contained therein is being accomplished by means of standard analytical techniques as well as a suite of non-standard microscopy and spectroscopy techniques. Likewise, a suite of physical and chemical extraction technologies are being designed and tested for accomplishing soil decontamination. However, the main theme of this paper is not the technologies being tested but the approach taken to integrate characterization, decontamination, and risk assessment efforts. It is the authors intent to outline the critical components of an integrated approach for characterizing and remediating uranium contaminated soils as well as provide a real-world example based on the lessons learned in the ID program.

2407 (SAND-94-0658C) A strategy for analysis of TRU waste characterization needs. Leigh, C.D. (Sandia National Labs., Albuquerque, NM (United States)); Chu, M.S.Y.; Arvizu, J.S.; Marcinkiewicz, C.J. Sandia National Labs., Albuquerque, NM (United States). [1994]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-940225-53: Waste management '94, Tucson, AZ (United States), 27 Feb - 3 mar 1994). Order Number DE94007741. Source: OSTI; NTIS; INIS; GPO Dep.

Regulatory compliance and effective management of the nation's TRU waste requires knowledge about the constituents present in the waste. With limited resources, the DOE needs a cost-effective characterization program. In addition, the DOE needs a method for predicting the present and future analytical requirements for waste characterization. Thus, a strategy for predicting the present and future waste characterization needs that uses current knowledge of the TRU inventory and prioritization of the data needs is presented.

2408 (SAND-94-0857C) Probability mapping of contaminants. Rautman, C.A. (Sandia National Labs., Albuquerque, NM (United States)); Kaplan, P.G.; McGraw, M.A.; Istok, J.D.; Sigda, J.M. Sandia National Labs., Albuquerque, NM (United States). [1994]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-940386-1: Cost efficient acquisition and utilization of data in the management of hazardous waste sites, Herndon, VA (United States), 23-25 Mar 1994). Order Number DE94008950. Source: OSTI; NTIS; INIS; GPO Dep.

Exhaustive characterization of a contaminated site is a physical and practical impossibility. Descriptions of the nature, extent, and level of contamination, as well as decisions regarding proposed remediation activities, must be made in a state of uncertainty based upon limited physical sampling. The probability mapping approach illustrated in this paper appears to offer site operators a reasonable, quantitative methodology for many environmental remediation decisions and allows evaluation of the risk associated with those decisions. For example, output from this approach can be used in quantitative, cost-based decision models for evaluating possible site characterization and/or remediation plans,

resulting in selection of the risk-adjusted, least-cost alternative. The methodology is completely general, and the techniques are applicable to a wide variety of environmental restoration projects. The probability-mapping approach is illustrated by application to a contaminated site at the former DOE Feed Materials Production Center near Fernald, Ohio. Soil geochemical data, collected as part of the Uranium-in-Soils Integrated Demonstration Project, have been used to construct a number of geostatistical simulations of potential contamination for parcels approximately the size of a selective remediation unit (the 3-m width of a bulldozer blade). Each such simulation accurately reflects the actual measured sample values, and reproduces the univariate statistics and spatial character of the extant data. Post-processing of a large number of these equally likely statistically similar images produces maps directly showing the probability of exceeding specified levels of contamination (potential clean-up or personnel-hazard thresholds).

2409 (SAND-94-8216) Environmental characterization of soils and sediments: Progress report, part 2. Yang, N.Y.C. Sandia National Labs., Livermore, CA (United States). Jan 1994. 34p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DR00789. Order Number DE94006334. Source: OSTI; NTIS; INIS; GPO Dep.

Elevated chromium level in the ground water at the SNL/CA site is a major concern. The author has developed an analytical methodology that allows one to identify the possible sources of the contamination. This methodology is focused on the integration of various analytical techniques to characterize physical and chemical properties of the soil samples from the contaminated area. The techniques include inductively coupled plasma spectroscopy (ICP), scanning electron microscopy (SEM), energy dispersive X-ray spectroscopy (EDS), X-ray diffraction spectroscopy (XRD), X-ray fluorescence spectroscopy (XRF), and electron microscopy with image analysis (EM/IA). This report describes the overall experimental approaches and findings for the soil samples from the area where the Cr-level was found to be elevated. Current findings suggest that the potential source of the Cr is the Cr-containing minerals that are present in natural abundance rather than externally introduced. In addition to chromium, other heavy metals, such as manganese, iron, and arsenic were also characterized and reported.

2410 (UCID-21536-Add.2) Logs of wells and boreholes drilled during hydrogeologic studies at Lawrence Livermore National Laboratory Site 300, January 1, 1991–September 1, 1992: Addendum 2. Crow, N.B. (Lawrence Livermore National Lab., CA (United States)); McConihe, W.L. Lawrence Livermore National Lab., CA (United States). 1992. 440p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93008622. Source: OSTI; NTIS; INIS; GPO Dep.

Lawrence Livermore National Laboratory (LLNL) Site 300 is located in the Altamont Hills between Livermore and Tracy, about 18 road miles southeast of Livermore, California. The site is used as a test facility to support national defense research carried out by LLNL. This Addendum 2 to the Logs of Wells and Boreholes Drilled During Hydrogeologic Studies at Lawrence Livermore National Laboratory Site 300 presents hydrogeologic logs for monitor wells and boreholes drilled primarily between January 1, 1991 and September 1, 1992. Some logs drilled earlier and not incorporated in earlier volumes of this document are also included here. A small number of logs drilled before

September 1, 1992, are not available at the time of closing the report for publication of this volume (Addendum 2), but will be included in subsequent documents. By September 1, 1992, a total of 495 monitor wells and 285 exploratory boreholes had been drilled at Site 300 since the beginning of hydrogeologic studies in 1982. The primary purpose of these logs is to document lithologic and hydrogeologic conditions together with well completion information. For this reason, not all chemical analytical data are presented. These logs report concentrations of only the most commonly encountered volatile organic compounds, trace metals, and radionuclides detected in ground water and soil samples collected during drilling.

2411 (UCRL-ID-110534) Clay mineralogy of selected borehole sediments from the Lawrence Livermore National Laboratory and Sandia National Laboratories, Livermore, California. Smith, D.K. (ed.); Peifer, D.W.; Rood, C.K. Lawrence Livermore National Lab., CA (United States). Apr 1992. 31p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93006967. Source: OSTI; NTIS; INIS; GPO Dep.

Smectite, 90 to 100% interstratified illite-smectite, chlorate, and kaolinite are identified in boreholes drilled in fluvial and alluvial fan deposits of the Plio-Pleistocene Livermore Formation in the vicinity of Lawrence Livermore National Laboratory (LLNL) and Sandia National Laboratories (SNL), Livermore. X-ray diffraction, scanning electron microscopy, and electron microprobe studies indicate the clays persist through 150 ft of gravels, sands, silts, and mudstones of the vadose zone to total drilling depths of 200 ft in the saturated zone. Scanning electron microscopy indicates that true clays (layer silicate only) comprise between 2 and 15 modal percent of the Livermore Formation. Authigenic and detrital smectite, 90% interlayered illite-smectite, and chlorate persist throughout the stratigraphic section; kaolinite occurs only in the upper 100 ft of the section and is absent below. Smectite comprises between 60 to 90% of the true (layer silicate only) clay fraction. Illite and kaolinite±chlorite abundances fluctuate between 10 to 30% and 10 to 20% of this fraction, respectively. Authigenic smectite, illite, and chlorate crystallize together with detrital phases; the authigenic component increases with depth. The relative percentages of clay minerals define unique mineralogical intervals, which can be correlated between boreholes. Pervasive microfractures and interconnected porosity are inherent in the finer sediments; the microfractures typically are 1 mm or less in width and are variably spaced. Voids and microfractures are conspicuously lined by clays. Porosity for the argillaceous sediments ranges between 23 and 40%; Brunauer, Emmett, and Teller (BET) specific surface area decreases variably from 40 m²/g near the surface to 15 m²/g at the 115-ft depth. Within the pelitic matrix, iron, iron-titanium, chromium, and manganese oxides are pervasive.

2412 (UCRL-ID-115373) Monitoring radio-frequency heating of contaminated soils using electrical resistance tomography. Ramirez, A.L.; Daily, W.D. Lawrence Livermore National Lab., CA (United States). Sep 1993. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE94007758. Source: OSTI; NTIS; GPO Dep.

Electrical resistance tomography (ERT) was used to monitor a radio-frequency heating process for the insitu remediation of volatile organic compounds from subsurface water and soil at the Savannah River Site, near Aiken, South Carolina. A dipole antenna located in a horizontal well

in the unsaturated zone was used to heat a contaminated clay layer. The heat-induced changes were tomographically imaged by their effects on the formation electrical resistivity. The resistivity changes observed appear to be related to heating and vaporization of the pore water, formation of steam condensate, and infiltration of rainwater through the heated zones and adjacent areas. There is a clear asymmetry downward in the resistivity decreases associated with the heating process. The resistivity decreases observed in the vicinity of the heating well are believed to be caused by the heating and downward migration of warm water originally located within a radius of a few feet around the heating well; the magnitude of the change is between 10–20%. The decreasing resistivity implies an increasing rate of radio wave attenuation as heating progressed; therefore, the rate of energy deposition around the heating well increased while the penetration distance of the radio waves decreased. Saturation changes in the clay near the antenna during heating were estimated to be 50–55% based on the observed resistivity decreases. Resistivity changes observed at distances greater than 3 meters to one side of the antenna appear to be related to rainwater infiltration. We propose that gaps in near surface clay layers allow rainwater to migrate downward and reach the top of clay rich zone penetrated by the antenna borehole. The water may then accumulate along the top of the clay.

2413 (UCRL-ID-115626) Effect of contaminant diffusion into and out of low-permeability zones. Bear, J. (Weiss Associates, Inc., Emeryville, CA (United States)); Nichols, E.; Kulshrestha, A.; Ziagos, J. Lawrence Livermore National Lab., CA (United States). Feb 1994. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE94009036. Source: OSTI; NTIS; GPO Dep.

We considered the case of an aquifer in the form of a network of high-permeability (HK) channels imbedded in a very low-permeability (LK) porous medium. Contaminants in the aquifer were adsorbed on the solid matrix in both the LK and HK materials. Contaminants were also diffused into and adsorbed onto the LK material. We also investigated the penetration of a contaminant into the LK material and its subsequent release into the aquifer material during cleanup by pump-and-treat operations. The model results indicate that the diffusive flux of contaminant into and within the LK zone may significantly reduce the rate of contaminant removal, and, therefore, the progress of remedial actions. We found that the use of a constant transfer coefficient to describe the rate of exchange of contaminant between the two materials was inappropriate for simulating cleanup to low concentrations. Instead, a different method for approximating the effect of diffusive flux into and out of an LK zone was proposed and demonstrated on zero- and one-dimensional models of contaminant transport. The technique was applied to Lawrence Livermore National Laboratory's environmental restoration. The diffusive exchange resulted in a lower concentration of contaminant in the HK material during the initial contamination phase, and a slower rate of concentration decrease during the cleanup phase. The concentrations in the LK material may remain above cleanup goals for prolonged periods.

2414 (UCRL-JC-109668) Environmental site characterization and remediation at Lawrence Livermore National Laboratory Site 300. Lamarre, A.L. (Lawrence Livermore National Lab., CA (United States)); Ferry, R.A. Lawrence Livermore National Lab., CA (United States). Apr

1992. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-920851-91: Spectrum '92: nuclear and hazardous waste management international topical meeting, Boise, ID (United States), 23-27 Aug 1992). Order Number DE93010498. Source: OSTI; NTIS; INIS; GPO Dep.

Lawrence Livermore National Laboratory (LLNL) is a research and development laboratory owned by the US Department of Energy (DOE) and operated by the University of California. The Laboratory operates its Site 300 test facility in support of DOE's national defense programs. In support of activities, at the 300 Site numerous industrial fluids are used and various process or rinse waters and solid wastes are produced. Some of these materials are hazardous by current standards. HE rinse waters were previously discharged to inlined lagoons; they now are discharged to a permitted Class II surface impoundment. Solid wastes have been deposited in nine landfills. Waste HE compounds are destroyed by open burning at a burn pit facility. As a result of these practices, environmental contaminants have been released to the soil and ground water.

2415 (UCRL-JC-110525) Characterization of ground water contamination at the LLNL main site: A case study. Hoffman, F. Lawrence Livermore National Lab., CA (United States). Jul 1992. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9209159-7: Eurocourse: technologies for environmental cleanup - soil and groundwater, Ispra (Italy), 21-25 Sep 1992). Order Number DE93009291. Source: OSTI; NTIS; GPO Dep.

When volatile organic compounds were discovered in ground water on and off Lawrence Livermore National Laboratory (LLNL), an extensive investigation of the hydrogeology began in, around, and under the site. This investigation involved collection of data concerning the hydrology, geology, and chemistry of the subsurface environment. After a thorough analysis of the existing information, a workplan was devised that allowed the investigation to proceed with built in flexibility to respond to new data as it was acquired. Where the unique characteristics of the site required a different approach to hydrogeologic investigations, new and innovative technologies were developed and deployed, such as a drilling and sampling method designed to allow the evaluation of the vertical distribution of contaminants in a single borehole. As the data were collected, equal attention was paid to methods of storing, arranging, and interpreting the information such that our decision making was well supported. The result is a well-characterized, well instrumented site that can serve as a model for hydrogeologic investigations wherever there is ground water contamination.

2416 (UCRL-JC-110827) Simulated A&PCT data to study the mixed waste forms characterization problem. Robert-Coutant, C.; Martz, H.E.; Azevedo, S.G. Lawrence Livermore National Lab., CA (United States). 30 Nov 1992. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-920882-4: Transuranic waste characterization conference, Pocatello, ID (United States), 10-12 Aug 1992). Order Number DE93009282. Source: OSTI; NTIS; INIS; GPO Dep.

Characterization of mixed wastes requires that the identity and strengths of all intrinsic radioactive sources be determined accurately and all hazardous materials identified. We have investigated the nondestructive evaluation/assay (NDE/DA) of 208-L drums with active (A) and passive (P) computed tomography (CI) in three phases: (1) computer

simulation, (2) experimental measurements, and (3) determination of minimum-detectable limits for various x-ray and gamma-ray attenuation properties typical of waste containers. We report here on the simulation effort; the other two are also presented elsewhere in these proceedings.¹ The A&PCT process consists of mapping the activity of intrinsic sources using PCT data and correcting the data for attenuation by A matrix obtained from an ACT scan. Simulated data are necessary to better understand A&PCT reconstruction algorithms, measure their performance, and better interpret experimental data. The simulation program is based on a forward-projection algorithm to discretely compute the projections (i.e., integrated counts per unit time per unit area) of an emitting object attenuated by a user-specified matrix. We use two algebraic, iterative, A&PCT reconstruction codes: a weighted-least-squares, steepest-descent (WLS-SD) algorithm and a maximum-likelihood expectation-maximization (MLEM) algorithm. We present three simulated phantom studies: (1) a large homogeneous source included in a large homogeneous attenuator, (2) a mock-waste drum involving small sources, and (3) a spatial-resolution phantom. All examples involve attenuation but are not strong enough to cause missing data, and the last example includes noise. Simulated results are reported and analyzed in the context of mixed-waste characterization.

2417 (UCRL-JC-113731) A new fiber-optic sensor technology for rapid and inexpensive characterization of soil contamination. Milanovich, F.P. (Lawrence Livermore National Lab., CA (United States)); Brown, S.B.; Colston, B.W. Jr.; Daley, P.F.; Rossabi, J. Lawrence Livermore National Lab., CA (United States). Apr 1993. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-930589-4: 4. international conference on contaminated soil, Berlin (Germany), 3-7 May 1993). Order Number DE93017973. Source: OSTI; NTIS; INIS; GPO Dep.

The extent and complexity of worldwide environmental contamination are great enough that remediation will be extremely costly and lengthy. There is an urgent need for characterization techniques that are rapid, inexpensive, and simple and that do not generate waste. Towards this end LLNL is developing a fiber-optic chemical sensor technology for use in groundwater and vadose-zone monitoring. We use a colorimetric detection technique, based on an irreversible chemical reaction between a specific reagent and the target compound. The accuracy and sensitivity of the sensor (<5 ppb by weight in water, determined by comparison with gas chromatographic standard measurements) are sufficient for environmental monitoring of at least trichloroethylene (TCE) and chloroform.

2418 (UCRL-JC-113790) DOE capabilities for in-situ characterization and monitoring of formation properties in the vadose zone. Hearst, J.R. (Lawrence Livermore National Lab., CA (United States)); Brodeur, J.R.; Koizumi, C.J.; Conaway, J.G.; Mikesell, J.L.; Nelson, P.H.; Stromswold, D.C.; Wilson, R.D. Lawrence Livermore National Lab., CA (United States). Sep 1993. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-931095-39: Department of Energy environmental remediation conference, Augusta, GA (United States), 24-28 Oct 1993). Order Number DE94002006. Source: OSTI; NTIS; INIS; GPO Dep.

The DOE Environmental Restoration (ER) Program faces the difficult task of characterizing the properties of the subsurface and identifying and mapping a large number of

contaminants at landfills, surface disposal areas, spill sites, nuclear waste tanks, and subsurface contaminant plumes throughout the complex of DOE facilities. Geophysical borehole logs can measure formation properties such as bulk density, water content, and lithology, and can quantitatively analyze for radionuclides and such elements as chlorine and heavy metals. Since these measurements can be replaced as desired, they can be used for both initial characterization and monitoring of changes in contaminant concentration and water content (sometimes linked to contaminant migration), at a fraction of the cost of conventional sampling. The techniques develop at several DOE laboratories, and the experience that the authors have gained in making in-situ measurements in the vadose zone, are applicable to problems at many other DOE sites. Moreover, they can capitalize on existing inventories of boreholes. By building on this experience workers involved in ER projects at those sites should be able to obtain high-quality data at substantial reductions in cost and time.

2419 (UCRL-JC-115724) Characterization of waste drums using nonintrusive NDE/NDA methods. Martz, H.E.; Roberson, G.P.; Azevedo, S.G.; Ryon, R.W. Lawrence Livermore National Lab., CA (United States). Dec 1993. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-940165-1: Symposium on hazardous materials, identification, handling and management, Arzamas-16 (Russian Federation), 25 Jan - 2 Feb 1994). Order Number DE94007070. Source: OSTI; NTIS; INIS; GPO Dep.

Characterization of mixed (radioactive and hazardous) wastes requires that all hazardous (e.g., heavy metals, volatile organic compounds-VOCs-and non-VOCs) and non-conforming materials (e.g. free liquids and pressurized containers) be identified, and that the identity and strengths of intrinsic radioactive sources be determined accurately. Comprehensive and accurate nondestructive evaluation (NDE) and nondestructive assay (NDA) methods can be used in this identification and determination process. With accurate quantitative data, wastes would be properly characterized and then discarded in the safest and most cost-effective manner without any need to open the waste container.

2420 (UCRL-JC-116144) Borehole induction logging for the Dynamic Underground Stripping Project LLNL gasoline spill site. Boyd, S.; Newmark, R.; Wilt, M. Lawrence Livermore National Lab., CA (United States). 21 Jan 1994. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-940353-1: Symposium on the application of geophysics to environmental and engineering problems, Boston, MA (United States), 27-31 Mar 1994). Order Number DE94006720. Source: OSTI; NTIS; INIS; GPO Dep.

Borehole induction logs were acquired for the purpose of characterizing subsurface physical properties and monitoring steam clean up activities at the Lawrence Livermore National Laboratory. This work was part of the Dynamic Underground Stripping Project's demonstrated clean up of a gasoline spill. The site is composed of unconsolidated sands and gravels which contain gasoline both above and below the water table. Induction logs were used to characterize lithology, to provide "ground truth" resistivity values for electrical resistance tomography (ERT), and to monitor the movement of an underground steam plume used to heat the soil and drive volatile organic compounds (VOCs) to the extraction wells.

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2421 (WHC-EP-0145-2) **Westinghouse Hanford Company environmental surveillance annual report - 200/600 Areas: Calendar year 1989.** Schmidt, J.W.; Huckfeldt, C.R.; Johnson, A.R.; McKinney, S.M. Westinghouse Hanford Co., Richland, WA (United States). Jun 1990. 153p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE90012640. Source: NTIS, PC A08/MF A01; OSTI; INIS; GPO Dep.

This document presents the results of near-field environmental surveillance as performed by Westinghouse Hanford Company in 1989 for the Operations Area of the Hanford Site, Richland, Washington. These activities were conducted in the 200 and 600 Areas to assess operational control on the work environment. Surveillance activities included external radiation measurements and radiological surveys of waste disposal sites, radiological control areas, and roads, as well as sampling and analysis of ambient air, surface water, groundwater, sediments, soil, and biota. 15 refs., 3 figs., 1 tab.

2422 (WHC-EP-0145-3) **Westinghouse Hanford Company Environmental surveillance annual report-200/600 Areas: Calendar year 1990.** Schmidt, J.W.; Huckfeldt, C.R.; Johnson, A.R.; McKinney, S.M. Westinghouse Hanford Co., Richland, WA (United States). Jun 1991. 116p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91018137. Source: OSTI; NTIS; INIS; GPO Dep.

This document presents the results of near-field environmental surveillance in 1990 of the Operations Area of the Hanford Site, in south central Washington State, as performed by Westinghouse Hanford Company. These activities are conducted in the 200 and 600 Areas to assess and control the impacts of operations on the workers and the local environment. Surveillance activities include sampling and analyses of ambient air, surface water, groundwater, sediments, soil, and biota. Also, external radiation measurements and radiological surveys are taken of waste disposal sites, radiological control areas, and roads. 16 refs., 3 figs., 1 tab.

2423 (WHC-EP-0145-4-Rev.4) **Westinghouse Hanford Company Environmental Surveillance annual report: 200/600 Areas: Calendar year 1990: Revision 4.** Schmidt, J.W.; Webb, C.R.; Johnson, A.R.; McKinney, S.M. Westinghouse Hanford Co., Richland, WA (United States). Mar 1992. 197p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92014220. Source: OSTI; NTIS; INIS; GPO Dep.

This document presents the results of near-field environmental surveillance in 1990 of the 200 and 600 Areas of the Hanford Site, in south-central Washington State, as performed by Westinghouse Hanford Company. These activities are conducted to assess and control the impacts of operations on the workers and the local environment. Surveillance activities include sampling and analyses of ambient air, surface water, groundwater, sediments, soil, and biota. Also, external radiation measurements and radiological surveys are taken at waste disposal sites, radiologically controlled areas, and roads.

2424 (WHC-EP-0253) **Animal Intrusion field test plan.** Landeen, D.S. (Westinghouse Hanford Co., Richland, WA (USA)); Cadwell, L.L.; Eberhardt, L.E.; Fitzner, R.E.; Simmons, M.A. Westinghouse Hanford Co., Richland, WA (United States). Apr 1990. 28p. Sponsored by USDOE,

Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE90010367. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Protective Barrier and Warning Marker System Development Plan identified tasks that need to be completed in order to design a final protective barrier to implement in-place disposal. This report summarizes the animal intrusion tasks that have been conducted by Westinghouse Hanford Company in fiscal year 1989 with respect to small mammals and water infiltration. An animal intrusion lysimeter facility was constructed and installed in fiscal year 1988. Small burrowing mammals common to the Hanford Site environs are introduced over a three to four month period and allowed to burrow. During the course of each test, supplemental precipitation is added to three of the lysimeters with a rainulator at a rate equivalent to a 100-yr storm. Soil moisture samples are taken before and after each test and soil moisture measurements are also taken with a hydroprobe during the test period. Two tests have been completed and a third test is in progress. Preliminary results from the first test indicate that the additional water, which was supplemented by the rainulator to the plots with burrowing animals, is being removed. Data from the second test, which was conducted during the winter, indicate that all the plots gained water. Additional test, scheduled to be conducted over the next few years, should substantiate or verify these preliminary observations, 7 refs., 10 figs., 8 tabs.

2425 (WHC-EP-0299) **Animal Intrusion status report for fiscal year 1989.** Landeen, D.S. Westinghouse Hanford Co., Richland, WA (United States). Aug 1990. 77p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91001289. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

The Protective Barrier and Warning Marker System Development Plan identified tasks that need to be completed to design a final protective barrier to implement in-place disposal of radioactive waste. This report summarizes the animal intrusion tasks that were conducted by Westinghouse Hanford Company in fiscal years 1988 and 1989 with respect to small mammals and water infiltration. 2 refs., 8 figs., 6 tabs.

2426 (WHC-EP-0342) **Hanford Site stream-specific reports.** Westinghouse Hanford Co., Richland, WA (United States). Aug 1990. 42p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91001175. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This document and the associated 33 stream-specific addenda were prepared in response to public comments received on the Hanford Federal Facility Agreement and Consent Order. The processes used to characterize the effluents and propose designations pursuant to the Washington (State) Administrative Code 173-303, Dangerous Waste Regulations, are described in this "parent" document. A combination of process knowledge and sampling data was used to accomplish these tasks. 26 refs., 1 fig., 4 tabs.

2427 (WHC-EP-0342-Add.2) **PUREX plant chemical sewer stream-specific report: PUREX/EO₃ operations: Addendum 2.** Westinghouse Hanford Co., Richland, WA (United States). Aug 1990. 121p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91001162. Source: NTIS, PC A06/MF A01 - OSTI; GPO Dep.

The proposed wastestream designation for the PUREX Plan CSL wastestream is that this stream is not a dangerous waste, pursuant to the Washington (State) Administration Code (WAC) 173-303, Dangerous Waste Regulations. A combination of process knowledge and sampling data was used to make this determination. 22 refs., 10 figs., 30 tabs.

2428 (WHC-EP-0342-Add.3) N Reactor effluent stream-specific report: Addendum 3. Westinghouse Hanford Co., Richland, WA (United States). Aug 1990. 164p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91001168. Source: NTIS, PC A08/MF A01 - OSTI; GPO Dep.

The N Reactor effluent is characterized in terms of its chemical and radiological composition, discharge history, and sources of discharge. The subject stream is a dilute aqueous effluent derived from circulating coolant systems and fuel storage basins within the reactor building. N Reactor is located on the Hanford Site in southcentral Washington State. A process description of N Reactor and sampling data are presented as a basis for the effluent characterization. A designation pursuant to Washington State Dangerous Waste Regulations is also presented. This report supports an effort by the US Department of Energy to provide the public with information about liquid discharges to the soil at the Hanford Site and to assess the potential for migration of contaminants from the receiving sites of these liquid discharges. 26 refs., 11 figs., 13 tabs.

2429 (WHC-EP-0342-Add.4) 163N Demineralization Plant wastewater stream-specific report: Addendum 4. Westinghouse Hanford Co., Richland, WA (United States). Aug 1990. 69p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91001166. Source: NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.

The 163N Demineralization Plant wastewater is characterized in terms of its chemical and radiological composition, discharge history, and sources of discharge. The subject stream is a dilute aqueous effluent derived from the production of high-quality water for coolant systems at N Reactor and the Washington Public Power Supply System Hanford Generating Plant. N Reactor and the 163N facility are located on the Hanford Site in southcentral Washington State. A process description of the 163N facility and sampling data are presented as a basis for the wastewater characterization. A designation pursuant to Washington State Dangerous Waste Regulations is also presented. This report supports an effort by the US Department of Energy to provide the public with information about liquid discharges to the soil at the Hanford Site and to assess the potential for migration of contaminants from receiving sites of these liquid discharges. 19 refs., 7 figs., 11 tabs.

2430 (WHC-EP-0342-Add.5) PUREX plant steam condensate stream-specific report: PUREX/EO₃ operations: Addendum 5. Westinghouse Hanford Co., Richland, WA (United States). Aug 1990. 111p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91001164. Source: NTIS, PC A06/MF A01 - OSTI; GPO Dep.

The proposed wastestream designation for the Plutonium-Uranium Extraction (PUREX) Plant Steam Condensate (SCD) wastestream is that this stream is not a dangerous waste, pursuant to the Washington (State) Administration Code (WAC) 173-303, Dangerous Waste Regulations. A

combination of process knowledge and present sampling data was used to make this determination. 18 refs., 11 figs., 13 tabs.

2431 (WHC-EP-0342-Add.6) B Plant Chemical Sewer stream-specific report: Addendum 6. Peterson, K.A. Westinghouse Hanford Co., Richland, WA (United States). Aug 1990. 88p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91001159. Source: NTIS, PC A05/MF A01; OSTI; INIS; GPO Dep.

The proposed wastestream designation for the B Plant Chemical Sewer (BCE) wastestream is that this stream is not a dangerous waste, pursuant to the Washington (State) Administration Code (WAC) 173-303, Dangerous Waste Regulations. A combination of process knowledge and sampling data was used to make this determination. 21 refs., 7 figs., 11 tabs.

2432 (WHC-EP-0342-Add.7) UO₃/U-plant wastewater stream-specific report: Addendum 7. Toebe, W.E.; Adams, L.L.L.; Hedengren, D.C. Westinghouse Hanford Co., Richland, WA (United States). Aug 1990. 86p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91001160. Source: NTIS, PC A05/MF A01; OSTI; INIS; GPO Dep.

The proposed wastestream designation for the UO₃/U Plant Wastewater wastestream is that this stream is not a dangerous waste, pursuant to the Washington (State) Administration Code (WAC) 173-303, Dangerous Waste Regulations. A combination of process knowledge and sampling data was used to make this determination. 21 refs., 10 figs., 10 tabs.

2433 (WHC-EP-0342-Add.8) Plutonium finishing plant wastewater stream-specific report. Jensen, D.B. Westinghouse Hanford Co., Richland, WA (United States). Aug 1990. 142p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91001161. Source: NTIS, PC A07/MF A01 - OSTI; GPO Dep.

The proposed wastestream designation for the Plutonium Finishing Plant Wastewater wastestream is that this stream is not a dangerous waste, pursuant to the Washington (State) Administration Code (WAC) 173-303, Dangerous Waste Regulations. A combination of process knowledge and sampling data was used to make this determination. 11 refs., 4 figs., 8 tabs.

2434 (WHC-EP-0342-Add.9) S Plant Wastewater stream-specific report: Addendum 9. Egge, R.G. Westinghouse Hanford Co., Richland, WA (United States). Aug 1990. 80p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91001176. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

The proposed wastestream designation for the S Plant Wastewater wastestream is that this stream is not a dangerous waste, pursuant to the Washington (State) Administration Code (WAC) 173-303, Dangerous Waste Regulations. A combination of process knowledge and sampling data was used to make this determination. 21 refs., 12 figs., 8 tabs.

2435 (WHC-EP-0342-Add.10) T Plant wastewater stream-specific report: Addendum 10. Ayster, K.A. Westinghouse Hanford Co., Richland, WA (United States). Aug 1990. 78p. Sponsored by USDOE, Washington, DC (United

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States). DOE Contract AC06-87RL10930. Order Number DE91001174. Source: NTIS, PC A05/MF A01; OSTI; INIS; GPO Dep.

The proposed wastestream designation for T Plant wastewater wastestream is that this stream is not a dangerous waste, pursuant to the Washington (State) Administration Code (WAC) 173-303, Dangerous Waste Regulations. A combination of process knowledge and sampling data was used to make this determination. 21 refs., 9 figs., 10 tabs.

2436 (WHC-EP-0342-Add.11) 2724-W laundry wastewater stream-specific report: Addendum 11. Westinghouse Hanford Co., Richland, WA (United States). Aug 1990. 95p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91001181. Source: NTIS, PC A05/MF A01; OSTI; INIS; GPO Dep.

The proposed wastestream designation for the 2742-W Laundry wastewater wastestream is that this stream is not a dangerous waste, pursuant to the Washington (State) Administration Code (WAC) 173-303, Dangerous Waste Regulations. A combination of process knowledge and sampling data was used to make this determination. 19 refs., 4 figs., 8 tabs.

2437 (WHC-EP-0342-Add.12) PUREX Plant process condensate stream-specific report: Addendum 12. Westinghouse Hanford Co., Richland, WA (United States). Aug 1990. 95p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91001178. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

The proposed wastestream designation for the PUREX Plant PDD wastestream is that this stream is not a dangerous waste, pursuant to the Washington (State) Administration Code (WAC) 173-303, Dangerous Waste Regulations. A combination of process knowledge and sampling data was used to make this determination. 27 refs., 9 figs., 13 tabs.

2438 (WHC-EP-0342-Add.13) 222-S Laboratory wastewater stream-specific report: Addendum 13. Hall, M.J. Westinghouse Hanford Co., Richland, WA (United States). Aug 1990. 179p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91001185. Source: NTIS, PC A09/MF A01 - OSTI; GPO Dep.

The proposed wastestream designation for the 222-S Laboratory wastestream is that this stream is not a dangerous waste, pursuant to the Washington (State) Administration Code (WAC) 173-303, Dangerous Waste Regulations. A combination of process knowledge and sampling data was used to make this determination. 12 refs., 6 figs., 11 tabs.

2439 (WHC-EP-0342-Add.14) PUREX [Plutonium-Uranium Extraction] Plant Ammonia Scrubber Condensate stream-specific report: Addendum 14. Westinghouse Hanford Co., Richland, WA (United States). Aug 1990. 91p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91001182. Source: NTIS, PC A05/MF A01; OSTI; INIS; GPO Dep.

The proposed wastestream designation for the 242-A Evaporator Process Condensate wastestream is that this stream is a dangerous waste, pursuant to the Washington (State) Administration Code (WAC) 173-303, Dangerous Waste Regulations. A combination of process knowledge

and sampling data was used to make this determination. 16 refs., 7 figs., 11 tabs.

2440 (WHC-EP-0342-Add.15) 242-A evaporator process condensate stream-specific report: Addendum 15. Westinghouse Hanford Co., Richland, WA (United States). Aug 1990. 146p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91001183. Source: NTIS, PC A07/MF A01; OSTI; INIS; GPO Dep.

The proposed wastestream designation for the 242-A Evaporator Process Condensate wastestream is that this stream is a dangerous waste, pursuant to the Washington (State) Administration Code (WAC) 173-303, Dangerous Waste Regulations. A combination of process knowledge and sampling data was used to make this determination. 16 refs., 7 figs., 11 tabs.

2441 (WHC-EP-0342-Add.16) B plant steam condensate stream-specific report. Peterson, K.A. Westinghouse Hanford Co., Richland, WA (United States). Aug 1990. 60p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91001184. Source: NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.

The proposed wastestream designation for the B Plant Steam Condensate (BSC) wastestream is that this stream is not a dangerous waste, pursuant to the Washington (State) Administration Code (WAC) 173-303, Dangerous Waste Regulations. A combination of process knowledge and sampling data was used to make this determination. 23 refs., 8 figs., 9 tabs.

2442 (WHC-EP-0342-Add.17) B Plant Process Condensate stream-specific report: Addendum 17. Peterson, K.A. Westinghouse Hanford Co., Richland, WA (United States). Aug 1990. 65p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91001170. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The B Plant Process Condensate wastestream cannot be designated at this time, pursuant to the Washington (State) Administration Code (WAC) 173-303, Dangerous Waste Regulations. Sampling data were not sufficient to make a designation. 23 refs., 7 figs., 10 tabs.

2443 (WHC-EP-0342-Add.18) 2101-M Laboratory Wastewater stream-specific report: Addendum 18. Westinghouse Hanford Co., Richland, WA (United States). Aug 1990. 61p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91002438. Source: NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.

The proposed wastestream designation for the 2101-M Laboratory Wastewater is that it is not a dangerous waste, pursuant to the Washington (State) Administrative Code (WAC) 173-303, Dangerous Waste Regulations*. This proposed designation is based on applying both process knowledge and sample data to the WAC 173-303 requirements for the three types of dangerous waste: (1) listed, (2) criteria, and (3) characteristic dangerous waste. Current operations in the 2101-M Facility use very little, if any, materials that might lead to the disposal of regulated wastes in the 2101-M Laboratory Wastewater. The activities that are now being conducted in the facility are limited to soil testing, soil sample archiving, stores warehousing and staff work in administrative offices. Chemical constituents present in the old data set that may be of potential regulatory concern are

likely due to discontinued previous activities (such as the Basalt Waste isolation Program). Process knowledge used in this report was based on such things as present operating knowledge of the facility and Material Safety Data Sheets for all chemical products stored or used in the laboratory. Sample data consists of samples taken between September 9, 1985 and January 26, 1987.

2444 (WHC-EP-0342-Add.19) UO₃ plant process condensate stream-specific report: Addendum 19. Toebe, W.E.; Hedengren, D.C.; Rasmussen, J.H.E. Westinghouse Hanford Co., Richland, WA (United States). Aug 1990. 107p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91001165. Source: NTIS, PC A06/MF A01 - OSTI; GPO Dep.

The proposed wastestream designation for the UO₃ Plant Process Condensate wastestream is that this stream is not a dangerous waste, pursuant to the Washington (State) Administrative Code (WAC) 173-303, Dangerous Waste Regulations. A combination of process knowledge and sampling data was used to make this determination. 19 refs., 11 figs., 12 tabs.

2445 (WHC-EP-0342-Add.20) PUREX plant cooling water stream-specific report: PUREX/UO₃ operations: Addendum 20. Westinghouse Hanford Co., Richland, WA (United States). Aug 1990. 101p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91001163. Source: NTIS, PC A06/MF A01 - OSTI; GPO Dep.

The proposed wastestream designation for the Plutonium-Uranium Extraction (PUREX) Plant CWL wastestream is that this stream is not a dangerous waste, pursuant to the Washington (State) Administrative Code (WAC) 173-303, Dangerous Waste Regulations. A combination of process knowledge and sampling data was used to make this determination. 18 refs., 10 figs., 13 tabs.

2446 (WHC-EP-0342-Add.22) B Plant Cooling Water stream-specific report: Addendum 22. Peterson, K.A. Westinghouse Hanford Co., Richland, WA (United States). Aug 1990. 78p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91002453. Source: NTIS, PC A05/MF A01; OSTI; INIS; GPO Dep.

The proposed wastestream designation for the B Plant Cooling Water (CBC) waste stream is that the stream is not a dangerous waste, pursuant to the Washington (State) Administrative Code (WAC) 173-303, Dangerous Waste Regulations. This proposed designation, made by applying a combination of process knowledge and sample data for the CBC (October 1989 to March 1990), was used to determine if the effluent contains a listed dangerous waste (WAC 173-303-080). Sampling data alone is used to compare to the dangerous waste criteria (WAC 173-303-100) and dangerous waste characteristics (WAC 173-303-090). Sample data for the CBC operation was from the October 1989 to March 1990 timeframe that is based on the Liquid Effluent Study Characterization Data (WHC-EP-0355). 21 refs., 7 figs., 10 tabs.

2447 (WHC-EP-0342-Add.23) 241-A Tank Farm Cooling Water stream-specific report: Addendum 23. Westinghouse Hanford Co., Richland, WA (United States). Aug 1990. 65p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order

Number DE91001172. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The proposed wastestream designation for the 241-A Tank Farm Cooling Water wastestream is that this stream is not a dangerous waste, pursuant to the Washington (State) Administrative Code (WAC) 173-303, Dangerous Waste Regulations. A combination of process knowledge and sampling data was used to make this determination. 19 refs., 4 figs., 7 tabs.

2448 (WHC-EP-0342-Add.24) 284-E Powerplant Wastewater stream-specific report: Addendum 24. Westinghouse Hanford Co., Richland, WA (United States). Aug 1990. 71p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91002454. Source: NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.

The proposed wastestream designation for the 284-E Powerplant Wastewater stream is that it is not a dangerous waste, pursuant to the Washington (State) Administrative Code (WAC) 173-303, Dangerous Waste Regulations. This proposed designation is based on applying both process knowledge and sample data to the WAC 173-303 requirements for the three types of dangerous waste: listed; criteria; and characteristic dangerous waste. The "listed" dangerous waste determination was made with process knowledge; the "criteria" and "characteristic" dangerous waste determinations were made with sampling data. Process knowledge was based on knowledge of 284-E Powerplant operations. Sample data are based on samples downstream of all process contributors. The proposed designation is made using "validated" data from routine operations samples taken from October 1989 through March 1990. Samples of the other two waste contributing activities, blowdown and softener regeneration, were taken prior to implementation of a data validation procedure. These data are included in Appendix A to further support the proposed designation. 8 refs., 5 figs., 7 tabs.

2449 (WHC-EP-0342-Add.25) 244-AR vault cooling water stream-specific report: Addendum 25. Westinghouse Hanford Co., Richland, WA (United States). Aug 1990. 64p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91001179. Source: NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.

The proposed wastestream designation for the 244-AR Vault cooling water wastestream is that this stream is not a dangerous waste, pursuant to the Washington (State) Administrative Code (WAC) 173-303, Dangerous Waste Regulations. A combination of process knowledge and sampling data was used to make this determination. 21 refs., 6 figs., 7 tabs.

2450 (WHC-EP-0342-Add.26) 242-A evaporator steam condensate stream-specific report: Addendum 26. Westinghouse Hanford Co., Richland, WA (United States). Aug 1990. 66p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91001180. Source: NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.

The proposed wastestream designation for the 242-A Evaporator Steam Condensate wastestream is that this stream is not a dangerous waste, pursuant to the Washington (State) Administrative Code (WAC) 173-303, Dangerous Waste Regulations. A combination of process knowledge

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and sampling data was used to make this determination. 20 refs., 7 figs., 6 tabs.

2451 (WHC-EP-0342-Add.28) 400 Area Secondary Cooling Water stream-specific report: Addendum 28. Bloom, R.W. Westinghouse Hanford Co., Richland, WA (United States). Aug 1990. 166p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91001173. Source: NTIS, PC A08/MF A01 - OSTI; GPO Dep.

The proposed wastestream designation for the 400 Area Secondary Cooling Water wastestream is that this stream is not a dangerous waste, pursuant to the Washington (State) Administration Code (WAC) 173-303, Dangerous Waste Regulations. A combination of process knowledge and sampling data was used to make this determination. 13 refs., 11 figs., 13 tabs.

2452 (WHC-EP-0342-Add.29) 242-S evaporator steam condensate stream-specific report: Addendum 29. Westinghouse Hanford Co., Richland, WA (United States). Aug 1990. 67p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91001167. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The proposed wastestream designation for the 200 West Area 242-S Evaporator Steam Condensate wastestream is that this stream is not a dangerous waste, pursuant to the Washington (State) Administration Code (WAC) 173-303, Dangerous Waste Regulations. A combination of process knowledge and sampling data was used to make this determination. 19 refs., 7 figs., 7 tabs.

2453 (WHC-EP-0342-Add.30) 241-AI/AZ Tank Farms Steam Condensate stream-specific report: Addendum 30. Westinghouse Hanford Co., Richland, WA (United States). Aug 1990. 51p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91001186. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The proposed wastestream designation for the 200 East Area 241-AI/AZ Tank Farms Steam Condensate wastestream is that this stream is not a dangerous waste, pursuant to the Washington (State) Administration Code (WAC) 173-303, Dangerous Waste Regulations. A combination of process knowledge and sampling data was used to make this determination. 18 refs., 6 figs., 6 tabs.

2454 (WHC-EP-0342-Add.31) 209-E laboratory reflector water stream-specific report: Addendum 31. Neilsen, E.H. Westinghouse Hanford Co., Richland, WA (United States). Aug 1990. 49p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91001187. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The proposed wastestream designation for the 209-E Laboratory reflector water wastestream is that this stream is not a dangerous waste, pursuant to the Washington (State) Administration Code (WAC) 173-303, Dangerous Waste Regulations. A combination of process knowledge and sampling data was used to make this determination. 20 refs., 5 figs., 8 tabs.

2455 (WHC-EP-0342-Add.32) T Plant Laboratory wastewater stream-specific report: Addendum 32. Jeppson, D.W. Westinghouse Hanford Co., Richland, WA (United States). Aug 1990. 96p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930.

Order Number DE91001169. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

The proposed wastestream designation for the T Plant Laboratory wastestream is that this stream is not a dangerous waste, pursuant to the Washington (State) Administration Code (WAC) 173-303, Dangerous Waste Regulations. A combination of process knowledge and sampling data was used to make this determination. 19 refs., 7 figs., 15 tabs.

2456 (WHC-EP-0342-Add.33) 183-D filter backwash wastewater stream-specific report: Addendum 33. Westinghouse Hanford Co., Richland, WA (United States). Aug 1990. 64p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91002448. Source: NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.

The proposed wastestream designation for the 183-D Filter Backwash Wastewater is that this stream is not a dangerous waste, pursuant to the Washington (State) Administrative Code (WAC) 173-303, Dangerous Waste Regulations. This proposed designation is based on applying both process knowledge and sample data to the WAC 173-303 requirements for the three types of dangerous waste: listed, criteria, and characteristic dangerous waste. The "listed" dangerous waste determination was made with process knowledge; the "criteria" and "characteristic" dangerous waste determinations were made with sampling data. Process knowledge was based on such things as Material Safety Data Sheets and facility inspections for chemical products stored or used in the 183-D Filter Building. Sample data were obtained from samples taken downstream from all process contributors. The proposed designation is made using validated data collected from samples taken downstream from October 1989 through March 1990. Data from samples taken before October 1989, while not validated, are included in Appendix A for completeness. 10 refs., 4 figs., 7 tabs.

2457 (WHC-EP-0355) Liquid effluent study characterization data. Westinghouse Hanford Co., Richland, WA (United States). May 1990. 177p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91002447. Source: NTIS, PC A09/MF A01 - OSTI; GPO Dep.

During the development of the Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement), public comments were received regarding reduction of the discharge of liquid effluents into the soil column. As a result, the US Department of Energy (DOE), with concurrence of the Washington State Department of Ecology (WSDE) and the US Environmental Protection Agency (EPA), committed to a special project designed to document the discharge history and the character of Hanford Site liquid discharges. The results of this project will be used in determining the need for additional waste stream analysis, and/or to negotiate additional milestones pertaining to such discharges in the Tri-Party Agreement. Wastestream sampling data collected prior to October 1989 were reported in the Waste Stream Characterization Report. Preliminary Stream-specific Reports were prepared which evaluated that data and proposed dangerous waste designations for each stream. This document contains the wastestream sampling and analysis data collected as part of the liquid effluent study. Data contained in this report were obtained from samples collected from October 1989 through March 1990. Information is presented on the wastestreams that have been sampled, the parameters analyzed, and the dates and times at which the

samples were collected. This information will be evaluated in the final Stream-Specific Reports. 9 refs., 4 tabs.

2458 (WHC-EP-0359-Rev.1) North Slope investigation report: Revision 1. Roos, R.C. Westinghouse Hanford Co., Richland, WA (United States). Sep 1990. 79p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91001290. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

Approximately 190 square miles of the 570-square-mile Hanford Site is north and east of the Columbia river (referred to as the North Slope). In response to safety and environmental concerns reported from Washington Department of Ecology and the public to the US Department of Energy, Richland Operations Office, the North Slope area was investigated between December 1989 and April 1990. The investigation was limited to surface observation and comprised: review of historic records, interviews with people knowledgeable of the area, aerial search, and ground search. This investigation was used to develop an inventory of sites containing potential hazards on the North Slope and to verify whether there are any imminent safety or environmental threat(s) to the public. Potential safety hazards include open cisterns, pits, and military target areas. 1 fig., 1 tab.

2459 (WHC-EP-0366) Liquid effluent study: Ground water characterization data. Westinghouse Hanford Co., Richland, WA (United States). Aug 1990. 380p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91002509. Source: NTIS, PC A17/MF A01 - OSTI; GPO Dep.

This report is a support document to the Liquid Effluent Study Final Project Report (WHC 1990c). The focus is on sampling and analysis rationale, quality assurance (QA), data validation, and sampling conditions for the groundwater quality assessment. Interpretation of the groundwater data is provided in the final project report. 20 refs., 5 figs., 2 tabs.

2460 (WHC-EP-0394-1) Ground water maps of the Hanford Site. Kasza, G.L.; Harris, S.F.; Hartman, M.J. Westinghouse Hanford Co., Richland, WA (United States). Dec 1990. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91007160. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents the results of the June 1990, ground water level measurement program at the 100 Areas and 200 Areas of the Hanford Site (Figure 1). The water levels beneath these areas are measured regularly on a semiannual basis and the data received are used to produce the following set of maps for public release. For clarity, the locating prefixes have been omitted from all well numbers shown on the maps. Wells in the 100 Areas have the prefix 199; wells in the 200 Areas have the prefix 299, and the wells outside these areas have the prefix 699. Ground Water Maps of the Hanford Site is prepared by the Geosciences Group, Environmental Division, Westinghouse Hanford Company, for the US Department of Energy, Richland Operations Office. 1 ref., 6 figs., 2 tabs.

2461 (WHC-EP-0394-2) Ground water maps of the Hanford Site, December 1990. Kasza, G.L.; Hartman, M.J.; Hodges, F.N. Westinghouse Hanford Co., Richland, WA (United States). Jun 1991. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91016737. Source: OSTI; NTIS; GPO Dep.

This report presents the December 1990 ground water level measurement data for the 100 Areas, 200 Areas, and the 300-1100 areas of the Hanford Site. The depth to the ground water in the unconfined aquifer beneath these areas is reported on a semi-annual basis. Field depth to water measurements were collected by the Environmental Field Services Group, Westinghouse Hanford Company. The ground water maps are prepared by the Geosciences Group, Environmental Division, Westinghouse Hanford Company for the US Department of Energy-Richland Operations Office. 3 refs., 11 figs., 4 tabs.

2462 (WHC-EP-0394-3) Ground water maps of the Hanford Site, June 1991. Kasza, G.L.; Hartman, M.J.; Hodges, F.M.; Weekes, D.C. Westinghouse Hanford Co., Richland, WA (United States). Dec 1991. 52p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92006498. Source: OSTI; NTIS; INIS; GPO Dep.

Ground Water Maps of the Hanford Site is a series of reports prepared semiannually to present water level measurements taken each June and December at the Hanford Site (Figure 1). Each report presents a compilation of the ground water level measurement data from the unconfined aquifer and selected confined aquifer wells collected during the subject month. The ground water data are also presented in graphic form in a series of ground water maps to illustrate the hydrologic conditions on the Hanford Site. The purpose of this document is to provide water level data to support many of the ground water monitoring programs on the Hanford Site. This report presents water level data measured in ground water monitoring wells on the Hanford Site during June 1991. The depth to the ground water was measured at the wellhead. The procedure for measuring the depth to water and recording the data is contained in environmental investigations instruction (EII) 10.2 of the Environmental Investigation and Site Characterization Manual, WHC-CM-7-7 (WHC 1988).

2463 (WHC-EP-0394-4) Groundwater Maps of the Hanford Site, December 1991. Kasza, G.L.; Hartman, M.J.; Hodges, F.N.; Weekes, D.C. Westinghouse Hanford Co., Richland, WA (United States). Jun 1992. 46p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92019878. Source: OSTI; NTIS; INIS; GPO Dep.

The Groundwater Maps of the Hanford Site, December 1991 is the latest update to a series of semiannual reports providing the results of the water level measurement activity at the Hanford Site (Figure 1). These reports present a compilation of the ground water level measurement data from monitoring wells collected during the month of June or December. Ground water level data are presented in graphic form in a series of ground water maps to illustrate the hydrologic conditions on the Hanford Site. This document provides water level data to support the site characterization and ground water monitoring programs on the Hanford Site. Groundwater Maps of the Hanford Site is prepared for the US Department of Energy, Office of Environmental Restoration and Waste Management, by the Hanford Site Operations and Engineering Contractor, Westinghouse Hanford Company (WHC). This report presents the December 1991 water level data for the unconfined aquifer beneath the Hanford Site. The depth to the groundwater was measured at the wellhead by personnel from the Environmental Field Services Group, Environmental Division, WHC.

2464 (WHC-EP-0394-5) Groundwater maps of the Hanford Site, June 1992. Kasza, G.L.; Hartman, M.J.; Hodges, F.N.; Weekes, D.C. Westinghouse Hanford Co., Richland, WA (United States). Dec 1992. 55p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93016379. Source: OSTI; NTIS; INIS; GPO Dep.

The Groundwater Maps of the Hanford Site, June 1992 is an update to the series of reports that document the configuration of the water table in the unconsolidated sediments beneath the Hanford Site (Figure 1). Water level measurements for these reports are collected from site groundwater monitoring wells each June and December. The groundwater data are portrayed on a series of maps to illustrate the hydrologic conditions at the Hanford Site and are also tabulated in an appendix. The purpose of this report series is to document the changes in the groundwater level at Hanford as the site transitions from a nuclear material production role to environmental restoration and remediation. In addition, these reports provide water level data in support of the site characterization and groundwater monitoring programs on the Hanford Site. Groundwater maps of the Hanford Site are prepared for the US Department of Energy, Office of Environmental Restoration and Waste Management, by the Hanford Site Operations and Engineering Contractor, Westinghouse Hanford Company (WHC).

2465 (WHC-EP-0394-6) Groundwater Maps of the Hanford Site, December 1992. Kasza, G.L.; Hartman, M.J.; Hodges, F.N.; Simpson, K.R.; Weekes, D.C. Westinghouse Hanford Co., Richland, WA (United States). Sep 1993. 64p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94002484. Source: OSTI; NTIS; INIS; GPO Dep.

The Groundwater maps of the Hanford Site, December 1992 is the semiannual update of the series of reports that document the configuration of the uppermost unconfined aquifer beneath the Hanford Site (Figure 1). This series is based on water level measurements collected from site groundwater monitoring wells each June and December. These reports document the changes in the groundwater level at Hanford as the site transitions from a nuclear material production role to environmental restoration and remediation. In addition, these reports provide water level data to support the various site characterization and groundwater monitoring programs currently in progress on the Hanford Site. Groundwater Maps of the Hanford Site are prepared for the US Department of Energy, Office of Environmental Restoration and Waste Management, by the Hanford Site Operations and Engineering Contractor, Westinghouse Hanford Company (WHC). This document fulfills reporting requirements specified by WHC (1988a) Section 8.0, "Water Quality" and also described in the environmental monitoring plan for the Hanford Site (DOE-RL 1991).

2466 (WHC-EP-0394-7) Groundwater maps of the Hanford Site, June 1993. Kasza, G.L.; Hartman, M.J.; Jordan, W.A.; Weekes, D.C. Westinghouse Hanford Co., Richland, WA (United States). Feb 1994. 59p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94007149. Source: OSTI; NTIS; INIS; GPO Dep.

The Groundwater Maps of the Hanford Site, June 1993 is an update of the series of reports that document the configuration of the uppermost unconfined aquifer beneath the Hanford Site. This report series presents the semiannual

water level measurements taken at site groundwater monitoring wells each June and December and the groundwater maps derived from these measurements. These reports document the changes in the groundwater level at Hanford as the site has transitioned from nuclear material production to environmental restoration and remediation. In addition, these reports provide water level data to support the various site characterization and groundwater monitoring programs currently in progress on the Hanford Site. Groundwater Maps of the Hanford Site are prepared for the US Department of Energy, Office of Environmental Restoration and Waste Management, by the Hanford Site Operations and Engineering Contractor, Westinghouse Hanford Company (WHC). This document fulfills reporting requirements specified in WHC (1993), Section 8.0 "Water Quality" and also described in the Environmental Monitoring Plan for the Hanford Site (DOE-RL 1991). Maps depicting the water table beneath the Hanford Site south of the Columbia River are presented in this report. Appendix A lists the well identification number, depth to water, casing elevating and the water level elevation for each well measured during June 1993. A summary discussion of the data is included with a well index map, the depth to water map and the contoured map of the water table surface for the Hanford Site and each of the three operational areas (the 100, 200, and 300-1100 Areas).

2467 (WHC-EP-0398) Animal intrusion status report for fiscal year 1990. Landeen, D.S. Westinghouse Hanford Co., Richland, WA (United States). Mar 1991. 24p. Sponsored by USDOE, Washington, DC (USA). DOE Contract AC06-87RL10930. Order Number DE91010034. Source: OSTI; NTIS; INIS; GPO Dep.

The Protective Barrier and Warning Marker System Development Plan identified tasks that need to be completed to design a final protective barrier to implement in-place disposal of radioactive waste. This report summarizes the animal intrusion work conducted by Westinghouse Hanford Company in fiscal year 1990 regarding small mammals and water infiltration. An animal intrusion lysimeter facility was constructed and installed in fiscal year 1988. The facility consists of two outer boxes buried at grade that serve as receptacles for six animal intrusion lysimeters. Small burrowing mammals common to the Hanford Site environs are introduced over a 3- to 4-month period. Supplemental precipitation is added to three of the lysimeters with a rainulator at a rate equivalent to a 100-year storm. Soil moisture samples are taken before and after each test, and soil moisture measurements are also taken with a hydroprobe during the test period. During fiscal year 1990, tests three and four were completed and test five was initiated. Results of test three (summer treatment), which used Townsend ground squirrels and pocket gophers, indicated that the additional 1.5 inches of precipitation that was added with the rainulator was lost during this test. The plots that did not receive any additional precipitation all lost water (5 to 6 percent). Results from test four (winter treatment), which used pocket gophers and pocket mice, indicated that all of the lysimeters except one gained water. The two control lysimeters (rainulator plots and nonrainulator lysimeters with no animals) gained more water than their corresponding animal burrow lysimeters. 4 refs., 9 figs., 3 tabs.

2468 (WHC-EP-0400) 200-UP-2 Operable Unit technical baseline report. Deford, D.H. Westinghouse Hanford Co., Richland, WA (United States). Feb 1991. 133p. Sponsored by USDOE, Washington, DC (United States). DOE

Contract AC06-87RL10930. Order Number DE92002048. Source: OSTI; NTIS; INIS; GPO Dep.

This report is prepared in support of the development of a Remedial Investigation/Feasibility Study (RI/FS) Work Plan for the 200-UP-2 Operable Unit by EBASCO Environmental, Incorporated. It provides a technical baseline of the 200-UP-2 Operable Unit and results from an environmental investigation undertaken by the Technical Baseline Section of the Environmental Engineering Group, Westinghouse Hanford Company (Westinghouse Hanford). The 200-UP-2 Operable Unit Technical Baseline Report is based on review and evaluation of numerous Hanford Site current and historical reports, Hanford Site drawings and photographs and is supplemented with Hanford Site inspections and employee interviews. No field investigations or sampling were conducted. Each waste site in the 200-UP-2 Operable Unit is described separately. Close relationships between waste units, such as overflow from one to another, are also discussed. The 200-UP-2 Operable Unit consists of liquid-waste disposal sites in the vicinity of, and related to, U Plant operations in the 200 West Area of the Hanford Site. The "U Plant" refers to the 221-U Process Canyon Building, a chemical separations facility constructed during World War 2. It also includes the Uranium Oxide (UO₃) Plant, which was constructed at the same time and, like the 221-U Process Canyon Building, was later converted for other missions. Waste sites in the 200-UP-2 Operable Unit are associated with the U Plant Uranium Metal Recovery Program mission that occurred between 1952 and 1958 and the UO₃ Plant's ongoing uranium oxide mission and include one or more cribs, reverse wells, french drains, septic tanks and drain fields, trenches, catch tanks, settling tanks, diversion boxes, waste vaults, and the lines and encasements that connect them. 11 refs., 1 tab.

2469 (WHC-EP-0402) Status of birds at the Hanford Site in southeastern Washington. Landeen, D.S.; Johnson, A.R.; Mitchell, R.M. Westinghouse Hanford Co., Richland, WA (United States). Mar 1991. 25p. Sponsored by USDOE, Washington, DC (USA). DOE Contract AC06-87RL10930. Order Number DE91010111. Source: OSTI; NTIS; GPO Dep.

The Department of Energy has recently entered into agreements with the Washington State Department of Ecology, the Environmental Protection Agency, and Hanford Site contractors to focus work activities on cleanup and stabilization of radioactive and hazardous waste sites located at the Hanford Site in southern Washington. A list of 235 known birds that have been observed at the Hanford Site is given along with a status rating for abundance and seasonal occurrence. Previously published bird lists from the Hanford Site are included as well as the author observations from 1977 to 1990. Of the 235 species listed, 35 are considered common and 38 are listed as accidentals. All but nine birds on the Hanford Site list have previously been documented by the Audubon Society to occur within a 25-mile radius of the Tri-Cities. The nine birds that are not on the Audubon list, however, have been documented in other parts of eastern Washington. A list of hypothetical birds that have been documented within 50 miles of the Hanford Site but not actually observed at the Site is also provided. This is the most complete list of birds published to date from the Hanford Site and substantially augments other previously published lists by almost 100 species. 20 refs., 1 fig., 3 tab.

2470 (WHC-EP-0402-Rev.1) Status of birds at the Hanford Site in southeastern Washington: Revision 1.

Landeen, D.S.; Johnson, A.R.; Mitchell, R.M. Westinghouse Hanford Co., Richland, WA (United States). Jun 1992. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93002053. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy has entered into agreements with the Washington State Department of Ecology, the US Environmental Protection Agency, and Hanford Site contractors to focus work activities on cleanup and stabilization of radioactive and hazardous waste sites located at the Hanford Site in southeastern Washington. Ecological characterization is an essential part of the remediation process, and the identification of biotic components such as bird species that could be impacted by cleanup activities is an important part of the initial environmental characterizations. Site characterization work has resulted in this list of 238 birds that have been observed at the Hanford Site. This list is presented with a status rating for abundance and seasonal occurrence.

2471 (WHC-EP-0408) A review of the Hanford Site soil corrosion applicable to solid waste containers. Divvine, J.R. (Pacific Northwest Lab., Richland, WA (United States)). Westinghouse Hanford Co., Richland, WA (United States). May 1991. 64p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE91017742. Source: OSTI; NTIS; INIS; GPO Dep.

The first phase of the assessment of the soil corrosion in the solid waste burial grounds of the 200 Areas at the Hanford Site is completed with this review of both existing information developed at the site and relevant offsite information. Detailed soil corrosion data are needed for several reasons: (1) the possibility of predicting the damage to the containers of the retrievable stored transuranic waste that are under soil cover, (2) the feasibility of forecasting the state of waste containers being retrieved in remedial investigation/feasibility studies, (3) the capability of predicting subsidence of the soil over the waste containers, and (4) the capability of forecasting when stored lead shielding or hazardous chemicals might be exposed to the environment. Because corrosion in soils is dependent on the soil type, site-specific data are required even though offsite data can provide guidance on the type and the approximate extent of corrosion to expect. These data permit rough estimations of the corrosion rates of a variety of materials - including carbon steels, cast irons, stainless steels, and lead - in the Hanford Site soils. This report attempts to compile these data to facilitate current estimates of waste container longevity. However, because of the lack of well-documented, site-specific data, it is difficult to provide a definite life expectancy for waste containers and other structures. Consequently, additional data are essential for reliable container life estimates. 36 refs., 10 figs., 7 tabs.

2472 (WHC-EP-0445) PORMC: A model for Monte Carlo simulation of fluid flow, heat, and mass transport in variably saturated geologic media. Westinghouse Hanford Co., Richland, WA (United States). Sep 1991. 318p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92000233. Source: OSTI; NTIS; INIS; GPO Dep.

This computer program was developed in support of environmental restoration activities being conducted at the Hanford Site to comply with the Resource Conservation and Recovery Act of 1976 and its 1984 amendment; the Comprehensive Environmental Response, Compensation, and

Liability Act as amended in 1986; and the Hanford Federal Facility Agreement and Consent Order (Ecology et al. 1990). The results of analyses made using the computer program will be used in remedial investigations to study the possible nature and extent of contamination and in feasibility studies to analyze the environmental consequences associated with alternative remediation methods. This document provides details of the theory and instructions for use of the PORMC computer program. 80 refs.

2473 (WHC-EP-0448) Fiscal year 1991 100 Areas CERCLA ecological investigations. Sackschewsky, M.R.; Landeen, D.S. Westinghouse Hanford Co., Richland, WA (United States). Apr 1992. 82p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92012203. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses the status of the ecological investigations conducted by Westinghouse Hanford Company during Fiscal Year 1991. These ecological investigations provide a basic description of the flora and fauna that inhabit the operable units, emphasizing species that have been given special status under existing state and/or federal laws. The 1991 Westinghouse Hanford Company field investigations have concentrated on the following: (1) bird surveys, (2) mammal and insect surveys, (3) vegetation surveys, and (4) vegetation sampling. Work being conducted as part of the vegetation surveys includes a biological assessment of threatened and endangered plants, which is being prepared as a separate document. Similar ecological investigations will be conducted at 100- N, K, and F operable units in 1992.

2474 (WHC-EP-0500) Geology and hydrology of the 300 Area and vicinity, Hanford Site, south-central Washington. Gaylord, D.R. (Washington State Univ., Pullman, WA (United States)); Poeter, E.P. Westinghouse Hanford Co., Richland, WA (United States). Oct 1991. 97p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92006495. Source: OSTI; NTIS; INIS; GPO Dep.

The following report summarizes the findings of a joint Washington State University (WSU) and Colorado School of Mines (CSM) research team that investigated the geology and hydrogeology of the 300 Area during FY87-89. The primary goal of this research was to evaluate existing data and identify new and innovative techniques and/or methods necessary to characterize the 300 Area geology and hydrogeology. Site characterization the 300 Area demands the close integration of geologic and hydrogeologic research to achieve the most meaningful results. Geologic aspects of the research focused on the identification and analysis of both small- (i.e., sedimentary-textural characteristics) and large-scale (i.e., lithofacies and architectural elements) aquifer heterogeneities and on the derivation of fundamental compositional (i.e., mineralogy and geochemistry) data to assist in identification of marker beds. Hydrogeologic aspects of the research focused on identification and refinement of hydraulically significant, three-dimensional aquifer units termed hydrofacies and on preliminary inverse modeling of ground water flow in the 300 Area. Hydrofacies are fundamental units that will aid in site characterization, development of monitoring programs, and design of remedial action. Inverse modeling is used to improve estimates of the values of hydraulic parameters associated with each hydrofacies. The WSU/CSM research team identified two major shortcomings of the geologic and hydrogeologic data base for the 300

Area. First the quality of geologic data from 300 Area drilling is far below that necessary to characterize either the geology or hydrogeology of the suprabasalt strata. Second, the limited number of field-scale aquifer tests and the veritable lack of hydraulic testing of discrete aquifer intervals greatly limit attempts to accurately identify basic hydraulic parameters such as hydraulic conductivity and/or specific yield.

2475 (WHC-EP-0523) Modern and Pleistocene climatic patterns in the west. Petersen, K.L. Westinghouse Hanford Co., Richland, WA (United States). Dec 1991. 32p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92006437. Source: OSTI; NTIS; GPO Dep.

This document was prepared as a chapter entitled, "Modern and Pleistocene Climatic Patterns in the West," for the two volume book, *The Biogeography of the Great Basin and Colorado Plateau*, being edited by Dr. Wilford M. Hess (Brigham Young University, Provo, Utah) and is scheduled to be published in 1992 by Westview Press (Boulder, Colorado). It was prepared in support of the Climate Change Task of the Protective Barrier Program. This document shows that regional climate cannot be viewed in isolation, but must be viewed as part of a larger continental and global system to fully understand the underlying driving mechanism. This document is an attempt to provide the global and continental contexts. These contexts are necessary for the overall project of which this is a part. The overall object of this task is to obtain quantitative estimates of past, present, and especially future climate in the Pacific Northwest and the Western United States. These estimates which will be used in future papers are needed to aid in the development of a defensible Hanford Site Protective barrier design and Hanford Site Performance Assessment, and in proposals to help in the development of protective barriers at the Idaho National Engineering Laboratory and at the DOE's Monticello (Utah) Remedial Action Project for uranium mill tailings. The defensibility of estimates of potential future climate in the Pacific Northwest and the Western United States is greatly enhanced by demonstrating an understanding of the present climate system and the range of change that has occurred in the past.

2476 (WHC-EP-0526) Biological assessment for rare and endangered plant species: Related to CERCLA characterization activities. Sackschewsky, M.R. Westinghouse Hanford Co., Richland, WA (United States). Apr 1992. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE92015906. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental characterization in support of hazardous, radioactive, and mixed waste cleanup (in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980) can involve a large number of both nonintrusive and intrusive activities. Many of these activities could have a detrimental impact on listed plant species. These impacts can be minimized by following simple conservation policies while conducting the various field activities. For instance, frequent off-road vehicular traffic and have a severe impact on native habitats and, therefore, should be kept to a minimum. Personnel performing the field activities should be trained to preserve, respect, and minimize their impact on native habitat while performing work in the field. In addition, areas where sampling is planned should be surveyed for the presence of listed plant species before the initiation of the field activities. Extremely distributed areas could be exempted from this requirement

provided adequate habitat assessments have been performed by qualified personnel. Twelve special status plant species are known to survive on or very near the Hanford Site. None of these species currently are listed as Federal Threatened or Endangered Species. However, four local species currently are candidates for federal protection. These species are the Northern Wormwood (*Artemisia campestris* ssp. *borealis* var. *wormskioldii*), Persistentsepal Yellowcress (*Rorippa columbiae*), Hoover's Desert Parsley (*Lomatium tuberosum*), and Columbia Milkvetch (*Astragalus columbianus*).

2477 (WHC-EP-0554) **Vascular plants of the Hanford Site.** Sackschewsky, M.R. (Westinghouse Hanford Co., Richland, WA (United States)); Landeen, D.S.; Downs, J.L.; Rickard, W.H.; Baird, G.I. Westinghouse Hanford Co., Richland, WA (United States). Jul 1992. 190p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93003638. Source: OSTI; NTIS; GPO Dep.

An updated listing of the vascular plants of the Hanford Site is provided, along with discussions of how humans may interact with local plants and have influenced the regional flora. Based on examinations of herbarium collections at the Westinghouse Hanford Company, Pacific Northwest Laboratory, Washington State University, and Brigham Young University, 590 vascular plant species have been identified on or near the Hanford Site. This is more than twice the number of species on previously published lists of Hanford Site vascular plants. A review of the plant species that are currently listed as endangered, threatened, sensitive, or otherwise of concern to the Washington State Natural Heritage Program and the Federal Fish and Wildlife Service is included. Color photographs of selected species are included to aid identification. Lists are provided of the Hanford Site plant species that could be used as food and medicinal sources and of those introduced to the region through human activities. The information provided in this report will be useful to workers charged with performing environmental characterizations in the field, preparing environmental assessments for permitting purposes, performing risk assessments using transport-to-man scenarios, and selecting species for revegetation and environmental reconstruction projects.

2478 (WHC-EP-0569) **Long-term climate change assessment study plan for the Hanford Site permanent isolation barrier development program.** Petersen, K.L. (Westinghouse Hanford Co., Richland, WA (United States)); Chatters, J.C.; Waugh, W.J. Westinghouse Hanford Co., Richland, WA (United States). Jul 1992. 60p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93008906. Source: OSTI; NTIS; INIS; GPO Dep.

The Hanford Site Permanent Isolation Barrier Development Program (Barrier Development Program) was organized to develop the technology needed to provide an in-place disposal capability for the Hanford Site (Adams and Wing 1986; Wig and Gee 1990). The goal of the Barrier Development Program is to provide defensible evidence that final barrier design(s) will adequately control water infiltration; plant and animal intrusion; and wind and water erosion for a minimum of 1,000 yr and isolate wastes from the accessible environment and warn inadvertent human intruders using markers. This document describes the long-term climate change studies planned to support the Barrier Development Program. The plan outlines a multi-year and

multi-discipline approach to assess long-term climate change issues and to help optimize the design of the permanent isolation barriers. A multi-disciplinary approach to climatic data acquisition will be responsible for obtaining needed information for concurrent barrier tasks and for developing a local climate forecast model. This model will couple past climate patterns with models of regional and global climate drivers to provide bounding conditions for barrier performance assessment analyses.

2479 (WHC-EP-0569-Rev.1) **Long-term climate change assessment study plan for the Hanford Site Permanent Isolation Barrier Development Program: Revision 1.** Petersen, K.L. (Westinghouse Hanford Co., Richland, WA (United States)); Chatters, J.C.; Waugh, W.J. Westinghouse Hanford Co., Richland, WA (United States). May 1993. 71p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (PNL-8359). Order Number DE93014836. Source: OSTI; NTIS; INIS; GPO Dep.

The Hanford Site Permanent Isolation Barrier Development Program (Barrier Development Program) was organized to develop the technology needed to provide an in-place disposal capability for low-level nuclear waste for the US Department of Energy at the Hanford Site in south-central Washington. The goal of the Barrier Development Program is to provide defensible evidence that final barrier design(s) will adequately control water infiltration, plant and animal intrusion, and wind and water erosion for a minimum of 1,000 yr; to isolate wastes from the accessible environment; and to use markers to warn inadvertent human intruders. Evidence for barrier performance will be obtained by conducting laboratory experiments, field tests, computer modeling, and other studies that establish confidence in the barrier's ability to meet its 1,000-yr design life.

2480 (WHC-EP-0596) **Horizontal Drilling Workshop summary report for the arid integrated demonstration program.** Jensen, E.J. (Bovay Northwest, Inc., Richland, WA (United States)); Airhart, S.P.; Edison, C.L.; McLellan, G.W. Westinghouse Hanford Co., Richland, WA (United States). Oct 1992. 92p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93008174. Source: OSTI; NTIS; GPO Dep.

The United States Department of Energy's (DOE) Horizontal Drilling Workshop was held at Cavanaugh's Motor Inn, in Kennewick, Washington, on May 12-13, 1992. The objective of the workshop was to obtain information about the latest deep horizontal drilling methods, that may be applicable at DOE facilities (specifically those having arid site geologic settings). Presentations included existing technologies and technologies that are currently under development. There was no attempt at the workshop or in the closed door session which followed to evaluate, rate, or select any specific drilling company who participated in the workshop. The workshop was held in two sessions. The first session was open to the public and consisted of presentations from local experts on the Hanford Site and from four horizontal drilling contractors. The second was a closed door session designed to discuss the horizontal drilling needs at DOE sites. This report is organized into two parts to document both sessions of the workshop.

2481 (WHC-EP-0601) **A synthesis of ecological data from the 100 Areas of the Hanford Site.** Weiss, S.G.; Mitchell, R.M. Westinghouse Hanford Co., Richland, WA (United States). Oct 1992. 137p. Sponsored by USDOE,

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Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93003385. Source: OSTI; NTIS; INIS; GPO Dep.

Complete plant and wildlife species lists for the Hanford Site have been compiled, and information on levels of contamination (as current as possible) in biota is presented. A list of major species has also been proposed. These are species that are structurally or functionally important in the ecosystem, are granted protective management status, provide an environmental service to humans, or serve as a possibly important pathway for contaminant movement. From this information, potential indicator species – those that might be used to evaluate future prevailing environmental conditions at the Hanford Site – have been suggested. Because of the vast quantity of information available regarding biota on the Hanford Site, and to make review of the two important ecosystems (Columbia River and terrestrial) easier, this document discusses each ecosystem independently. A large amount of information is associated with the aquatic resources of the Columbia River, which borders each of the 100 Areas. However, much of the information related to terrestrial ecology has been collected in the Arid Lands Ecology Reserve and 200 Areas. Therefore, that available information is used for reference here with the assumption that most communities in these areas demonstrate a similarity of life forms. Also, unique studies conducted on man-made ponds and ditches in the 200 Areas that could shed light on Columbia River studies are included.

2482 (WHC-EP-0644) Long-Term Climate Change Assessment Task for the Hanford Site Permanent Isolation Barrier Development Program: Status through FY 1992. Petersen, K.L. (Westinghouse Hanford Co., Richland, WA (US)); Chatters, J.C. (Westinghouse Hanford Co., Richland, WA (United States)). Jul 1993. 42p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93018501. Source: OSTI; NTIS; INIS; GPO Dep.

The Hanford Site Permanent Isolation Barrier Development Program (Barrier Development Program) was organized (Adams and Wing 1986) to develop the technology needed to provide an in-place disposal capability for the US Department of Energy at the Hanford Site in southeastern Washington. The goals of the Barrier Development Program are to provide defensible evidence that final barrier design(s) will adequately control water infiltration, plant and animal intrusion, and wind and water erosion for a minimum of 1,000 years; to isolate wastes from the accessible environment; and to use markers to warn inadvertent human intruders. Evidence for barrier performance will be obtained by conducting laboratory experiments, field tests, computer modeling, and other studies that establish confidence in the barrier's ability to meet its 1,000-year design life. The performance and stability of natural barrier analogs that have existed for several millennia and the reconstruction of climate changes during the past 10,000 to 125,000 years also will provide insight into bounding conditions of possible future changes and increase confidence in the barriers design. In the following discussion the term "long-term" references periods of time up to 1000's of years, distinguishing it from "short-term" weather patterns covering a decade or less. Specific activities focus on planning and conducting a series of studies and tests required to confirm key aspects of the barrier design. The effort is a collaborative one between scientists and engineers from Westinghouse Hanford Company (Westinghouse Hanford) and Pacific Northwest Laboratory (PNL) to design barriers to limit movement of

radionuclides and other contaminants to the accessible environment for at least 1,000 years. These activities have been divided into 14 groups of tasks that aid in the complete development of protective barrier and warning marker system.

2483 (WHC-EP-0651) Barometric pressure variations. Crippen, M.D. (Westinghouse Hanford Co., Richland, WA (United States)). Jun 1993. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93019122. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents Hanford Site barometric data that can be used to determine the breathing rate of Hanford Site tanks and details the derivation of the data. The barometric pressure data recorded at the Hanford Weather Station were used for this analysis. Data for 1988, 1989, 1990, and 1991 were used.

2484 (WHC-MR-0284) Naval Trench 94 soils report. Carlos, W.C. (Ebasco Services, Inc., New York, NY (United States)). Westinghouse Hanford Co., Richland, WA (United States); Ebasco Services, Inc., New York, NY (United States). Oct 1992. 106p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93006906. Source: OSTI; NTIS; INIS; GPO Dep.

This document is submitted in accordance with Westinghouse Hanford Company Order No. MLW-SW-037106, Task Order E-91-23. This report responds to direction given to Ebasco by Westinghouse Hanford Company on September 26, 1991. The soil test results provided herein are applicable to the 100 year design life and 26 year design life passive cathodic protection designs for the SRC's in Trench 94. These test results are also applicable to the 100 year design life and 26 year design life active cathodic protection systems presently being designed.

2485 (WHC-MR-0420) Vadose Zone Modeling Workshop proceedings, March 29-30, 1993. Khaleel, R. (Westinghouse Hanford Co., Richland, WA (United States)). Aug 1993. 295p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93040395. Source: OSTI; NTIS; INIS; GPO Dep.

At the Hanford Site, the record of decision for remediation of CERCLA sites is largely based on results of the baseline risk and performance assessment of the remedial action alternatives. These assessments require the ability to predict the fate and transport of contaminants along appropriate exposure pathways which, in case of the Hanford Site, includes the migration of contaminants through the vadose zone to the water table. Listed below are some of the requirements, as prescribed by the regulators, relative to CERCLA risk and performance assessment at Hanford. A workshop was organized by the Environmental Risk and Performance Assessment Group, Westinghouse Hanford Company on March 29-30, 1993 at the Richland Best Western Tower Inn. During the workshop, an assessment was made of the need for and scope of various tasks being conducted or planned as part of the Hanford Site waste isolation performance assessment/risk assessment activities. Three external, nationally-recognized experts served as part of a review panel for the workshop: (a) Professor Lynn Gelhar of MIT; (b) Professor Peter Wierenga of University of Arizona; and (c) Dr. Rien van Genuchten of US Salinity Laboratory, Riverside, California. The technical experts provided their perspectives on the current state-of-the-art in vadose zone flow and transport modeling. In addition, the technical

experts provided an outside independent assessment of the work being performed or planned in support of various activities identified in TPA Milestone M-29-02. This document includes the following: Recommendations from the three peer reviewers; areas of expertise of the three peer reviewers; workshop agenda; copies of viewgraphs (where available) from presenters at the workshop; workshop minutes; and list of workshop attendees.

2486 (WHC-MR-0426) Residual herbicide study on selected Hanford Site roadsides. Smith, J.L.; Kemp, C.J.; Sackschewsky, M.R. Westinghouse Hanford Co., Richland, WA (United States). Aug 1993. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94005511. Source: OSTI; NTIS; GPO Dep.

Westinghouse Hanford Company routinely treats roadsides with herbicides to control undesirable plant growth. An experiment was conducted to test perennial grass germination in soils adjacent to roadways of the Hanford Site. The primary variable was the distance from the roadside. A simple germination test was executed in a controlled-environment chamber to determine the residual effects of these applications. As expected, the greatest herbicide activity was found directly adjacent to the roadway, approximately 0 to 20 ft (0 to 6.3 m) from the roadway.

2487 (WHC-MR-0441) Geologic map of the Richland 1:100,000 quadrangle, Washington. Reidel, S.P.; Fecht, K.R. (comps.). Westinghouse Hanford Co., Richland, WA (United States). Sep 1993. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930 ; FG06-91ER14172. Order Number DE94006326. Source: OSTI; NTIS; GPO Dep.

This map of the Richland 1:100,000-scale quadrangle, Washington, shows the geology of one of fifteen complete or partial 1:100,000-scale quadrangles that cover the southeast quadrant of Washington. Geologic maps of these quadrangles have been compiled by geologists with the Washington Division of Geology and Earth Resources (DGER) and Washington State University and are the principal data sources for a 1:250,000-scale geologic map of the southeast quadrant of Washington, which is in preparation. Eleven of these quadrangles are being released as DGER open-file reports. The map of the Wenatchee quadrangle has been published by the US Geological Survey, and the Moses Lake, Ritzville quadrangles have already been released.

2488 (WHC-MR-0442) Geologic map of the Priest Rapids 1:100,000 quadrangle, Washington. Reidel, S.P.; Fecht, K.R. (comps.). Westinghouse Hanford Co., Richland, WA (United States). Sep 1993. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930 ; FG06-91ER14172. Order Number DE94006325. Source: OSTI; NTIS; GPO Dep.

This map of the Priest Rapids 1:100,000-scale quadrangle, Washington, shows the geology of one of fifteen complete or partial 1:100,000-scale quadrangles that cover the southeast quadrant of Washington. Geologic maps of these quadrangles have been compiled by geologists with the Washington Division of Geology and Earth Resources (DGER) and Washington State University and are the principal data sources for a 1:250,000-scale geologic map of the southeast quadrant of Washington, which is in preparation. Eleven of those quadrangles are being released as DGER open-file reports (listed below). The map of the Wenatchee

quadrangle has been published by the US Geological Survey (Tabor and others, 1982), and the Moses Lake (Gulick, 1990a), Ritzville (Gulick, 1990b), and Rosalia (Waggoner, 1990) quadrangles have already been released. The geology of the Priest Rapids quadrangle has not previously been compiled at 1:100,000 scale. Furthermore, this is the first 1:100,000 or smaller scale geologic map of the area to incorporate both bedrock and surficial geology. This map was compiled in 1992, using published and unpublished geologic maps as sources of data.

2489 (WHC-SA-1124) Statistical approach on RCRA groundwater monitoring projects at the Hanford Site. Chou, C.J. Westinghouse Hanford Co., Richland, WA (United States). Apr 1991. 17p. Sponsored by USDOE, Washington, DC (USA). DOE Contract AC06-87RL10930. (CONF-9108100-4: American Statistical Association (ASA) annual meeting, Atlanta, GA (United States), 18-22 Aug 1991). Order Number DE91014682. Source: OSTI; NTIS; GPO Dep.

Hanford Site interim-status groundwater monitoring projects are conducted as background, indicator parameter evaluation, or groundwater quality assessment monitoring programs as specified in the Resource Conservation and Recovery Act of 1976. Requirements for the groundwater monitoring system, sampling and analysis, and statistical evaluation found in Washington Administrative Code 173-303-400 and Title 40, Code of federal Regulations, Part 265, Subpart F are discussed. Problems associated with analyzing groundwater chemistry data are addressed. The use of limit-of-quantitation is proposed as the comparison value between the upgradient and downgradient wells for cases where the calculated critical mean is not quantifiable. 9 refs., 5 figs., 1 tab.

2490 (WHC-SA-1130) Ephemeral radioactive tracers for hydrostatic balancing fluids when drilling core samples in radioactive waste tanks. Barker, J.J. Westinghouse Hanford Co., Richland, WA (United States). Jun 1991. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-911071-1: American Chemical Society (ACS) symposium on emerging technologies for hazardous waste management, Atlanta, GA (United States), 1-3 Oct 1991). Order Number DE91016733. Source: OSTI; NTIS; INIS; GPO Dep.

An objective is to add a tracer to the balancing fluid so that the quantity (if any) of balancing fluid leaking into the core sample can be determined. Stable tracers could cause confusion when subsequent samples are taken from the same tank. Therefore, radioactive tracers with short half-lives (2 to 5 weeks, since resampling could be done after a year) and a strong gamma (for ease of counting) are preferred. The small portion that is counted would be taken from a homogenized part of the sample and would come from either a linear section (if a distribution of the leak is desired) or from the entire sample (if only the quantity leaked is sought). The temporal behavior of the counting sample activity is derived, and a dimensionless plot for interpreting the results is given. 1 fig.

2491 (WHC-SA-1155) Hydrogeology of the Hanford Site in South-Central Washington State. Delaney, C.D. Westinghouse Hanford Co., Richland, WA (United States). Jun 1991. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-9110190-1: Association of Engineering Geologists (AEG) national meeting, Chicago, IL (United States), 1-4 Oct

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1991). Order Number DE91016629. Source: OSTI; NTIS; INIS; GPO Dep.

The Hanford Site is situated within the Pasco Basin of south-central Washington and occupies an area of approximately 1450 Km². The Columbia River flows through the northern edge of the Site and forms part of the eastern boundary. Activities over the past 45 years at the Hanford Site include the siting of nuclear reactors, characterization activities for the Basalt Waste Isolation Project (BWIP), and waste management activities. The purpose of this paper is to discuss the hydrogeology of the Hanford Site and the general extent of contamination due to past activities at the Site. 12 refs., 6 figs.

2492 (WHC-SA-1225) Remedial investigation for the 200-BP-1 operable unit, Hanford Site, Richland, Washington. Buckmaster, M.A. Westinghouse Hanford Co., Richland, WA (United States). [1991]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-911286-2: Pacific Northwest International Air and Waste Management Association conference, Kalispell, MT (United States), 4-6 Dec 1991). Order Number DE92006497. Source: OSTI; NTIS; INIS; GPO Dep.

The Hanford Site, Richland, Washington, contains over 1500 identified waste sites that will be characterized and remediated over the next 30 years. In support of the "Hanford Federal Facility Agreement and Consent Order," the US Department of Energy has initiated a remedial investigation/feasibility study (RI/FS) at the 200-BP-1 operable unit. The 200-BP-1 RI is the first Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) investigation on the Hanford Site that involves drilling into highly radioactive and chemically contaminated soils. The initial phase of the site characterization is oriented toward determining the nature and extent of any contamination present in the vicinity of the 200-BP-1 operable unit. The major focus of the Phase I RI is the drilling and sampling of 10 inactive waste disposal units which received low level radioactive liquid waste.

2493 (WHC-SA-1297) Development of an adjoint sensitivity method for site characterization, uncertainty analysis, and code calibration/validation. Lu, A.H. Westinghouse Hanford Co., Richland, WA (United States). Sep 1991. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-910981-27: Environmental remediation '91 conference, Pasco, WA (United States), 8-11 Sep 1991). Order Number DE92001720. Source: OSTI; NTIS; INIS; GPO Dep.

The adjoint method is applied to groundwater flow-mass transport coupled equations in variably saturated media. The sensitivity coefficients derived by this method can be calculated by a single execution for each performance measure regardless of the number of parameters in question. The method provides an efficient and effective way to rank the importance of the parameters, so that data collection can be guided in support of site characterization programs. The developed code will facilitate the sensitivity/uncertainty analysis in both model prediction and model calibration/validation. 13 refs., 1 tab.

2494 (WHC-SA-1355) Assessment of candidate sites for disposal of treated effluents at the Hanford Site, Washington. Davis, J.D. Westinghouse Hanford Co., Richland, WA (United States). Jan 1992. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-920307-25: Waste management

'92, Tucson, AZ (United States), 1-5 Mar 1992). Order Number DE92008384. Source: OSTI; NTIS; INIS; GPO Dep.

A rigidly defined evaluation process was used to recommend a preferred location to dispose of treated effluents from facilities in the 200 Areas of the US Department of Energy's Hanford Site in Washington State. First, siting constraints were defined based on functional design considerations and siting guidelines. Then, criteria for selecting a preferred site from among several candidates were identified and their relative importance defined. Finally, the weighted criteria were applied and a site was selected for detailed characterization by subsurface investigations.

2495 (WHC-SA-1384) A comparative risk evaluation for the siting of a Waste Analysis Laboratory. Wang, O.S.; Howard, D.W.; Smith, R.J. Westinghouse Hanford Co., Richland, WA (United States). Dec 1991. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-920606-7: American Nuclear Society annual meeting, Boston, MA (United States), 7-12 Jun 1992). Order Number DE92007721. Source: OSTI; NTIS; INIS; GPO Dep.

With the US Department of Energy (DOE) focus on environmental restoration and waste management at DOE nuclear waste sites, a significant increase is forecast in the quantity of transuranic (TRU) mixed waste samples that require detailed environmental analysis. Under the direction of the Laboratory Management Branch (EM-532), Westinghouse Hanford Company (Westinghouse Hanford) was commissioned to lead the preparation of an engineering study for site selection of the proposed \$300-million DOE waste Analysis Laboratory (WAL). This assessment provides the DOE with important comparative risk information and data in site selection process. The six DOE sites under consideration are Hanford Site (HANF), Idaho National Engineering Laboratory (INEL), Los Alamos National Laboratory (LANL), Savannah River Site (SRS), Rocky Flats Plant (RFP), and Oak Ridge National Laboratory (ORNL). Detailed calculations and relevant information are documented in the report, WHC-SD-WM-ES-190. This comparative risk assessment provides an objective engineering study that the Hanford Site is the most desirable location for the proposed WAL. The favorable safety data for the Hanford Site can be translated to less risk for identical construction, or less cost for achieving the same level of safety.

2496 (WHC-SA-1451) RCRA groundwater data analysis protocol for the Hanford Site, Washington. Chou, C.J.; Jackson, R.L. Westinghouse Hanford Co., Richland, WA (United States). Apr 1992. 36p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-920851-33: Spectrum '92: nuclear and hazardous waste management international topical meeting, Boise, ID (United States), 23-27 Aug 1992). Order Number DE92015896. Source: OSTI; NTIS; INIS; GPO Dep.

The Resource Conservation and Recovery Act of 1976 (RCRA) groundwater monitoring program currently involves site-specific monitoring of 20 facilities on the Hanford Site in southeastern Washington. The RCRA groundwater monitoring program has collected abundant data on groundwater quality. These data are used to assess the impact of a facility on groundwater quality or whether remediation efforts under RCRA corrective action programs are effective. Both evaluations rely on statistical analysis of groundwater monitoring data. The need for information on groundwater quality by regulators and environmental managers makes statistical analysis of monitoring data an important part of RCRA

groundwater monitoring programs. The complexity of groundwater monitoring programs and variabilities (spatial, temporal, and analytical) exhibited in groundwater quality variables indicate the need for a data analysis protocol to guide statistical analysis. A data analysis protocol was developed from the perspective of addressing regulatory requirements, data quality, and management information needs. This data analysis protocol contains four elements: data handling methods; graphical evaluation techniques; statistical tests for trend, central tendency, and excursion analysis; and reporting procedures for presenting results to users.

2497 (WHC-SA-1456) Process for selecting a soil column disposal site to receive treated effluent containing tritium. Koegler, K.J. Westinghouse Hanford Co., Richland, WA (United States). Mar 1992. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-920466-9: Engineering and technology conference on waste management and environmental restoration, San Juan (Puerto Rico), 9-11 Apr 1992). Order Number DE92012301. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy Hanford Site is located in south-central Washington State. Established in 1943, the mission of the Hanford Site for over 40 years was the production of defense-related nuclear materials. During that era, a great amount of nuclear and hazardous waste was generated. The primary mission of the Hanford Site is now environmental remediation and restoration. Past practice at the Hanford Site permitted discharge of untreated liquid effluents directly to the soil column. This was an accepted method due to the favorable characteristics of the area including isolation, low precipitation, deep water table, and soil ion-exchange properties. During March 1987, the US Department of Energy-Richland Field Office (DOE-RL), issued a plan to discontinue disposal of contaminated liquids into the soil column at the Hanford Site (DOE-RL 1987). This plan outlines a strategy for implementing treatment of the major waste streams currently discharged to the soil column; the 242-A Evaporator process condensate waste stream is one of the stream identified. A constituent of concern remaining in the treated effluent is tritium. The intended disposition of the treated effluent is discharge to the soil column at a State Approved Land Disposal Site, in compliance with Washington State Department of Ecology (Ecology) Washington Administrative Code (WAC) 173-216, State Waste Discharge Permit Program (Ecology 1986). The C-018H Disposal Siting Evaluation (siting evaluation) addresses the site selection and characterization for a new soil column disposal site. The primary goal of the siting evaluation is to identify the best available location for the treatment facility disposal structure. The siting evaluation process includes the following major components: (1) establish selection criteria; (2) select candidate sites; and (3) evaluate candidate sites. Evaluation and justification of the effluent disposal method and regulatory compliance are addressed in following sections.

2498 (WHC-SA-1460) Drilling and sampling highly radioactive contaminated soil at the 200-BP-1 Operable Unit, Hanford Site, Richland, Washington. Buckmaster, M.A.; Kaczor, A.M. Westinghouse Hanford Co., Richland, WA (United States). Jan 1992. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-920307-22: Waste management '92,

Tucson, AZ (United States), 1-5 Mar 1992). Order Number DE92008386. Source: OSTI; NTIS; INIS; GPO Dep.

The Hanford Site, Richland, Washington, contains over 1,500 identified waste sites and four groundwater plumes that will be characterized and remediated over the next 30 years. In support of the Hanford Federal Facility Agreement and Consent Order, the US Department of Energy has initiated a remedial investigation/feasibility study at the 200-DP-1 Operable Unit. The 200-BP-1 remedial investigation is the first Comprehensive Environmental Response, Compensation, and Liability Act of 1980 investigation on the Hanford Site that involves drilling into highly radioactive and chemically contaminated soils. The initial phase of the site characterization is oriented toward determining the nature and extent of any contamination present in the vicinity of the 200-BP-1 Operable Unit. The major focus of the Phase I remedial investigation is the drilling and sampling of 10 inactive waste disposal units that received low level radioactive liquid waste.

2499 (WHC-SA-1665) Field screening for heavy metals with portable XRF units. McCain, R.G.; Guzek, S.J. Westinghouse Hanford Co., Richland, WA (United States). May 1992. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-920851-39: Spectrum '92: nuclear and hazardous waste management international topical meeting, Boise, ID (United States), 23-27 Aug 1992). Order Number DE92015909. Source: OSTI; NTIS; GPO Dep.

Portable X-ray Fluorescence (XRF) units are available for sample analysis or in situ measurement of heavy metals. In many field screening applications, it is sufficient to identify samples or areas in which contamination is present. This paper presents a new approach that provides a qualitative indication of heavy metal content with minimal samples preparation and data evaluation. In the "scan" approach, a portable XRF unit is configured to report the integrated gross count rate for each of several contiguous energy bands. Detection of heavy metal contaminants is based on comparison of gross count rates in each energy band with corresponding background levels from material with a similar matrix.

2500 (WHC-SA-1763) Field observations of variability of soil gas measurements. Fancher, J.D. Westinghouse Hanford Co., Richland, WA (United States). Dec 1992. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930167-1: National symposium on measuring and interpreting VOCs in soils: state of the art and research needs, Las Vegas, NV (United States), 12-14 Jan 1993). Order Number DE93006904. Source: OSTI; NTIS; INIS; GPO Dep.

A baseline monitoring survey is being performed at the US Department of Energy's Hanford Site located in southeast Washington State. Monitoring is in support of the carbon tetrachloride Expedited Response Action (ERA) vapor extraction system (VES) operations. Since late 1991, soil-gas probes and wellheads have been routinely monitored for volatile organic concentrations. The monitoring network now encompasses 59 locations. These include 46 wellhead locations, 11 shallow soil-gas probes [1.2 m (4 ft) deep], and 2 deep soil-gas probes [11 and 22 m (37 and 73 ft) deep]. The project site is an area where carbon tetrachloride (CCl₄) and co-contaminants were discharged to the soil between 1955 and 1973. There are three separate CCl₄ disposal areas at the project site. This contamination is linked to past liquid waste disposal practices resulting from operation of the Plutonium Finishing Plant at the Hanford Site.

CHARACTERIZATION

The contamination caused an extensive vapor plume in the vadose zone and a groundwater contamination plume that covers over 12 km². The following are the objectives of this baseline monitoring survey: (1) to measure the existing concentrations of CCl₄ in the subsurface prior to initiation of the vacuum extraction; (2) to investigate how the existing concentrations of CCl₄ vary with time; (3) to evaluate the impact of vapor extraction on the distribution and concentrations of CCl₄ in the subsurface; and (4) to provide data to help maintain a safe working environment.

2501 (WHC-SA-1764) Late Cenozoic structure and stratigraphy of south-central Washington. Reidel, S.P. (Westinghouse Hanford Co., Richland, WA (United States)); Campbell, N.P.; Fecht, K.R.; Lindsey, K.A. Westinghouse Hanford Co., Richland, WA (United States); Washington State Univ., Pullman, WA (United States). Dept. of Geology. 1 Sep 1993. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930 ; FG06-91ER14172. Order Number DE94002483. Source: OSTI; NTIS; INIS; GPO Dep.

The structural framework of the Columbia Basin began developing before Columbia River Basalt Group (CRBG) volcanism. Prior to 17.5 Ma, the eastern part of the basin was a relatively stable area, with a basement of Paleozoic and older crystalline rock. The western part was an area of subsidence in which large volumes of sediment and volcanic rocks accumulated. Concurrent with eruption of the CRBG, anticlinal ridges of the Yakima Fold Belt (YFB) were growing under north-south compression. Topographic expression of these features was later masked by the large volume of CRBG basalt flowing west from fissures in the eastern Columbia Basin. The folds continued to develop after cessation of volcanism, leading to as much as 1,000 m of structural relief in the past 10 million years. Post-CRBG evolution of the Columbia Basin is recorded principally in folding and faulting in the YFB and sediments deposited in the basins. The accompanying tectonism resulted in lateral migration of major depositional systems into subsiding structural lows. Although known late Cenozoic faults are on anticlinal ridges, earthquake focal mechanisms and contemporary strain measurements indicate most stress release is occurring in the synclinal areas under north-south compression. There is no obvious correlation between focal mechanisms for earthquakes whose foci are in the CRBG and the location of known faults. High in situ stress values help to explain the occurrence of microseismicity in the Columbia Basin but not the pattern. Microseismicity appears to occur in unaltered fresh basalt. Faulted basalt associated with the YFB is highly brecciated and commonly altered to clay. The high stress, abundance of ground water in confined aquifers of the CRBG, and altered basalt in fault zones suggest that the frontal faults on the anticlinal ridges probably have some aseismic deformation. 85 refs.

2502 (WHC-SA-1792) Statistical application of groundwater monitoring data at the Hanford Site. Chou, C.J.; Johnson, V.G.; Hodges, F.N. Westinghouse Hanford Co., Richland, WA (United States). Sep 1993. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-931002-1: Geological Society of America (GSA) annual meeting, Boston, MA (United States), 25-28 Oct 1993). Order Number DE94001698. Source: OSTI; NTIS; INIS; GPO Dep.

Effective use of groundwater monitoring data requires both statistical and geohydrologic interpretations. At the

Hanford Site in south-central Washington state such interpretations are used for (1) detection monitoring, assessment monitoring, and/or corrective action at Resource Conservation and Recovery Act sites; (2) compliance testing for operational groundwater surveillance; (3) impact assessments at active liquid-waste disposal sites; and (4) cleanup decisions at Comprehensive Environmental Response Compensation and Liability Act sites. Statistical tests such as the Kolmogorov-Smirnov two-sample test are used to test the hypothesis that chemical concentrations from spatially distinct subsets or populations are identical within the uppermost unconfined aquifer. Experience at the Hanford Site in applying groundwater background data indicates that background must be considered as a statistical distribution of concentrations, rather than a single value or threshold. The use of a single numerical value as a background-based standard ignores important information and may result in excessive or unnecessary remediation. Appropriate statistical evaluation techniques include Wilcoxon rank sum test, Quantile test, "hot spot" comparisons, and Kolmogorov-Smirnov types of tests. Application of such tests is illustrated with several case studies derived from Hanford groundwater monitoring programs. To avoid possible misuse of such data, an understanding of the limitations is needed. In addition to statistical test procedures, geochemical, and hydrologic considerations are integral parts of the decision process. For this purpose a phased approach is recommended that proceeds from simple to the more complex, and from an overview to detailed analysis.

2503 (WHC-SA-1907) Assessment of unsaturated zone radionuclide contamination in the 200 areas of the Hanford site, Washington. Brodeur, J.R.; Wittreich, C.D. Westinghouse Hanford Co., Richland, WA (United States). Mar 1993. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-9304117-5: International waste management conference, San Juan (Puerto Rico), 28 Apr - 1 May 1993). Order Number DE94004484. Source: OSTI; NTIS; INIS; GPO Dep.

The 200 East and 200 West Areas at the Department of Energy's Hanford site in southeastern Washington, contain chemical and nuclear fuel processing facilities that disposed of large volumes of chemical and radionuclide effluents to the ground via various structures such as ponds, cribs and ditches. A geophysical logging investigation was implemented in 1992 to assess the nature and extent of contamination beneath select liquid disposal sites in the 200 Areas. The borehole geophysical logging was accomplished with a recently developed spectral gamma-ray logging system called the Radionuclide Logging System (RLS). This system has a high-resolution, intrinsic germanium detector mounted in a downhole probe and is calibrated and operated specifically for use in a borehole environment. It provides a means to develop in-situ, gamma-emitting radioelement concentration profiles. Approximately 50 boreholes were logged in this study. The RLS log data provided information about the migration and deposition patterns of specific radionuclides in the unsaturated zone and their impacts on the groundwater. Approximately 10 radionuclide species were detected and quantified. Results of the field investigation are being used to refine site specific conceptual models, support Hanford Site remediation decisions and focus future characterization activities.

2504 (WHC-SA-1908) Prioritization and accelerated remediation of groundwater contamination in the 200 Areas of the Hanford Site, Washington. Wittreich, C.D.;

Ford, B.H. Westinghouse Hanford Co., Richland, WA (United States). Apr 1993. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-9304117-4: International waste management conference, San Juan (Puerto Rico), 28 Apr - 1 May 1993). Order Number DE94003094. Source: OSTI; NTIS; INIS; GPO Dep.

The Hanford Site, operated by the US Department of Energy (DOE), occupies about 1,450 km² (560 mi²) of the southeastern part of Washington State north of the confluence of the Yakima and Columbia Rivers. The Hanford Site is organized into numerically designated operational areas. The 200 Areas, located near the center of the Hanford Site, encompasses the 200 West, East and North Areas and cover an area of over 40 km². The Hanford Site was originally designed, built, and operated to produce plutonium for nuclear weapons using production reactors and chemical reprocessing plants. Operations in the 200 Areas were mainly related to separation of special nuclear materials from spent nuclear fuel and contain related chemical and fuel processing and waste management facilities. Large quantities of chemical and radioactive waste associated with these processes were often disposed to the environment via infiltration structures such as cribs, ponds, ditches. This has resulted in over 25 chemical and radionuclide groundwater plumes, some of which have reached the Columbia River. An Aggregate Area Management Study program was implemented under the Hanford Federal Facility Agreement and Consent Order to assess source and groundwater contamination and develop a prioritized approach for managing groundwater remediation in the 200 Areas. This included a comprehensive evaluation of existing waste disposal and environmental monitoring data and the conduct of limited field investigations (DOE-RL 1992, 1993). This paper summarizes the results of groundwater portion of AAMS program focusing on high priority contaminant plume distributions and the groundwater plume prioritization process. The objectives of the study were to identify groundwater contaminants of concern, develop a conceptual model, refine groundwater contaminant plume maps, and develop a strategy to expedite the remediation of high priority contaminants through the implementation of interim actions.

2505 (WHC-SA-1964) The Mobile Surface Contamination Monitor II environmental radiological characterization utilizing GPS/GIS technologies. Wendling, M.A. Westinghouse Hanford Co., Richland, WA (United States). May 1993. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-9306184-1: GPS/GIS '93 trademarks meeting, Seattle, WA (United States), 21-25 Jun 1993). Order Number DE93016225. Source: OSTI; NTIS; INIS; GPO Dep.

Time, cost, and most importantly quality of data are the three factors to measure the success of field radiological characterizations. The application of coupling radiation detection instrumentation to a GPS receiver has dramatically increased the data quality achievable compared to traditional environmental radiological survey methods. Improvements in verifying adequate spatial coverage of an area while collecting data and at the same time reducing field time requirements can be realized. Data acquired during the recent implementation of the Mobile Surface Contamination Monitor 11 (MSCM-11) will be presented to demonstrate the advantages of this system over traditional radiological

survey methods. The comparison will include time and manpower requirements. Linking the complimentary GPS, GIS and radiation detection technologies on a mobile tractor based platform has provided a tool to provide radiological characterization data faster, cheaper, and better to assist in the Environmental Restoration Mission of the Hanford Site.

2506 (WHC-SA-2055) Application of spectral gamma-ray borehole geophysics for characterization of radionuclide contamination at Hanford. Brodeur, J.R.; Koizumi, C.J.; Meisner, J.P.; Price, R.K.; Fassett, J.W. Westinghouse Hanford Co., Richland, WA (United States). Oct 1993. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-931095-28: Department of Energy environmental remediation conference, Augusta, GA (United States), 24-28 Oct 1993). Order Number DE94001691. Source: OSTI; NTIS; INIS; GPO Dep.

An innovative, passive, gamma-ray borehole logging program was developed at Hanford for the purpose of identifying and quantifying the gamma-ray-emitting radioisotopes in the subsurface. Recent nuclear counting equipment was configured into a borehole logging system and calibration methods were devised for the in situ assay of man-made radionuclides. Operation procedures and data analysis methods were developed, creating an efficient production logging system. The logging program has proven to be effective when used in a screening mode for characterizing effluent release sites at Hanford. It located the primary gamma-emitting contaminants and identified which of the sites had contributed to the groundwater contamination. At one of the single-shell tank farms, the system was used to quantify the unsaturated zone contamination and trace the contamination back to the tank leak sources. It also provided a baseline of the radioelement concentrations for future data comparisons and to permit identification of a dynamic radionuclide transport system. In this manner, the logging program can help to identify future tank leaks. When combined with an inexpensive drilling method, the logging program can produce in situ radioelement concentration data at a fraction of the cost of conventional drilling and sampling, without personnel exposure to the contamination or generation of waste, and it can be done in a matter of days instead of months. Future developments will refine the quality assurance program so that the system will produce laboratory-quality in situ assays. Future applications will require a high degree of quality assurance.

2507 (WHC-SA-2058) Characterization and remediation of highly radioactive contaminated soil at Hanford. Buckmaster, M.A. (Westinghouse Hanford Co., Richland, WA (United States)); Erickson, J.K. Westinghouse Hanford Co., Richland, WA (United States). Sep 1993. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-931095-22: Department of Energy environmental remediation conference, Augusta, GA (United States), 24-28 Oct 1993). Order Number DE94001689. Source: OSTI; NTIS; INIS; GPO Dep.

The Hanford Site, Richland, Washington, contains over 1,500 identified waste sites and numerous groundwater plumes that will be characterized and remediated over the next 30 years. As a result of the Hanford Federal Facility Agreement and Consent Order, the US Department of Energy (DOE) has initiated a remedial investigation/feasibility study (RI/FS) at the 200-BP-1 operable unit. The 200-BP-1 RI/FS is the first Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) investigation on

the Hanford Site that involves highly radioactive and chemically contaminated soils. The initial phase of site characterization was designed to assess the nature and extent of contamination associated with the source waste sites within the 200-BP-1 operable unit. Characterization activities consisted of drilling and sampling, chemical and physical analysis of samples, and development of a conceptual vadose zone model. These data were then used to develop remedial alternatives during the FS evaluation. The preferred alternative resulting from the RI/FS process for the 200-BP-1 operable unit is to construct a surface isolation barrier. The multi-layered earthen barrier will be designed to prevent migration of contaminants resulting from water infiltration, biointrusion, and wind and water erosion.

2508 (WHC-SA-2061) Planning a site investigation using analogous groups. Pak, P.M. (USDOE Richland Operations Office, WA (United States)); Galtoul, M.J.; Witreich, C.D. Westinghouse Hanford Co., Richland, WA (United States). Sep 1993. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-931095-35: Department of Energy environmental remediation conference, Augusta, GA (United States), 24-28 Oct 1993). Order Number DE94001687. Source: OSTI; NTIS; INIS; GPO Dep.

A limited field investigation (LFI) has been designed for the 200-UP-2 Operable Unit within the 200 Areas of the US Department of Energy (DOE) Hanford Site in Washington state using the concept of analogous groups. The LFI is part of a RCRA facility investigation (RFI) corrective measures study (CMS) being conducted in this operable unit. The concept emphasizes that characterization activities can be reduced by identifying select sites (analogous sites) for characterization that represents a group of sites (analogous groups). This concept is particularly applicable to operable units that contain several waste management units that are similar in design, disposal history, and geology. Application of this concept reduced the number of waste management units initially undergoing characterization by more than two-thirds. The work plan is presently in the approval cycle with the field characterization phase expected to begin August 1993.

2509 (WHC-SA-2175) A sitewide approach to the characterization and use of soil and groundwater background at the Hanford Site. Hoover, J.D. (Westinghouse Hanford Co., Richland, WA (United States)); Ruck, F.A.; LeGore, T.; Thompson, K.M. Westinghouse Hanford Co., Richland, WA (United States). Oct 1993. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-9310157-79: Nuclear Information and Records Management Association (NIRMA) conference, Augusta, GA (United States), 1 Oct 1993). Order Number DE94001699. Source: OSTI; NTIS; INIS; GPO Dep.

A Sitewide approach to the characterization and use of soil and groundwater background has been developed for use in environmental restoration activities on the Hanford Site. Sitewide background more accurately represents the range of background compositions that exist in soil and groundwater at the over 140 Resource Conservation and Recovery Act of 1976 facilities and Comprehensive Environmental Response, Compensation, and Liability Act of 1980 operable units, and provides a more consistent, credible, integrated, and efficient basis for identifying and evaluating contamination in these media than using unit-specific backgrounds.

2510 (WHC-SA-2304) Preliminary results of a seismic borehole test using downhole shaped charges at the DOE Hanford Site. Narbutovskih, S.M. (Westinghouse Hanford Co., Richland, WA (United States)); Michelsen, F. Westinghouse Hanford Co., Richland, WA (United States). Feb 1994. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-940353-4: Symposium on the application of geophysics to environmental and engineering problems, Boston, MA (United States), 27-31 Mar 1994). Order Number DE94008077. Source: OSTI; NTIS; GPO Dep.

Geophysical site characterization studies can be important steps in the process of designing and monitoring remediation at hazardous waste storage facilities. Use of seismic techniques for subsurface characterization at the DOE Hanford Site has been limited. One reason is the lack of borehole velocity control, and low-velocity sediments are highly attenuative. Consequently, standard techniques to provide velocity control are not adequate. Both Vertical Seismic Profiling and reversed VSP surveys are currently being investigated to provide velocity control and for subsurface imaging capabilities. Recently a jet perforating gun was used to perforate a double-cased borehole in the 200 West Area. Acoustic emissions were recorded from numerous depths to obtain velocity control for a previous surface survey conducted in the same area. Both P- and S-wave data were recorded simultaneously from multiple horizons using the DAS-1 seismograph and 3-component geophones. The data were analyzed for a variety of uses besides velocity control. Signal attenuation was studied as a function of source depth and offset distance to evaluate formation absorption while vertical resolution was determined from the frequency spectrum. Preliminary results indicate that adequate P-wave velocity control can be obtained even though the near-surface sediments are very attenuative. However, we conclude that the perforating gun produces little SH energy. Preliminary velocities indicate that reflection coefficients should be great enough to use surface techniques. Results from the frequency study suggest that a swept source for both surface and borehole surveys may be necessary to obtain required resolutions. Finally, signal attenuation as a function of formation facies suggest that seismic techniques may be useful in mapping perched water zones and for long term vadose zone monitoring.

2511 (WHC-SD-C018H-ER-004) Geohydrologic evaluation for the 200 Area Effluent Treatment Facility State-Approved Land Disposal Site: Addendum to WAC 173-240 Engineering Report. Ballantyne, N.A. Westinghouse Hanford Co., Richland, WA (United States). Aug 1993. 78p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93041342. Source: OSTI; NTIS; INIS; GPO Dep.

This document provides a geohydrologic evaluation for the disposal of liquid effluent from the 200 Area Effluent Treatment Facility (ETF) at the Hanford Site. This work forms an addendum to the engineering report that supports the completion of the ETF.

2512 (WHC-SD-C018H-PLN-004) Groundwater monitoring plan for the proposed state-approved land disposal structure. Reidel, S.P. Westinghouse Hanford Co., Richland, WA (United States). 13 Oct 1993. 90p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94002495. Source: OSTI; NTIS; INIS; GPO Dep.

This document outlines a detection-level groundwater monitoring program for the state-approved land disposal structure (SALDS). The SALDS is an infiltration basin proposed for disposal of treated effluent from the 200 Areas of the Hanford Site. The purpose of this plan is to present a groundwater monitoring program that is capable of determining the impact of effluent disposal at the SALDS on the quality of groundwater in the uppermost aquifer. This groundwater monitoring plan presents an overview of the SALDS, the geology and hydrology of the area, the background and indicator evaluation (detection) groundwater monitoring program, and an outline of a groundwater quality assessment (compliance) program. This plan does not provide a plan for institutional controls to track tritium beyond the SALDS.

2513 (WHC-SD-EN-AP-134) Site characterization plan for the W-058 Project. Rowley, C.A. Westinghouse Hanford Co., Richland, WA (United States). [1993]. 58p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93040403. Source: OSTI; NTIS; INIS; GPO Dep.

The objective of this preoperational study plan is to characterize the proposed pipeline route for the Cross-Site Transfer System (W-058). The purpose of this study is to meet the requirements set forth in US Department of Energy (DOE) Order 5400.1, Chapter 4, (DOE 1990). The W-058 pipeline is intended to replace the existing Cross-Site Transfer System (H-2-43056). The proposed route for the W-058 project will be reviewed to provide information on documented waste sites and potentially to identify any undocumented hazards that may currently exist along the proposed route. Historical records will be researched for pertinent information. Health Physics personnel will perform a "walk-down" radiological survey of the proposed path. A sampling plan will be generated and will consist of actual drilling of boreholes to allow field screening for radionuclides and/or chemical contamination and the collection of samples at selected sites for laboratory analyses. The information generated from this combined effort will establish existing/potential contamination levels, aid in developing personnel safety requirements, assist in determining the need for any changes in the proposed route prior to installation/construction of the new pipeline, and satisfy the requirements of a preoperational baseline for the project.

2514 (WHC-SD-EN-AP-141) Description of work for 216-U-Pond test pits. Kelty, G.G. Westinghouse Hanford Co., Richland, WA (United States). 11 Aug 1993. 39p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93040393. Source: OSTI; NTIS; INIS; GPO Dep.

This description of work (DOW) details the field activities associated with the test pit excavation and soil sampling at the 216-U-10 Pond (U-10 Pond) in the 200 West Area and will serve as a field guide for those performing the work. It will be used in conjunction with the 200-UP-2 Resource Conservation and Recovery Act of 1976 (RCRA) Facility Investigation/Corrective Measures Study (DOE-RL 1993a, [LFI]) and Site Characterization Manual (WHC 1988a). Test pits will be constructed to characterize the vertical extent of contaminants in sediments within and beneath the former U-10 pond.

2515 (WHC-SD-EN-AP-145) C-018H Pre-Operational Baseline Sampling Plan. Guzek, S.J. (Westinghouse Hanford Co., Richland, WA (United States)). Westinghouse

Hanford Co., Richland, WA (United States); Kaiser Engineers Hanford Co., Richland, WA (United States). 20 Aug 1993. 38p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93041106. Source: OSTI; NTIS; INIS; GPO Dep.

The objective of this task is to field characterize and sample the soil at selected locations along the proposed effluent line routes for Project C-018H. The overall purpose of this effort is to meet the proposed plan to discontinue the disposal of contaminated liquids into the Hanford soil column as described by DOE (1987). Detailed information describing proposed transport pipeline route and associated Kaiser Engineers Hanford Company (KEH) preliminary drawings (H288746...755) all inclusive, have been prepared by KEH (1992). The information developed from field monitoring and sampling will be utilized to characterize surface and subsurface soil along the proposed C-018H effluent pipeline and its associated facilities. Potentially existing contaminant levels may be encountered therefore, soil characterization will provide a construction preoperational baseline reference, develop personnel safety requirements, and determine the need for any changes in the proposed routes prior to construction of the pipeline.

2516 (WHC-SD-EN-AP-151) Description of work for 200-UP-1 characterization of monitoring wells. Innis, B.E.; Kelty, G.G. Westinghouse Hanford Co., Richland, WA (United States). [1994]. 68p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94006991. Source: OSTI; NTIS; GPO Dep.

This description of work (DOW) details the field activities associated with the drilling, soil sampling, and construction of groundwater monitoring and dual-use wells in the 200-UP-1 Operable Unit (Tasks 2, 3, and 5 in the 200-UP-1 RI/FS Work Plan DOE/RL 1993a) and will serve as a field guide for those performing the work. It will be used in conjunction with the Remedial Investigation/Feasibility Study Work Plan for the 200-UP-1 Groundwater operable Unit (DOE-RL 1993a, [LFI]) and Site Characterization Manual (WHC 1988a). Groundwater wells are being constructed to characterize the vertical and horizontal extent of the Uranium and ⁹⁹Tc plumes and to define aquifer properties such as hydraulic communication between aquifers and hydrostratigraphy. Some of these wells may be utilized for extraction purposes during the IRM phase anticipated at this operable unit and are being designed with a dual use in mind. These data will be used to optimize the Interim Remedial Measures (IRM) for the cleanup of these two plumes. The data will also be used with later Limited Field Investigation (LFI) data to perform a Qualitative Risk Assessment (QRA) for the operable unit. The locations for the proposed groundwater wells are presented in Figure 1. The contaminants of concern for the project are presented in Table 1.

2517 (WHC-SD-EN-AP-154) Field characterization plan for the 216-U-8 vitrified clay pipeline. Rowley, C.A. Westinghouse Hanford Co., Richland, WA (United States). 21 Jan 1994. 37p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94007146. Source: OSTI; NTIS; INIS; GPO Dep.

The 216-U-8 Crib was constructed in 1952 and received waste from 1952 to 1960 as described in Appendix A. This description of work details the field activities associated with the characterization of the vitrified clay pipe (VCP) delivery line to the 216-U-8 Crib and subsurface soil sampling along the pipe route in the 200 West Area of Hanford U Plant. It

will serve as a field guide for those performing the work. Soil sampling locations will be determined by a combination of radiological surface surveys and internal camera surveys of the VCP line. Depending on the condition of the pipeline and field conditions, the objectives are as follows: examine the internal condition of the VCP with a survey camera to the extent allowed by field conditions; determine precise location and depth of the VCP; document VCP integrity; document gamma radiation profile through the VCP; and correlate any relationships between surface contamination zones at grade above the VCP to identify breaches in the pipe integrity.

2518 (WHC-SD-EN-AP-157) Surface soil sampling plan for the 200-UP-2 operable unit. Mitchell, R.M. Westinghouse Hanford Co., Richland, WA (United States). [1994]. 52p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94010356. Source: OSTI; NTIS; GPO Dep.

The purpose of the Description of Work (DOW) is to provide detailed guidance for implementation of the field activities outlined in the 200-UP-2 Operable Unit Work Plan. This work plan provides the basis for conducting a limited field investigation (LFI) in the unit, with the DOW outlining the protocols and procedures to be utilized in performing the surface soil sampling. As outlined in the Work Plan, the data to be collected in the LFI will be utilized to determine the need for, and possible selection of, an Interim Remedial Measure (IRM). In order to do that, detailed information on the current nature and extent of contamination in surface soils at selected management units is required for assessment in conjunction with the existing areas of highest concentration for each unit. Field screening efforts using surface radiation surveys will allow for surface soil samples to be collected from those points that represent the highest contaminant concentrations. Analysis of these samples will provide data on the types and concentrations of the contaminants of concern.

2519 (WHC-SD-EN-EV-027) Hydrogeology of the 100-N Area, Hanford Site, Washington. Hartman, M.J.; Lindsey, K.A. Westinghouse Hanford Co., Richland, WA (United States). 20 Dec 1993. 196p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94006328. Source: OSTI; NTIS; INIS; GPO Dep.

Hydrogeologic units beneath the 100-N Area include the vadose zone (primarily Hanford formation). The unconfined aquifer (upper Ringold Formation), a series of confined aquifers in the Ringold Formation, and a series of confined aquifers in the basalts and interbeds. The uppermost aquifer is an unconfined sand and gravel unit in the Ringold Formation. It is 40 to 50 ft thick. The base of the aquifer is a series of fine-grained units in the Ringold Formation. Groundwater flows toward the Columbia River beneath most of the 100-N Area, except when river stage is high for extended periods of time. Groundwater chemistry has been affected by 100-N Area operations. Primary constituents of interest include: (1) ^{90}Sr and tritium associated with the 1301-N and 1325-N sites, (2) sulfate and sodium associated with the 1324-N/NA site, and (3) petroleum products associated with leaks and spills between the N Reactor building and the river. Radionuclides are detectable in water flowing into the Columbia River from N-Springs. The most significant constituents in spring water are tritium and ^{90}Sr . Concentrations of these constituents have declined since 1987. These constituents have also been detected in river water immediately

adjacent to the 100-N Area, but are rapidly diluted below detection limits.

2520 (WHC-SD-EN-TI-162) Geophysical survey for cone penetrometer site, CPT-4, 200 West area. Mitchell, T.H. Westinghouse Hanford Co., Richland, WA (United States). [1993]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94002480. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes a geophysical survey performed at the Hanford Reservation. The objective of the survey was to locate subsurface obstructions that may affect cone penetrometer work at site CPT-4, adjacent to and west of borehole 299-W18-252, Figure 1. Based upon the results of the survey, possible "drill sites" within the zone, with the least likelihood of encountering identified obstructions, were identified.

2521 (WHC-SD-EN-TI-164) 382-1 underground gasoline storage tank soil-gas survey. Jacques, I.D. Westinghouse Hanford Co., Richland, WA (United States). 27 Aug 1993. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93041109. Source: OSTI; NTIS; GPO Dep.

A soil-gas survey was conducted near the 382 Pump House in the 300 Area of the Hanford Site. The objective of the soil-gas survey was to characterize the extent of petroleum product contamination in the soil beneath the 382-1 underground gasoline storage tank excavation. The tank was discovered to have leaked when it was removed in September 1992. The results of this soil-gas survey indicate petroleum products released from the 382-1 tank are probably contained in a localized region of soil directly beneath the tank excavation site. The soil-gas data combined with earlier tests of groundwater from a nearby downgradient monitoring well suggest the spilled petroleum hydrocarbons have not penetrated the soil profile to the water table.

2522 (WHC-SD-EN-TI-174) Geophysical investigation of 218-W-4C trenches #1 and #4, 200 west. Kiesler, J.P.; Bergstrom, K.A.; Mitchell, T.H. Westinghouse Hanford Co., Richland, WA (United States). 1993. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93040394. Source: OSTI; NTIS; INIS; GPO Dep.

The objective of these surveys was to determine the effectiveness of Ground-Penetrating Radar (GPR) for defining the depth and location of barrels in Burial Ground 218-W-4C, 200 West area of the Hanford Reservation. GPR data were collected in a portion of trench #1-module 3 and trench #4. The GPR system used for this work utilized a 300-megahertz antenna to transmit the electromagnetic energy into the ground. A percentage of the transmitted energy is reflected back to a receiving antenna where variations in the return signal are recorded. Common reflectors include natural geologic conditions such as bedding, cementation moisture and clay, or man-made objects such as pipes, barrels, foundations and buried wires. Depth of penetration, which varies with changes in geology, ranged from 10 to 15 feet for this survey. The method is limited in depth by transmit power, receiver sensitivity and attenuation of the transmitted energy. Depth of investigation is also limited by highly conductive materials, such as metal drums, which reflect all the transmitted energy, preventing investigation below such objects. Display and interpretation of the data are similar to that of seismic reflection data. In some areas interpretations can be straight forward, however, unknown

parameters within a highly variable subsurface often yield complex data.

2523 (WHC-SD-EN-TI-195) Geophysical survey of 105-DR Pluto Crib, 116-DR-4, 100-D Area. Bergstrom, K.A. Westinghouse Hanford Co., Richland, WA (United States). [1993]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94001685. Source: OSTI; NTIS; INIS; GPO Dep.

The objective of this Geophysical Survey was to verify the location of the 105-DR Pluto Crib, 116-DR-4. A surface monument currently marks its location. The crib is 10 feet by 10 feet and 15 feet deep. Ground-Penetrating Radar was the geophysical method selected to conduct the investigation.

2524 (WHC-SD-EN-TI-212) 100-DR-1 radiological surveys. Naiknimbalkar, N.M. Westinghouse Hanford Co., Richland, WA (United States). 28 Jan 1994. 61p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94006994. Source: OSTI; NTIS; INIS; GPO Dep.

This report summarizes and documents the results of the radiological surveys conducted over the surface of the 100-DR-1 Operable Unit, Hanford Site, Richland, Washington. In addition, this report explains the survey methodology using the Ultrasonic Ranging and Data System (USRADS). The 100-DR-1 radiological survey field task consisted of two activities: characterization of the operable unit-specific background conditions and the radiological survey of the operable unit surface area. The survey methodology was based on utilization of USRADS for automated recording of the gross gamma radiation levels at or near 6 in. and at 3 ft from the surface soil. The purpose of the survey is to identify the location of unidentified subsurface radioactive material areas and any surface contamination associated with these areas. The radiological surveys were conducted using both a digital count rate meter with a NaI detector reporting in counts per minute (CPM) and a dose rate meter reporting micro-Roentgen per hour (uR) connected to a CHEMRAD Tennessee Corp. Series 2000 USRADS. The count rate meter was set for gross counting, i.e., Window "out". The window setting allows detection of low, intermediate, and high energy photons. The USRADS equipment is used to record the detector readings versus the location of the readings, generate a map of the survey area, and save the data on computer storage media.

2525 (WHC-SD-EN-TI-218) Material properties data and volume estimate of silt loam soil at the NRDWL Reserve, McGee Ranch. Westinghouse Hanford Co., Richland, WA (United States). 17 Feb 1994. 66p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94009664. Source: OSTI; NTIS; GPO Dep.

A closure and postclosure plan for the Hanford Site Non-radioactive Dangerous Waste Landfill (NRDWL) was prepared by Westinghouse Hanford Company (WHC) and submitted for regulatory agency review in 1990. In the closure plan, construction of a final cover over the NRDWL is proposed. The design specifies a topsoil component consisting of layers of compacted and noncompacted fine-textured soil. The objective of compacting a portion of the topsoil layer is to impede infiltration of soil moisture. The McGee Ranch area on the Hanford Site is proposed as the source area for fine-textured soils to support cover construction. A number of data needs are identified in the closure plan for definitive design of the NRDWL final cover. Specifically, the

plan identifies a need to characterize potential borrow areas for fine-textured soil, to ensure that (1) material properties vary within acceptable limits for the application, and (2) sufficient quantities of suitable material are available.

2526 (WHC-SD-EN-TP-020) Integrated test plan for directional boring. Volk, B.W. Westinghouse Hanford Co., Richland, WA (United States). 10 Feb 1993. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93011376. Source: OSTI; NTIS; INIS; GPO Dep.

This integrated test plan describes the field testing of the DITCH WITCH Directional Boring System. DITCH WITCH is a registered trademark of The Charles Machine Works, Inc., Perry, Oklahoma. The test is being conducted as a coordinated effort between Charles Machine Works (CMW), Sandia National Laboratories (SNL), and the Westinghouse Hanford Company (WHC). Funding for the WHC portion of the project is through the Volatile Organic Compound-Arid Integrated Demonstration (VOC-Arid ID). The purpose of the test is to evaluate the performance of the directional boring system for possible future use on environmental restoration projects at Hanford and other Department of Energy (DOE) sites. The test will be conducted near the 200 Areas Fire Station located between the 200 East and 200 West Area of the Hanford Site. The directional boring system will be used to drill and complete (with fiberglass casing) two horizontal boreholes. A third borehole will be drilled to test sampling equipment but will not be completed with casing.

2527 (WHC-SD-EN-TP-028) Test plan for sonic drilling at the Hanford Site in FY 1993. McLellan, G.W. Westinghouse Hanford Co., Richland, WA (United States). 8 Jul 1993. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93017680. Source: OSTI; NTIS; INIS; GPO Dep.

This test plan describes the field demonstration of the sonic drilling system being conducted as a coordinated effort between the VOC-Arid ID (Integrated Demonstration) and the 200 West Area Carbon Tetrachloride ERA (Expedited Response Action) programs at Hanford. The purpose of this test is to evaluate the Water Development Corporation's drilling system, modify components as necessary and determine compatible drilling applications for the sonic drilling method for use at facilities in the DOE complex. The sonic demonstration is being conducted as the first field test under the Cooperative Research and Development Agreement (CRADA) which involves the US Department of Energy, Pacific Northwest Laboratory, Westinghouse Hanford Company and Water Development Corporation. The sonic drilling system will be used to drill a 45 degree vadose zone well, two vertical wells at the VOC-Arid ID site, and several test holes at the Drilling Technology Test Site north of the 200 Area fire station. Testing at other locations will depend on the performance of the drilling method. Performance of this technology will be compared to the baseline drilling method (cable-tool).

2528 (WHC-SD-EN-TP-030) Integrated test plan for the demonstration of a commercial Fourier Transform Infrared instrument. Kogler, K.J. Westinghouse Hanford Co., Richland, WA (United States). [1993]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93018518. Source: OSTI; NTIS; GPO Dep.

This integrated test plan describes the use of a commercial Fourier Transform Infrared instrument for measuring Carbon Tetrachloride concentrations. The Fourier Transform

CHARACTERIZATION

Infrared will measure CCL4 concentrations in a line of sight path average mode in mass per cubic meter as a function of time. The goal of this test is to demonstrate the usefulness of a long path Fourier Transform Infrared instrument in determining CCL4 fluxes from the soil in the 200 area adjacent to disposal cribs where high soil fluxes are believed to exist. The instrument will be set up such that it can have a clear line of site path to its reflector and this line of site will be as near to the Z-9 fence as possible and have a path length as long as possible.

2529 (WHC-SD-EN-TP-031) Aquifer test plan for the 100-HR-3 Operable Unit. Swanson, L.C.; Hartman, M.J. Westinghouse Hanford Co., Richland, WA (United States). 28 Mar 1994. 61p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94010378. Source: OSTI; NTIS; INIS; GPO Dep.

This test plan directs hydrologic testing activities planned at three existing Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) wells in the 100-HR-3 Operable Unit of the Hanford Site. Three additional wells will be installed near these existing wells and used as additional testing and observation points during the field activities. Figure 1 shows the locations of the three test sites. A primary objective of the testing program is to provide more detailed hydraulic characterization information for the unconfined aquifer and targeted test sites than provided by the initial reconnaissance-level slug testing of Vukelich. A second objective is to evaluate the applicability of slug interference and dipole flow tests for detailed hydraulic characterization in an unconfined aquifer. This aquifer testing program will also be useful for substantiating hydraulic conductivities reported from previous slug tests and evaluating the effects of filter pack volume/configuration on slug test data. Vukelich recommended additional testing to address the latter two issues.

2530 (WHC-SD-EN-TP-033) Hydrologic test plan for the Environmental Remediation Disposal Facility. Swanson, L.C. Westinghouse Hanford Co., Richland, WA (United States). 30 Sep 1993. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94001684. Source: OSTI; NTIS; GPO Dep.

Hydrologic tests are planned at seven wells that will be drilled at the proposed Environmental Remediation Disposal Facility (ERDF). These wells are supporting hydrologic, geologic, and hydrochemical characterization at this new facility. Hydrologic testing will consist of instantaneous slug tests, slug interference tests, step-drawdown tests, and constant rate discharge tests (generally single-well). These test results and later groundwater monitoring data will be used to determine groundwater flow directions, flow rates, and the chemical makeup of the groundwater below the proposed ERDF. The seven wells will be drilled in two phases. In Phase I four wells will be drilled and tested: Two to the top of the uppermost aquifer (water table) and two as characterization boreholes to the top of basalt. The Phase I wells are located in the northern portion of the proposed ERDF site (699-32-72, 699-SDF-6, -7 and -8) (Figure 1). If Phase II drilling proceeds, the remaining three wells will be installed and tested (two deep and one shallow). A phased approach to drilling is warranted because of current uncertainty in the land use requirements at the proposed ERDF.

2531 (WHC-SD-EN-TP-038) Aquifer test plan for two wells at the proposed C-018H disposal site. Swanson,

L.C. Westinghouse Hanford Co., Richland, WA (United States). [1994]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94008076. Source: OSTI; NTIS; GPO Dep.

Aquifer testing will be conducted at groundwater monitoring well No. 3 at the proposed State-Approved Land Disposal Site (SALDS) north of the 200 West Area. Hydrologic testing will consist of instantaneous slug tests and constant rate discharge tests in a "drill-and-test" type sequence. Well No. 2 will be installed as a shallow groundwater monitoring well prior to testing, and used as an observation well during the constant rate discharge tests at well No. 3. Pumping tests will be performed at two to three intervals during the drilling process at well No. 3. Aquifer test results (hydraulic conductivities) will be used to refine estimates of groundwater travel time from the SALDS to the Columbia River. The SALDS location was selected because it provides the longest travel time to the Columbia River, allowing sufficient time for the tritium to decay to acceptable levels before entering the river.

2532 (WHC-SD-EN-TP-039) Integrated test plan for crosswell compressional and shear wave seismic tomography for site characterization at the VOC Arid Site. Elbring, G.J.; Narbutovskih, S.M. Westinghouse Hanford Co., Richland, WA (United States). 1 Feb 1994. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94006995. Source: OSTI; NTIS; INIS; GPO Dep.

This integrated test plan describes the demonstration of the crosswell acoustic tomography technique as part of the Volatile Organic Compounds-Arid Integrated Demonstration (VOC-Arid ID). The purpose of this demonstration is to image the subsurface seismic velocity structure and to relate the resulting velocity model to lithology and saturation. In fiscal year (FY) 1994 an initial fielding will test three different downhole sources at two different sites at the Hanford US Department of Energy facility to identify which sources will provide the energy required to propagate between existing steel-cased wells at these two sites. Once this has been established, a second fielding will perform a full compressional and shear wave tomographic survey at the most favorable site. Data reduction, analysis, and interpretation of this full data set will be completed by the end of this fiscal year. Data collection for a second survey will be completed by the end of the fiscal year, and data reduction for this data set will be completed in FY 1995. The specific need is detailed subsurface characterization with minimum intrusion. This technique also has applications for long term vadose zone monitoring for both Resource Conservation and Recovery Act (RCRA) waste storage facilities and for remediation monitoring. Images produced are continuous between boreholes. This is a significant improvement over the single point data derived solely from core information. Saturation changes, either naturally occurring (e.g., perched water tables) or remediation induced (e.g., water table mounding from injection wells or during inwell air sparging) could be imaged. These crosswell data allow optimal borehole placement for groundwater remediation, associated monitoring wells and possibly evaluation of the effective influence of a particular remediation technique.

2533 (WSRC-TR-93-459) Characterization of the geology, geochemistry, and microbiology of the radio frequency heating demonstration site at the Savannah River Site. Eddy Dilek, C.A.; Jarosch, T.R.; Fliermans, C.B.; Looney, B.B.; Parker, W.H. Westinghouse Savannah River

Co., Aiken, SC (United States). Aug 1993. 189p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE94003819. Source: OSTI; NTIS; INIS; GPO Dep.

The overall objective of the Integrated Demonstration Project for the Remediation of Organics at Nonrad Sites at the Savannah River Site (SRS) is to evaluate innovative remediation, characterization, and monitoring systems to facilitate restoration of contaminated sites. The first phase of the demonstration focused on the application and development of in situ air stripping technologies to remediate sediments and groundwater contaminated with volatile organic compounds (VOCs). The second phase focused on the enhancement of the in situ air stripping process by adding selected nutrients to stimulate naturally occurring microorganisms that degrade VOCs. The purpose of the third phase was to evaluate the use of heating technologies [radio frequency (rf) and ohmic heating] to enhance the removal of contamination from clay layers where mass transfer is limited. The objective of this report is to document pretest and post-test data collected in support of the rf heating demonstration. The following data are discussed in this report: (1) a general description of the site including piezometers and sensors installed to monitor the remedial process; (2) stratigraphy, lithology, and a detailed geologic cross section of the study site; (3) tabulations of pretest and post-test moisture and VOC content of the sediments; (4) sampling and analysis procedures for sediment samples; (5) microbial abundance and diversity; (6) three-dimensional images of pretest and post-test contaminant distribution; (7) volumetric calculations.

2534 (Y/ER-3) Work plan, health and safety plan, and site characterization for the Rust Spoil Area (D-106). Bohman, D.E.; Uziel, M.S.; Landguth, D.C.; Hawthorne, S.W. Oak Ridge Y-12 Plant, TN (United States). Jun 1990. 95p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OS21400. Order Number DE92019627. Source: OSTI; NTIS; INIS; GPO Dep.

As part of the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) of the Department of Energy's Y-12 Plant located in Oak Ridge, Tennessee, this work plan has been developed for the Rust Spoil Area (a solid waste disposal area). The work plan was developed by the Measurement Applications and Development Group (MAD) of the Health and Safety Research Division (HASRD) at Oak Ridge National Laboratory (ORNL) and will be implemented jointly by ORNL/MAD and the Y-12 Environmental Surveillance Section. This plan consists of four major sections: (1) a project description giving the scope and objectives of the investigation at the Rust Spoil Area; (2) field and sampling procedures describing sample documentation, soil sampling techniques, sample packaging and preservation, equipment decontamination, and disposal of investigation generated wastes; (3) sample analysis procedures detailing necessary analytical laboratory procedures to ensure the quality of chemical results from sample receipt through analysis and data reporting; and (4) a health and safety plan which describes general site hazards and particular hazards associated with specific tasks, assigns responsibilities, establishes personnel protection standards and mandatory safety procedures, and provides emergency information for contingencies that may arise during the course of field operations.

2535 (Y/ER/Sub-90/97777/2) Remedial investigation report for Chestnut Ridge OU 2 (Filled Coal Ash Pond/

McCoy Branch) at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee: Environmental Restoration Program. Martin Marietta Energy Systems, Inc., Oak Ridge, TN (United States); CH2M Hill Southeast, Inc., Oak Ridge, TN (United States). Dec 1991. 626p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OS21400. (ES/ER-23D1). Order Number DE92005401. Source: OSTI; NTIS; INIS; GPO Dep.

CH2M HILL was contracted by Energy Systems to conduct a Remedial Investigation (RI) for Solid Waste Management Unit (SWMU) D-112, the Filled Coal Ash Pond (FCAP), at the Y-12 Plant. This site is identified by Energy Systems as associated with the Y-12 Plant Group 3 Sites. The RI was conducted in accordance with an existing RCRA Facility Investigation plan prepared by Battelle Columbus Division. The site investigation was conducted to define the nature and extent of contamination at the SWMU; it was designed to collect information to assess the migration pathways of contaminants and to assess the potential risk to human health from site contaminants. An alternatives assessment was also conducted to identify preliminary remedial alternatives appropriate for the SWMU.

2536 (Y/ER/Sub-91-ALV96/2-Draft) Draft postclosure permit application for Bear Creek Hydrogeologic Regime at the Oak Ridge Y-12 Plant Oil Landform Hazardous Waste Disposal Unit: Revision. Oak Ridge Y-12 Plant, TN (United States); Geraghty and Miller, Inc., Oak Ridge, TN (United States). Aug 1991. 376p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OS21400. Order Number DE92005403. Source: OSTI; NTIS; INIS; GPO Dep.

The Oil Landfarm Hazardous-Waste Disposal Unit (HWDU) is located approximately one and one-half miles west of the Department of Energy's (DOE) Y-12 Plant in Oak Ridge, Tennessee. The Oil Landfarm HWDU consists of three disposal plots and along with the Bear Creek Burial Grounds and the S-3 Site comprise the Bear Creek Valley Waste Disposal Area (BCVWDA). The facility was used for the biological degradation of waste oil and machine coolants via landfarming, a process involving the application of waste oils and coolants to nutrient-adjusted soil during the dry months of the year (April to October). The Oil Landfarm HWDU has been closed as a hazardous-waste disposal unit and therefore will be subject to post-closure care. The closure plan for the Oil Landfarm HWDU is provided in Appendix A.1. A post-closure plan for the Oil Landfarm HWDU is presented in Appendix A.2. The purpose of this plan is to identify and describe the activities that will be performed during the post-closure care period. This plan will be implemented and will continue throughout the post-closure care period.

2537 (Y/TS-1016) Identification and characterization of wetlands in the Bear Creek watershed. Rosensteel, B.A. (JAYCOR, Oak Ridge, TN (United States)); Trettin, C.C. Oak Ridge Y-12 Plant, TN (United States); Oak Ridge National Lab., TN (United States). Oct 1993. 65p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OS21400. (ORNL/M-3070). Order Number DE94002538. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental Sciences Division Publication No. 4075.

The primary objective of this study was to identify, characterize, and map the wetlands in the Bear Creek watershed. A preliminary wetland categorization system based on the Cowardin classification system (Cowardin et al. 1979) with additional site-specific topographic, vegetation, and

disturbance characteristic modifiers was developed to characterize the type of wetlands that exist in the Bear Creek watershed. An additional objective was to detect possible relationships among site soils, hydrology, and the occurrence of wetlands in the watershed through a comparison of existing data with the field survey. Research needs are discussed in the context of wetland functions and values and regulatory requirements for wetland impact assessment and compensatory mitigation.

TECHNOLOGY INTEGRATION AND INTERNATIONAL TECHNOLOGY EXCHANGE

Refer also to citation(s) 252

2538 (ANL/CMT/CP-80402) **Development of an Integrated Performance Evaluation Program (IPEP) for the Department of Energy's Office of Environmental Restoration and Waste Management.** Streets, W.E. (Argonne National Lab., IL (United States)); Ka; Lindahl, P.C.; Bottrell, D.; Newberry, R.; Klusek, C.; Morton, S.; Karp, K. Argonne National Lab., IL (United States). [1993]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9309139-5: 20. American Society for Quality Control (ASQC) national energy and environmental annual conference, Indian Wells, CA (United States), 19-22 Sep 1993). Order Number DE93019767. Source: OSTI; NTIS; INIS; GPO Dep.

Argonne National Laboratory (ANL), in collaboration with DOE's Radiological and Environmental Sciences Laboratory (RESL), Environmental Measurements Laboratory (EML), and Grand Junction Project Office (GJPO), is working with the Department of Energy (DOE) Headquarters and the US Environmental Protection Agency (EPA) to develop the Integrated Performance Evaluation Program (IPEP). The purpose of IPEP is to integrate performance evaluation (PE) information from existing PE programs with expanded quality assurance (QA) activities to develop information about the quality of radiological, mixed waste, and hazardous environmental sample analyses provided by all laboratories supporting DOE Environmental Restoration and Waste Management (EM) programs. The IPEP plans to utilize existing PE programs when available and appropriate for use by DOE-EM; new PE programs will be developed only when no existing program meets DOE's needs.

2539 (CONF-901285-) **Solvent substitution: A proceedings/compendium of papers.** USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). Office of Technology Development; Air Force Engineering and Services Center, Tyndall AFB, FL (United States). [1990]. 339p. Sponsored by USDOE, Washington, DC (United States); Department of Defense, Washington, DC (United States). DOE Contract AC07-76ID01570. From USAF/DOE workshop on solvent substitution; Phoenix, AZ (United States); 4-7 Dec 1990. Order Number DE92003262. Source: OSTI; NTIS; INIS; GPO Dep.

The DOE Environmental Restoration and Waste Management Office of Technology Development and the Air Force Engineering and Services Center convened the First Annual International Workshop on Solvent Substitution on December 4-7, 1990. The primary objectives of this joint effort

were to share information and ideas among attendees in order to enhance the development and implementation of required new technologies for the elimination of pollutants associated with industrial use of hazardous and toxic solvents; and to aid in accelerating collaborative efforts and technology transfer between government and industry for solvent substitution. There were workshop sessions focusing on Alternative Technologies, Alternative Solvents, Recovery/Recycling, Low VOC Materials and Treatment for Environmentally Safe Disposal. The 35 invited papers presented covered a wide range of solvent substitution activities including: hardware and weapons production and maintenance, paint stripping, coating applications, printed circuit boards, metal cleaning, metal finishing, manufacturing, compliance monitoring and process control monitoring. This publication includes the majority of these presentations. In addition, in order to further facilitate information exchange and technology transfer, the US Air Force and DOE solicited additional papers under a general "Call for Papers." These papers, which underwent review and final selection by a peer review committee, are also included in this combined Proceedings/Compendium. For those involved in handling, using or managing hazardous and toxic solvents, this document should prove to be a valuable resource, providing the most up-to-date information on current technologies and practices in solvent substitution. Individual papers are abstracted separated.

2540 (CONF-9108226-Summ.) **Proceedings of Industrial needs workshop.** USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). Office of Technology Development. Jan 1992. 33p. Sponsored by USDOE, Washington, DC (United States). From Industrial needs workshop; Washington, DC (United States); 27-28 Aug 1991. Order Number DE93005316. Source: OSTI; NTIS; GPO Dep.

DOE is holding a series of workshops to encourage the participation of the private sector in US. Department of Energy's (DOE) environmental remediation and management activities. The workshops are designed to solicit private industry's concerns and recommendations in order to develop better cooperative programs. The first of these Industrial Needs Workshops was held August 27-28 1991. The goals of this workshop were to: Seek industry input on improving collaboration between private sector and DOE on environmental management efforts; initiate alliances with workshop participants who are representative of the US environmental management industry; discuss existing DOE/industry relationships leading to improved cooperative alliances; Provide a foundation and catalyst for future industrial outreach activities; document workshop results with proceedings containing critical issues and recommendations as defined by industry. The workshop was designed to solicit candid comments from industry representatives on their current interactions with DOE's environmental management efforts, and their recommendations for improving these interactions. The workshop focused on five key areas: Institutional; Communications; Procurement; Integrated Demonstrations; and Legal.

2541 (DOE/DP/48075-7) **A proposed office of technology development education program.** Virginia Polytechnic Inst. and State Univ., Blacksburg, VA (United States). Waste Policy Inst. [1992]. 46p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG07-89DP48075. Order Number DE93005143. Source: OSTI; NTIS; GPO Dep.

The office of Environmental Restoration and Waste Management (EM) was formed within the US Department of Energy (DOE) to clean up radioactive and hazardous wastes on US government sites associated with the production and use of nuclear weapon materials. In order to insure the development and demonstration of technologies necessary for the task, EM established an office of Technology Development (OTD). Furthermore, in order to accomplish this massive effort, DOE and its contractors will need large numbers of technically trained people. Because of the demands on the same pool of such individuals by other government agencies and the private sector, it is not clear that the supply will be sufficient to meet the competing demands.

2542 (DOE/DP/48075-8) Implementation of the DOE Office of Technology Development Strategic Program Plan for Environmental Education and Development. Prestwich, S.M. (USDOE, Washington, DC (United States)); Chee, T.C.; Middleman, L.I. Waste Policy Inst., Blacksburg, VA (United States). [1992]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG07-89DP48075. (CONF-920307-91: Waste management '92, Tucson, AZ (United States), 1-5 Mar 1992). Order Number DE93005144. Source: OSTI; NTIS; GPO Dep.

With the November 1989 formation of the Office of Technology Development (OTD) within the Office of Environmental Restoration and Waste Management (EM) came the responsibility to develop programs to ensure that enough trained and educated people would be available to support the achievement of EM's 30-year goal. This mission responsibility derives from public policy and Departmental environmental management requirements. Within DOE, urgency to move forward resulted from the assumptions (1) that the current workforce was insufficiently prepared for the transition from a production mission to a mission of environmental compliance and cleanup; and (2) that, given current trends and forecasts, the national education infrastructure was unlikely to yield the scientists, engineers, and technicians to meet future DOE workforce needs, especially in the case of women and minorities who, projected to make up two-thirds of the net entering workforce by the year 2000, have traditionally been least prepared for and inclined to enter scientific and technical fields. This paper displays DOE's environmental education and development mission, goals, and strategy, and describes progress in and plans for implementing this strategy.

2543 (DOE/EM-0011P) Long-range plan for technology integration programs, Office of Technology Development. USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). May 1991. 50p. Sponsored by USDOE, Washington, DC (USA). Order Number DE91012191. Source: OSTI; NTIS; GPO Dep.

This long-range plan describes the Technology Integration Programs (TIP) that support the mission of the Office of Technology Development (OTD), within the US Department of Energy's (DOE) Office of Environmental Restoration and Waste Management (EM). TIP will provide the structure to facilitate applications of innovative environmental technologies through collaborative partnerships with US industry, the National laboratories, other Federal agencies, universities, and appropriate international participants. The TIP mission is to transfer information, knowledge, concepts, and technology in, out, and among interested users. The TIP will provide the structure to infuse faster, better, safer, and

cheaper technology across DOE sites to accomplish its 30-year clean-up goal, while maintaining and achieving compliance. In addition, TIP will successfully transfer OTD-developed environmental technology to potential users. 8 refs., 9 figs., 4 tabs.

2544 (DOE/EM-0012P) Technology Integration Branch FY 1991 program plan, Office of Technology Development. USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). May 1991. 31p. Sponsored by USDOE, Washington, DC (USA). Order Number DE91012276. Source: OSTI; NTIS; GPO Dep.

The US Department of Energy (DOE) is committed to a 30-year goal to clean up and restore the environment at its nuclear sites. The Office of Technology Development (OTD) was established to help achieve this goal. Its mission is to rapidly develop and apply existing and innovative environmental restoration and waste management technologies in a way that meets applicable regulations. This document provides an overview of the Technology Integration Programs (TIP) that support the mission of the Office of Technology Development (OTD), Environmental Restoration and Waste Management (EM), US Department of Energy (DOE). It serves as a guide for the TIP for FY 91. This plan has been discussed with the field at complex-wide management meetings and comments have been incorporated. The TIP were established to facilitate applications of technologies through collaborative partnership with US industry, the National laboratories, other Federal Agencies, universities, and appropriate international participants. 6 refs., 4 figs., 1 tab.

2545 (DOE/EM-0058P) Environmental Education Strategic Plan. USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). Office of Technology Development. Dec 1991. 72p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92007163. Source: OSTI; NTIS; GPO Dep.

This document is designed to guide the Environmental Education and Development Branch (EM-522) of the EM Office of Technology (OTD) Development, Technology Integration and Environmental Education Division (EM-52) in planning and executing its program through EM staff, Operations Offices, National Laboratories, contractors, and others.

2546 (DOE/EM-0060P) Technology Integration Division FY 1992 Public Participation Program Management and Implementation Plan. USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). Dec 1991. 49p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92007385. Source: OSTI; NTIS; INIS; GPO Dep.

The mission of the Office of Technology Development (OTD), to develop and apply existing and innovative environmental restoration and waste management technologies to the cleanup of Department of Energy (DOE) sites and facilities in accordance with applicable regulations, is to be carried out through the central mechanisms of the Integrated Demonstration (ID) and Integrated Program (IP). Regulations include provisions for public participation in DOE decision making regarding IDs. Beyond these requirements, DOE seeks to foster a more open culture in which public participation, based on two-way communication between DOE and the public, is not only welcomed, but actively encouraged. The public to which the Program is addressed actually consists of several distinct "publics:" state and local

government officials; Indian tribes; citizen groups and individuals concerned about specific issues; citizen groups or individuals who are opinion leaders in their communities; other federal agencies; private industry; and academia involved in IDs. Participation of these publics in decision making means that their concerns, needs, objectives, and other input are identified by two-way communication between them and DOE, and that these factors are considered when decisions made about OTD activities. This plan outlines the TIPs Public Participation Program goals, objectives, and steps to be taken during Fiscal Year (FY) 1992 to move toward those goals and objectives, based on the challenges and opportunities currently recognized or assumed.

2547 (DOE/EM-0061P) Technology Integration Programs: Fiscal year 1992 Regulatory Coordination Program Management and Implementation Plan. USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). Dec 1991. 18p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92007386. Source: OSTI; NTIS; GPO Dep.

One mission of the Office of Technology Development (OTD) Technology Integration Programs (TIPs) is to facilitate Integrated Demonstrations (IDs). TIPs Regulatory Coordination Program is critical to the success of OTD Technology Integration Programs because it ensures that all ID activities are implemented consistently with applicable regulations and that regulators participate in the implementation process. Through the TIPs Regulatory Coordination Program, OTD coordinates with other offices within DOE, and other Federal and state agencies, to resolve regulatory issues related to IDs. TIPs also assists the ID Coordinators (IDCs) in defining ID regulatory requirements and identifying barriers to compliance. This plan outlines the goals and objectives of the TIPs Regulatory Coordination Program, as well as actions needed for implementation. The program's overall goals are: (1) to provide regulatory guidance to IDs; (2) to attain and maintain awareness of current and emerging regulations and how they affect the IDs; and (3) to coordinate regularly with other Federal agencies to address common issues. TIPs has the following goals for Fiscal Year (FY) 1992: (1) to identify needs of IDCs for regulatory compliance of the IDs; (2) to identify and establish linkages with decision makers in the regulatory arena; and (3) to enhance the regulatory skills of ID personnel, based on risk-based decision making.

2548 (DOE/EM-0062P) Technology Integration Division FY 1992 Technology Integration Programs Plan, Office of Technology Development. USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). Dec 1991. 50p. Sponsored by USDOE, Washington, DC (United States). Order Number DE92007387. Source: OSTI; NTIS; GPO Dep.

This plan describes Technology Integration Programs (TIPs) missions and activities to be initiated and implemented in Fiscal Year (FY) 1992, to support the mission of the Office of Technology Development (OTD), Environmental Restoration and Waste Management (EM), US Department of Energy (DOE). This document, to serve as a guide for TIP's program planning and implementation, provides information on TIP's goals and missions, planning assumptions, and program benefits. This plan also describes TIP's concept of operations, TIPs participants' roles and responsibilities, FY 1992 program implementation activities, program management controls, and planning/evaluation mechanisms. OTD, as the support organization for EM's Offices of Environmental Restoration and Waste Operations, is

to develop and apply innovative environmental technology systems to DOE Environmental Restoration (ER) and Waste Management (WM) site-specific needs. These OTD-initiated activities are to be conducted in a manner that will facilitate compliance with applicable laws, regulations, and agreements and minimize the generation of waste. To fulfill its mission requirements, OTD established TIPs to work with industry, universities, and other government agencies and programs to build public-private collaborative partnerships. TIP's three-part mission is to facilitate the transfer of EM-relevant information, knowledge, concepts, and technology into and out of DOE and among interested parties.

2549 (DOE/EM-0099) EM International: Volume 1. USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). Jul 1993. 44p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94001564. Source: OSTI; NTIS; GPO Dep.

It is the intent of EM International to describe the Office of Environmental Restoration and Waste Management's (EM's) various roles and responsibilities within the international community. Cooperative agreements and programs, descriptions of projects and technologies, and synopses of visits to international sites are all highlighted in this semiannual journal. Focus on EM programs in this issue is on international collaboration in vitrification projects. Technology highlights covers: in situ sealing for contaminated sites; and remote sensors for toxic pollutants. Section on profiles of countries includes: Arctic contamination by the former Soviet Union, and EM activities with Germany-cooperative arrangements.

2550 (DOE/EM-0138P) Technology Catalogue: First edition. USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). Office of Technology Development. Feb 1994. 211p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94008866. Source: OSTI; NTIS; INIS; GPO Dep.

The Department of Energy's Office of Environmental Restoration and Waste Management (EM) is responsible for remediating its contaminated sites and managing its waste inventory in a safe and efficient manner. EM's Office of Technology Development (OTD) supports applied research and demonstration efforts to develop and transfer innovative, cost-effective technologies to its site clean-up and waste management programs within EM's Office of Environmental Restoration and Office of Waste Management. The purpose of the Technology Catalogue is to provide performance data on OTD-developed technologies to scientists and engineers assessing and recommending technical solutions within the Department's clean-up and waste management programs, as well as to industry, other federal and state agencies, and the academic community. OTD's applied research and demonstration activities are conducted in programs referred to as Integrated Demonstrations (IDs) and Integrated Programs (IPs). The IDs test and evaluate systems, consisting of coupled technologies, at specific sites to address generic problems, such as the sensing, treatment, and disposal of buried waste containers. The IPs support applied research activities in specific applications areas, such as in situ remediation, efficient separations processes, and site characterization. The Technology Catalogue is a means for communicating the status of the development of these innovative technologies. The FY93 Technology Catalogue features technologies successfully demonstrated in the field through IDs and sufficiently mature to be used in the near-term. Technologies from the following

IDs are featured in the FY93 Technology Catalogue: Buried Waste ID (Idaho National Engineering Laboratory, Idaho); Mixed Waste Landfill ID (Sandia National Laboratories, New Mexico); Underground Storage Tank ID (Hanford, Washington); Volatile organic compound (VOC) Arid ID (Richland, Washington); and VOC Non-Arid ID (Savannah River Site, South Carolina).

2551 (DOE/EM-0141P) Environmental Education and Development Program. USDOE Assistant Secretary for Environmental Restoration and Waste Management, Washington, DC (United States). Office of Technology Integration and Environmental Education and Development. Mar 1994. 64p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94009188. Source: OSTI; NTIS; GPO Dep.

The Environmental Education and Development Program is a component on the effort to accomplish the Office of Environmental Restoration and Waste Management's (EM) goal of environmental compliance and cleanup of the 1989 inventory of inactive DOE sites and facilities by the year 2019. Education and Development programs were designed specifically to stimulate the knowledge and workforce capability necessary to achieve EM goals while contributing to DOE's overall goal of increasing scientific and technical literacy and competency. The primary implementation criterion for E&D activities involved a focus on programs and projects that had both immediate and long-range leveraging effects on infrastructure. This focus included programs that yielded short term results (one to five years), as well as long-term results, to ensure a steady supply of appropriately trained and educated human resources, including women and minorities, to meet EM's demands.

2552 (DOE/EM-0147P) Technology development needs summary, FY 1995. USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). Office of Technology Development. Mar 1994. 204p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94012580. Source: OSTI; NTIS; INIS; GPO Dep.

Historic activities of DOE during the period of nuclear weapons development, and disposal practices of that time, resulted in the discharge of chemical and radioactive materials to the environment at many DOE facilities and sites. DOE has now focused a major technical effort on mitigating the effects of those discharges through an environmental restoration program. Since this could lead to prohibitive costs if conventional technology is applied for remedial action, a national program will be initiated to develop and demonstrate faster, better, cheaper, and safer means of restoring the DOE sites to conditions that will meet state and federal environment regulations. Key elements of the initiative are the Integrated Programs and Integrated Demonstrations, which work together to identify possible solutions to major environmental problems. Needed statements are given for the following programs: mixed waste landfill, uranium in soils, VOC-arid, decontamination and decommissioning of facilities, buried waste, characterization/monitoring/sensor technology, mixed waste, in situ remediation, efficient separations/processing, minimum additive waste stabilization, supercritical water oxidation. A section on how to get involved is included.

2553 (DOE/EM-0153P) US - Former Soviet Union environmental restoration and waste management

activities, March 1994. USDOE Assistant Secretary for Environmental Management, Washington, DC (United States). Mar 1994. 49p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94012127. Source: OSTI; NTIS; INIS; GPO Dep.

The Peaceful Uses of Atomic Energy Agreement was signed between DOE and the Ministry of Atomic Energy for the Russian Federation and provides a mechanism for cooperation in research, development, and safe utilization of nuclear energy. Under the umbrella of this agreement, DOE and the former Ministry of Atomic Power and Industry signed a Memorandum of Cooperation in the areas of environmental restoration and waste management in September 1990. This document discusses the environmental situation, science and technology process, technical projects (separations, contaminant transport, waste treatment, environmental restoration), scientist exchanges, enhanced data transfer, the US-Russia industry partnership (conference, centers), and future actions.

2554 (DOE/FTR-93010493) [Coordination of work on two-phase flow properties in halite and anhydrite]: Foreign trip report, November 5-18, 1992. Howarth, S.M. Sandia National Labs., Albuquerque, NM (United States). 9 Dec 1992. 87p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93010493. Source: OSTI; NTIS (US Sales Only); GPO Dep.

An information exchange and coordination meeting was held with German scientists from Gesellschaft für Reaktorsicherheit (GRS) and Forschungszentrum Jülich (KFA) on November 16 and 17, 1992 in Jülich GERMANY to discuss coordination of work on two-phase flow properties in halite and anhydrite. The agenda included an initial exchange and planning meeting and technical discussions of the planned WIPP two-phase flow laboratory program, laboratory experimental methods, and the need to develop new experimental techniques. Tours of the German laboratory facilities (GRS, Jülich Research Center) and the Asse Test Facility were also provided.

2555 (DOE/FTR-93010639) [Environmental aspects of solid waste technology]: Foreign trip report, September 11-20, 1992. Jasen, W.G. Westinghouse Hanford Co., Richland, WA (United States). 1992. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93010639. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The purpose of the trip was to present a paper at the Third Annual Scientific-Technical Conference of the Soviet Nuclear Society in St. Petersburg, Russia, sponsored by the Soviet Nuclear Society and cosponsored by the European and American Nuclear Societies. The conference was the third annual meeting of this type in Russia providing a forum to discuss trends, new research, issues and problems associated with most matters related to nuclear energy. Judging by the size of the proceedings and the number of participants, this was the first conference that could be construed as international in nature. In the future, this conference could be better integrated with other international conferences such as the joint international waste management conference which is held every two years.

2556 (DOE/FTR-93010782) Travel to Russia to convene a technology exchange workshop on chemical separations at the Khlopin Radium Institute in St. Petersburg, and to conduct the second meeting of the US

DOE-Russian MINATOM Joint Coordinating Committee on Environmental Restoration and Waste Management (JCCEM) in Moscow: Foreign trip report, October 30–November 7, 1992. Bradley, D.J. (Pacific Northwest Lab., Richland, WA (United States)); Frank, C.W.; Fryberger, T.A.; De La Torre, G.; Solecki, J.E.; Carlson, T.J.; Hunter, T.O.; Keen, R.N. Sandia National Labs., Albuquerque, NM (United States). 6 Dec 1992. 78p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93010782. Source: OSTI; NTIS (US Sales Only); GPO Dep.

A US Department of Energy (DOE) delegation, led by Dr Clyde Frank, visited Russia from November 1–6, 1992 to conduct a technology exchange workshop at the Khlopin Radium Institute in St. Petersburg in the area of chemical separations or partitioning. This technology is of interest due to the possibility of reducing the amount of radioactive materials, via chemical separation and concentration, that may have to be disposed of. Presentations on separations chemistry activities were presented by both US and Russian scientists. A basis for a continuing scope of work for application of Russian separations technology for processing US radioactive wastes was prepared for review. A US DOE/Russian Joint Coordinating Committee on Environmental Restoration and Waste Management (JCCEM) meeting was held in Moscow on November 4–5, 1992 to discuss the progress made to date on technology exchanges in the four areas agreed upon at the first JCCEM meeting. In waste vitrification, the first of the areas to be discussed, it was agreed that cooperation should continue, but that specific goals should be defined. Similarly, continuing cooperation in the field of contaminant transport modeling, as outlined during the October 1991 technology exchange meeting, was agreed to. Work done at the Khlopin Radium Institute in the third technology area, chemical separations, was reviewed and the meeting record signed in St. Petersburg, including the basis for continuing studies, was approved. The last technology exchange area, that of student and scientist exchanges, brought forth several areas of discussion. This activity is to continue, but the scope, benefits and objectives should be redefined to address non-technical areas of great importance to the JCCEM, such as intellectual property rights.

2557 (DOE/FTR-93010923) [Travel to France to discuss radioactive waste management and treatment technologies]: Foreign trip report, August 26–30, 1991. Cash, R.J.; Gilchrist, R.L.; Wodrich, D.D. Westinghouse Hanford Co., Richland, WA (United States). 1991. 42p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830 ; AC06-87RL10930. Order Number DE93010923. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This trip was one of a series of international fact-finding visits sponsored by the Department of Energy (DOE) Office of Environmental Restoration and Waste Management (EM) to obtain and share information with the French on storage, treatment and management of radioactive wastes. The trip was organized by DOE/EM and NUMATEC Corporation (Bethesda, MD) to follow up on a high-level DOE delegation visit to France on July 1–5, 1991. The purpose of the trip was twofold: (1) to discuss with French scientists the technologies developed at Cadarache and in use at LaHague to treat intermediate level liquid radioactive waste for possible application to the high-level waste (HLW) stored at Hanford and other DOE sites and (2) to share data with French scientists on the potential hazards of using ferrocyanide in

treatment processes where both oxidizers and elevated temperatures are also present. The US delegation consisted of two teams, a Waste Pretreatment Team and a Ferrocyanide Team. The two teams generally participated in common discussions with the French representatives; however, the two teams did meet separately during several sessions to discuss their specific areas of concern in more detail.

2558 (DOE/FTR-93011057) [Travel to The Netherlands and Russia to assess international electrokinetic technology as applied to remedial treatment of metal-contaminated soils and groundwater]: Foreign trip report, December 11–19, 1991. Adams, R.E. Martin Marietta Energy Systems, Inc., Oak Ridge, TN (United States). 1991. 59p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93011057. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The purpose of this trip was to serve as a member of an evaluation team composed of the Department of Energy (DOE) and DOE contractor personnel to evaluate and assess the state of international electrokinetic technology as it is being applied to the remedial treatment of metal-contaminated soils and groundwater. This travel was requested by the DOE Office of Technology Development (OTD) to determine whether electrokinetic technology research, development, and field demonstrations on foreign soils and groundwater have applicability for the remediation of metal contamination at DOE sites.

2559 (DOE/FTR-93011412) Summary of US Delegation visit to Germany emphasizing environmental restoration of uranium mining and milling facilities: Foreign trip report, June 29–July 11, 1992. USDOE Albuquerque Field Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office; Jacobs Engineering Group, Inc., Albuquerque, NM (United States). Jul 1992. 72p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93011412. Source: OSTI; NTIS (US Sales Only); GPO Dep.

A Delegation of US representatives visited Germany from July 1 through July 10, 1992, to explore areas of possible technology exchange in the field of environmental restoration and waste management. A primary goal was to determine the scope of the German effort to environmentally restore uranium mining and milling facilities operated by the former East German Government for the former Soviet Union during the cold war era. A related purpose of the Delegation was to identify potential areas for an exchange of information, equipment and/or personnel on the basis of reciprocity and mutual benefit to the respective national environmental programs. An Advanced Delegation of personnel from the Uranium Mill Tailings Remedial Act Project Office (including Department of Energy (DOE) and Jacobs Engineering) visited the former East German mining and milling district from July 1 through July 5. Their purpose was to select appropriate sites for the Primary Delegation which began its visit on July 6. Three WISMUT facilities were selected; and, the entire Delegation, headed by Pat Whitfield of DOE and accompanied by Bob Dyer of EPA, Kay Whitfield of NRC, Ralph Lightner of DOE, and the Advance Delegation members, toured these areas. A detailed itinerary of both groups is shown in Appendix A. Appendix B shows selected photos of the sites visited. Appendix C shows the business cards of the German individuals who were visited.

2560 (DOE/FTR-93011432) **[Travel to Belgium to attend Workshop on In situ testing of radioactive waste forms and engineered barriers]: Foreign trip report, October 10-17, 1992.** Molecke, M.A.; Sorensen, N.R. Sandia National Labs., Albuquerque, NM (United States). 11 Nov 1992. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93011432. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Three technical papers were presented at the Workshop on In Situ Testing of Radioactive Waste Forms and Engineered Barriers, held in Corsendonk, Belgium, on October 13-16, 1992. These papers are: 1. "Materials Interface Interactions Test (MIIT): Details and Observations on In Situ Sample Retrievals and Test Termination," SAND92-1954C; 2. "Summary of the WIPP Materials Interface Interactions Test - Metal Corrosion" SAND92-1921C; and, 3. "An Overview of the Materials Interface Interactions Tests (MIIT) After Five Years of Testing - 1092 Update," WSRC-MS-92-392 /and SAND92-1953C. Interactive discussions were made with multiple foreign scientists on the topics of both WIPP and several foreign in situ tests, results, and future plans on the subject of nuclear waste package performance testing. A technical site tour was made of the Studiecentrum voor Kernenergie/Centre D'Energie Nucleaire (SCK/CEN) laboratories and HADES Underground Research Facility (U.R.F.), in Mol, Belgium, on the last day of the workshop.

2561 (DOE/FTR-93012248) **Radioactive waste management and environmental restoration issues in England: Foreign trip report, January 24-29, 1993.** Whitfield, R.P. (USDOE Assistant Secretary for Environmental Restoration and Waste Management, Washington, DC (United States)); King, W.H.H.; Adams, W.D.; Craig, J.R. Jr.; Whitfield, H.K.; Dyer, R.S. USDOE Assistant Secretary for Environmental Restoration and Waste Management, Washington, DC (United States). 26 Feb 1993. 8p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93012248. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The purpose of the trip was to gain an understanding of British regulations (and the evolution of these regulations) which permit recycling of previously radioactive-contaminated materials to the British economy; to review the British approach to the application of environmental regulations to nuclear cleanup activities; to observe the British method of communicating controversial information to the public; and to tour various facilities where radioactive waste management and environmental restoration activities are conducted.

2562 (DOE/FTR-93012360) **Travel to Russia to convene a technology exchange workshop in the area of chemical separations or partitioning of elements from radioactive waste streams: Foreign trip report, October 29-November 7, 1992.** Bradley, D.J. (Pacific Northwest Lab., Richland, WA (United States)); Frank, C.W.; Fryberger, T.A.; De LaTorre, G.; Solecki, J.E. USDOE, Washington, DC (United States). 6 Dec 1992. 79p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93012360. Source: OSTI; NTIS (US Sales Only); GPO Dep.

A US Department of Energy (DOE) delegation, led by Dr. Clyde Frank, visited Russia from November 1-6, 1992 to conduct a technology exchange workshop at the Khlopin Radium Institute in St. Petersburg in the area of chemical separations or partitioning. This technology is of interest due

to the possibility of reducing the amount of radioactive materials, via chemical separation and concentration, that may have to be disposed of. An initial joint US DOE/Khlopin Radium Institute study, completed in September 1992, was reviewed and the final report from this work is attached as Appendix A. Presentations on separations chemistry activities were presented by both US and Russian scientists. A basis for a continuing scope of work for application of Russian separations technology for processing US radioactive wastes was prepared for review. Waste streams in addition to those at Hanford will also be considered.

2563 (DOE/FTR-93012976) **Travel to the Envirotech Vienna 1992 conference in Vienna, Austria to obtain current information related to waste management activities and technologies: Foreign trip report, April 21-24, 1992.** Motes, B.G. EG and G Idaho, Inc., Idaho Falls, ID (United States). 22 Jun 1992. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93012976. Source: OSTI; NTIS (US Sales Only); GPO Dep.

During the conference, approximately 80 papers were presented in 12 technical sessions and one poster paper session. The papers were divided into the following subject areas: Waste minimization and avoidance; circular recycling processes; assessment, development and waste management perspectives; development and reduction of packaging; industrial wastes treatment; legislation and guidelines; detection, test methods, monitoring, and assessment of contaminated sites; site remediation; leachates; bioremediation of soils; surface and groundwater purification; and wastewater treatment. The comprehensive section of the report summarizes selected papers grouped by country. The titles of other papers presented are also provided by country. In addition, pertinent discussions with attendees are incorporated. In summary, the US is the world leader in waste management, including overall technology. A number of other more industrialized countries have established waste management programs and are aggressively addressing their waste management problems. The former soviet block countries are only initiating their waste management programs and are seeking foreign support and technology. A number of foreign countries have or are developing innovative technologies potentially applicable to site remediation in the US.

2564 (DOE/FTR-93013397) **Travel to Japan to assess PNC's remote systems and robotics technologies for possible application in the DOE Environmental Restoration and Waste Management programs and to evaluate the potential for future exchange interactions: Foreign trip report, July 20-24, 1992.** Bennett, D.W. Pacific Northwest Lab., Richland, WA (United States). 28 Aug 1992. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93013397. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The purpose of this trip was to participate in a DOE delegation visiting Japan Power Reactor and Nuclear Fuels Development Corporation sites and facilities. The principle objective of the delegation was to evaluate the potential for future exchange interactions in the broad areas of robotics and remote technology associated with environmental restoration and waste management.

2565 (DOE/FTR-93013558) **[Travel to Mol, Belgium and Karlsruhe, Germany to discuss decommissioning**

technology and noble metals testing]: Foreign trip report, June 29–July 17, 1992. Calmus, R.B. (comp.). Westinghouse Hanford Co., Richland, WA (United States). 1992. 51p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93013558. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Based on discussions between Belgoprocess, the company responsible for conducting the Belgian Radioactive Waste Management Program and Hanford staff, Dr. E. C. Norman of the US Department of Energy, Richland Field Office (RL), and Mr. R. B. Calmus, Westinghouse Hanford Company (WHC), during the subject trip to Mol, Belgium, there is a distinct potential for establishing a decommissioning technology information exchange agreement between US Department of Energy and the Belgian State. It appears that if the PAMELA decommissioning activities are relevant to Hanford activities [specifically Hanford Waste Vitrification Plant (HWVP) melter decommissioning] and, if decommissioning activities at Hanford are of interest to the Belgians, a bilateral technology exchange agreement could be established. Kernforschungszentrum GmbH ESM Testing. The HWVP noble metals testing being conducted at Kernforschungszentrum GmbH [Karlsruhe Nuclear Research Center, (KfK)] in Karlsruhe, Germany, includes feed preparation and vitrification of five batches of HWVP FY 1991 reference simulant feed (four with noble metals and one without). The first batch scheduled for processing is void of noble metals (NM) and is being tested to provide equipment verification and melter operating parameters information. The remaining batches (4) contain the reference noble metals composition. The noble metals testing is expected to provide important information on noble metals effects on melter, and ancillary equipment, performance and provide input data to the HWVP melter performance assessment activity.

2566 (DOE/FTR-93013560) [Travel to England, Italy, France and Germany to conduct an evaluation of remote systems and robotics technology specifically applicable to the light-duty utility arm for use in underground storage tanks]: Foreign trip report, May 1–19, 1992. Gilchrist, R.L.; Yount, J.A.; Raymond, R.E. Westinghouse Hanford Co., Richland, WA (United States). 1992. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93013560. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The purpose of this trip was to conduct an evaluation of remote systems and robotics technology in the United Kingdom, France, Italy, and Germany, specifically applicable to the light-duty utility arm for use in underground storage tanks. Additionally, an evaluation was to be performed on the readiness of specific French technology (e.g., surface barriers and characterization) for direct application to the UST-ID.

2567 (DOE/FTR-93013658) Innovative technologies for cleaning the environment: Air, water, and soil: Foreign trip report, 21 April–2 May 1992. Bonano, E.J. (Sandia National Labs., Albuquerque, NM (United States)); Harrington, M.W. Sandia National Labs., Albuquerque, NM (United States); GRAM, Inc., Albuquerque, NM (United States). 28 Jul 1992. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93013658. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The objective of this trip was threefold: (1) present the EnviroTRADE Information System, (2) discuss the International Technology Exchange Program (ITEP), and (3) establish contacts that may be of particular benefit to this program. In this context, the trip was successful. The discussions on both the ITEP and EnviroTRADE generated a significant amount of interest for long-term interactions with representatives of organizations from other countries. The course was well coordinated in terms of the agenda and the presentations, which were informative and included a good mix of government, academic, laboratory, and private-sector technologies. One drawback was the lack of a true international representation.

2568 (DOE/FTR-93014405) Evaluation of Joint Department of Energy - German Environmental Restoration and Waste Management Projects: Foreign trip report, November 2–9, 1991. Hunter, T.O. Sandia National Labs., Albuquerque, NM (United States). [1993]. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93014405. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The Department of Energy Office of Environmental Restoration and Waste Management (DOE/EM) participated in a series of fact finding meetings and facility tours in Germany. Activities at the Karlsruhe KfK include: (1) decontamination and decommissioning of a major industrial site involving the cleanup of toxins such as dioxins, PCB'S, and heavy metals; (2) development of sensors for heavy metals, nitrate, ammonium, TCE, PCE, and biosensors; (3) development of an advanced waste incinerator (Tamara Test Facility); and (4) development of advanced vitrification technologies (WAK HLW Vitrification Plant). Across town at the University of Karlsruhe, a number of waste management projects of relevance to EM were reviewed including a field test for biological in situ remediation of a contaminated gasworks subsoil, an underpressure vaporizer well for the stripping of volatile organics from deep aquifers, new technology for the stripping of contaminants from the unsaturated zone, development of liners and covers, and advanced sampling techniques for water treatment and sludge stabilization.

2569 (DOE/FTR-93014498) Meetings on hydrogeologic studies associated with radioactive waste disposal: Foreign trip report, May 30–June 16, 1992. Beauheim, R.L. Sandia National Labs., Albuquerque, NM (United States). 6 Jul 1992. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93014498. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Meetings were held with Golder Associates Umwelttechnik to discuss equipment and procedures for gas-threshold-pressure testing. Gorleben, Moll and WIPP test cases were discussed at the INTRAVAL Working Group 3 meeting. A tour was taken of the SCK/CEN HADES Underground Research Facility in Mol, Belgium. A meeting was held with Geosigma to discuss tracers, procedures, and equipment used in tracer testing. Finnsjoen, Stripa, and WIPP test cases were discussed at the INTRAVAL Working Group 2 meeting. Plans for final reports were made at both INTRAVAL meetings. Tours were taken of the Swedish SFR and the Finnsjoen site.

2570 (DOE/FTR-93014810) Travel to Japan to witness current proof-of-concept testing activities and perform a quality surveillance on the laboratory procedures: Foreign trip report, February 6–16, 1992. Noble,

J.J.; Kelly, J.W. Westinghouse Hanford Co., Richland, WA (United States). 16 Mar 1992. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93014810. Source: OSTI; NTIS (US Sales Only); GPO Dep.

In November 1991, Kaiser Engineers Hanford Company (KEH) awarded contract KEH-5232 (C-018H) to JGC Corporation of Tokyo, Japan, for the design and construction of the Effluent Treatment Facility (ETF), Project C-018H. The contractor's schedule for Basic Engineering (30%) indicated all basic engineering, Proof of Concept testing and development of the process would be performed in their Yokohama and Oarai, Japan, facilities during the period January through April, 1992. The C-018H Integrated Management Team (IMT) determined that it was necessary to perform a progress assessment of the Basic Engineering and Proof of Concept Testing in February 1992, to assure the design and testing were proceeding according to schedule and within the parameters of the contract specification. In addition, and in support of this assessment, a Quality surveillance was planned.

2571 (DOE/FTR-93015303) Travel to Paris, France for the third meeting of the NEA Coordinating Group on site evaluation and design of experiments for radioactive waste disposal (SEDE): Foreign trip report, January 28-31, 1992. Tillerson, J.R. Sandia National Labs., Albuquerque, NM (United States). 26 Feb 1992. 54p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93015303. Source: OSTI; NTIS (US Sales Only); GPO Dep.

A trip was taken to Paris, France to actively participate in the OECD/NEA/SEDE coordinating group meeting. The meeting was held to identify interest in and potential projects for international cooperation that contribute to confidence building in site characterization capabilities. Participation would likely cost the WIPP program about \$30K/year; the most likely focus of efforts will be in flow in fractured media although no recognition was given to similar, ongoing cooperative efforts. discussions at the BGR in Hannover and during a visit to the Asse Mine in Germany identified that the construction of an important full-scale seal is about 1/3 complete and that details of planning, analysis, construction, and testing activities are of direct interest to the planning of large-scale seal tests needed within the next two years at the WIPP site. The large-scale test was planned because the staff and advisory committees believe they could not expect success without full-scale demonstrations of the construction and performance evaluations of seals.

2572 (DOE/FTR-93015529) Travel to Europe to evaluate electrokinetic technology applications to remedial treatment of metal contaminated soils and groundwater: Foreign trip report, December 11-18, 1991. Tyler, L.D. Sandia National Labs., Albuquerque, NM (United States). 12 Mar 1992. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93015529. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The purpose of this trip was to serve as a member of an evaluation team composed of the Department of Energy (DOE) and DOE contractor personnel to evaluate and assess the state of international electrokinetic technology as it is being applied to the remedial treatment of metal contaminated soils and groundwater. This travel was requested by DOE Office of Technology Development (OTD) to determine whether electrokinetic technology research, development,

and field demonstrations on foreign soils and groundwater have applicability for the remediation of metal contamination at DOE sites.

2573 (DOE/FTR-93017128) Travel to Europe to visit various underground waste disposal sites: Foreign trip report, May 10-20, 1993. Arthur, J. (USDOE, Washington, DC (United States)); Ellis, D.; Weart, W. Sandia National Labs., Livermore, CA (United States). [1993]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93017128. Source: OSTI; NTIS (US Sales Only); GPO Dep.

England's Department of Environment is in charge of all policies associated with all radioactive waste programs as well as the authorizing license. The United Kingdom's (UK) Department of Energy, which is under the UK's Department of Transportation, has the role of Conducting the safety assessment (the dose to workers) as well as being a stockholder in Nirex, which is in charge of deep geologic repository development. We were briefed on the current planning associated with the Nirex development of the deep geologic repository near the Sellafield/Driggs area of the UK. The facility is currently in the drilling stages collecting various geotechnical data and will plan at the end of 1993 to permit an underground laboratory. After construction, key geotechnical information will be collected for approximately five years, at which time they will plan to go operational. One of the keys to gaining acceptance in the region was to involve the public in discussions of the facility in an early stage. Because of opposition to negative visual impacts, the original plan to access the underground by shafts (which require tall headframes), the design was changed to provide access by a long, inclined ramp. The Nirex projected waste volume is approximately two million cubic meters of material that is low level and intermediate level, of which about 400,000 cubic meters would be intermediate level waste. The plans are to initiate operations in the year 2010 with approximately a 50-year operation.

2574 (DOE/FTR-93018125) Travel to France for a series of international fact-finding visits on environmental restoration and waste management: Foreign trip report, June 28-July 5, 1991. Livingston-Behan, E. (USDOE, Washington, DC (United States)); Downing, M.; Duffy, L.; Tseng, J.; Izatt, R.D.; Oakley, D.T.; Schutte, W.; Gallagher, W.; Miller, N. USDOE Idaho Operations Office, Idaho Falls, ID (United States). 9 Sep 1991. 26p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93018125. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Geographic concentration of nuclear operations, proximity to port facilities and rail, technical excellence, and a commitment to overcome institutional barriers continue to establish France as a world leader in the nuclear industry. From this base, France is undertaking an aggressive and successful nuclear waste management program. France reprocesses fuel for its own industry and for foreign customers including Japan. Current activities which are operationally advanced over those in the United States, include: (1) the decontamination and decommissioning of formerly used facilities and sites; (2) the treatment, encapsulation, vitrification and storage of a wide range of radioactive waste at Marcoule and; (3) advanced robotic manipulators designed to perform a number of remote operations at nuclear power plants (In many ways analogous to the Hanford tanks); and (4) disposal of low level wastes at the ANDRA LLW site. In particular, the delegation teamed in the recent visit to LaHague

that the Vitrification Plant is operated by 85 direct personnel as compared to over 900 direct personnel projected for the operation of the Savannah River vitrification facility. As a result, the delegation is recommending a joint French/US Department of Energy system engineering study including comparisons of facility design, operating procedures, safety practices, and manpower requirements.

2575 (DOE/FTR-93018126) Travel to French nuclear facilities to identify innovative technologies and operating practices for waste management: Foreign trip report, June 28-July 5, 1991. Livingston-Behan, E. USDOE, Washington, DC (United States). [1991]. 18p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93018126. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The purposes of this trip were to identify innovative technologies and operating practices for waste management, and to select means by which technologies could be demonstrated or directly applied at Department of Energy sites. This visit was arranged by representatives of the French Atomic Energy Agency (CEA) and its subsidiary groups. Meetings and tours were held at the following nuclear facilities: CEA and Cogema headquarters, Saclay and Fontenay-aux-Roses nuclear research establishments, Framatome-Le Creusot, Marcoule, Cadarache, La Hague, and ANDRA-Soulaines. Innovative waste management practices were identified at each of the facilities that was visited. Of particular interest were the development of robotics for remote characterization and handling of wastes, treatment and disposal of intermediate wastes (including partitioning and transmutation), and the efficient production of vitrified high-level waste. Also noted were extensive D&D operations that have been completed or are underway. For example, electric arc furnaces will be used to demonstrate the melting of contaminated steel and aluminum for reuse. Recycle limits on decontaminated metals are being negotiated between the Atomic Energy Agency and the Health Ministry.

2576 (DOE/FTR-93018259) Travel to United Kingdom for investigation of the contamination weeping program: Foreign trip report, May 5-11, 1991. Bennett, P.C. Sandia National Labs., Albuquerque, NM (United States). [1991]. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93018259. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The objectives of the trip were to visit prominent scientists and engineers in the UK in the fields of contamination control and robotic applications, as well as to present a paper, Application of a Chemical Ion Exchange Model to Transport Cask Surface Decontamination, at the Second International Conference on Transportation for the Nuclear Industry. The conference provided an opportunity to discuss decontamination and handling technologies with an international group of scientists engaged in various aspects of transportation.

2577 (DOE/FTR-93018260) Travel to France to observe activities in radioactive waste management and environmental restoration: Foreign trip report, June 28, 1991-July 5, 1991. Livingston-Behan, E. (USDOE Assistant Secretary for Environmental Restoration and Waste Management, Washington, DC (United States)); Downing, M.; Duffy, L.; Tseng, J.; Izatt, R.D.; Oakley, D.T.; Schutte, W.; Gallagher, W.; Miller, N. USDOE Assistant Secretary for Environmental Restoration and Waste Management, Washington, DC (United States). 9 Sep 1991. 26p. Sponsored by

USDOE, Washington, DC (United States). Order Number DE93018260. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Geographic concentration of nuclear operations, proximity to port facilities and rail, technical excellence, and a commitment to overcome institutional barriers continue to establish France as a world leader in the nuclear industry. Current activities which are operationally advanced over those in the United States, include: decontamination and decommissioning the treatment, encapsulation, vitrification and storage of a wide range of radioactive waste at Marcoule and La Hague; advanced robotic manipulators and disposal of low level wastes at the ANDRA LLW site. The traveler visited France in order to: Identify specific mechanisms, countries & organizations suitable for international bilateral exchange with the UK; identify areas for France/DOE working groups for evaluating environmental restoration technologies; and observe progress on vitrification.

2578 (DOE/FTR-93018609) Travel to the Netherlands and Russia to assess electrokinetic technology as it is being applied to the remedial treatment of metal-contaminated soils and groundwater: Foreign trip report, December 11-19, 1991. Adams, R.E. USDOE Oak Ridge Field Office, TN (United States). 8 Jan 1992. 65p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93018609. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The purpose of this trip was to serve as a member of an evaluation team composed of the Department of Energy (DOE) and DOE contractor personnel to evaluate and assess the state of international electrokinetic technology as it is being applied to the remedial treatment of metal-contaminated soils and groundwater. This travel was requested by the DOE Office of Technology Development (OTD) to determine whether electrokinetic technology research, development, and field demonstrations on foreign soils and groundwater have applicability for the remediation of metal contamination at DOE sites.

2579 (DOE/FTR-93018760) Travel to Japan to participate in a series of fact finding meetings and facility tours in Japan, to explore International Technologies that can be applied to US cleanup efforts: Foreign trip report, November 3-15, 1990. Schutte, W.C. USDOE, Washington, DC (United States). [1993]. 54p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93018760. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The Department of Energy Office of Environmental Restoration and Waste Management (DOE/EK) participated in a series of fact finding meetings and facility tours in Japan. Meetings with Power Reactor and Nuclear Fuel Development Corporation (PNC) were conducted in accordance with the bilateral agreement between the United States Department of Energy and Power Reactor and Nuclear Fuel Development Corporation (PNC). In the opening session with Japan's Science and Technology Agency the EM delegation, led by Mr. Leo P. Duffy, jointly underscored the continuing US commitment that the technologies to be discussed would be limited to peaceful uses in the areas of environmental restoration and waste management. The delegation visited government, quasi-government and private organizations during the November 3-14, 1990, fact finding mission including the Science and Technology Agency

(Tokyo), the Ministry of Trade and Industry (Tokyo, Mito, Osaka), the Power reactor and Nuclear Fuel Development Corporation (Tokyo, Tokai, Oarai, Chubu), the Japan Atomic Energy Research Institute (Tokai, Tokyo) Kyoto University, JGC Corporation (Oarai), and Kobe Steel. The delegation concludes that expanded collaboration in several technical areas described in this report appear to be of potential mutual benefit. Several areas of potential technical collaboration appear to have considerable merit in addition to successful on-going interactions related to vitrification, decommissioning, and TRU. This report provides meeting summaries and selected information on a wide range of technologies by organization.

2580 (DOE/FTR-93019182) Fact finding trip to Russia concerning the April 6, 1993 chemical explosion at the Siberian Chemical Combine in order to support a safety review of US facilities: Foreign trip report, June 18-29, 1993. Wodrich, D.D. Westinghouse Hanford Co., Richland, WA (United States). 27 Jul 1993. 11p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93019182. Source: OSTI; NTIS (US Sales Only); GPO Dep.

On April 6, 1993, at the fuel reprocessing ("radiochemical") plant of the Siberian Chemical Combine in Tomsk-7, Russia, a sequence of events occurred that caused substantial physical damage to the facility. Because the Tomsk-7 facility utilized the PUREX process, similar to that used at US facilities, the US Department of Energy (DOE) has undertaken an effort to learn the details of this accident and its causes. The building roof has been replaced and most of the wall has been reconstructed. The plant is expected to be physically ready for operation in July 1993. Actions have been identified to prevent this type of accident in the future, and an independent safety group must be satisfied before the plant can be restarted. The US team has visited both MINATOM and the Tomsk-7 facilities in an effort to determine information that would support the safety reviews of similar reprocessing facilities in the US. Both of the meetings were productive in achieving this objective. The US delegation also provided information on similar US chemical processing accidents. We believe that continued interchanges of information related to chemical nuclear facility safety in the future would be mutually beneficial to the US and Russian programs.

2581 (DOE/FTR-94003540) Effectiveness of processes applied to the remediation of mixed transuranic wastes: Foreign trip report, September 28-October 16, 1993. Macdonald, D.W. USDOE Idaho Operations Office, Idaho Falls, ID (United States). 18 Nov 1993. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE94003540. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The purpose of this trip was to witness and review tests being performed by British Nuclear Fuels, plc (BNFL) as part of the fulfillment of contractual requirements under a contract with EG&G Idaho. This contract is for the performance of certain Proof of Process tests, designed to demonstrate the effectiveness of processes which can be applied to the remediation of mixed transuranic wastes at the Idaho National Engineering Laboratory (INEL) and other DOE sites. In addition, information on the experiences and lessons learned of BNFL and the UK Atomic Energy Authority (AEA) in the handling and treatment of Sodium-Potassium eutectic metals (NaK) in the UK was sought. A comprehensive trip report has been prepared and provides

a review of the activities and facilities witnessed at the Sellafeld site pertaining to the Pit 9 Proof of Process, including initial cementation of Pit 9 simulated waste processing product and evaluations of BNFL plants now on-line for vitrification of liquid high level wastes and cementation of high activity but low heat generating wastes from fuel reprocessing. Additionally the low-level waste treatment and disposal operations were reviewed. The comprehensive report also provides details of meetings and facility activities regarding British experiences in treating radioactively contaminated alkali metals, liquid Na and NaK, used in the primary and secondary cooling loops of their fast reactors. These sessions were held to help provide lessons learned as DOE moves to begin to deal with its inventory of these materials, held principally in Idaho, Hanford, Argonne and Oak Ridge.

2582 (DOE/FTR-94003794) Travel to Prague, Czech Republic, to attend the 1993 International Conference on Nuclear Waste Management and Environmental Remediation: Foreign trip report, September 5-11, 1993. Slate, S.C. (comp.) (Pacific Northwest Lab., Richland, WA (United States)); Allen, R.E. (ed.). Westinghouse Hanford Co., Richland, WA (United States). 30 Oct 1993. 76p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE94003794. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The purpose of the trip was to attend the 1993 International Conference on Nuclear Waste Management and Environmental Remediation. The principal objective of this conference was to facilitate a truly international exchange of information on the management of nuclear wastes as well as contaminated facilities and sites emanating from nuclear operations. The conference was sponsored by the American Society of Mechanical Engineers, the Czech and Slovak Mechanical Engineering Societies, and the Czech and Slovak Nuclear Societies in cooperation with the Commission of the European Communities, the International Atomic Energy Agency, and the OECD Nuclear Agency. The conference was cosponsored by the American Nuclear Society, the Atomic Energy Society of Japan, the Canadian Nuclear Society, the (former USSR) Nuclear Society, and the Japan Society of Mechanical Engineers. This was the fourth in a series of biennial conferences, which started in Hong Kong, in 1987. This report summarizes shared aspects of the trip; however, each traveler's observations and recommendations are reported separately. Foreign contacts are consolidated in Appendix B; literature acquired is reported in Appendix C. The agenda of the conference is in Appendix D. Action items reported by individuals are summarized in Appendix E.

2583 (DOE/FTR-94004456) Trip to France to attend the OECD Program on Decommissioning: Foreign trip report, October 25-29, 1993. Murphie, W.E. USDOE, Washington, DC (United States). [1993]. 6p. Sponsored by USDOE, Washington, DC (United States). Order Number DE94004456. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The purpose of the trip was to meet with the Liaison Committee (LC) for the Organization for Economic Co-operation and Development's (OECD) Program on Decommissioning. The most significant action involved the addition of several new projects to the Program, including Fernald and Fort St. Vrain (FSV) from the US, two French installations, a Spanish reactor at Vandellós, and two of four proposed German facilities. These projects will significantly add to the groups decontamination and decommissioning (D&D) active projects. Of other interest, the group discussed a letter written

by a Russian group seeking to establish cooperation with the group.

2584 (DOE/RL-93-59) 1992 Environmental Summer Science Camp Program evaluation: The International Environmental Institute of Westinghouse Hanford Company. Westinghouse Hanford Co., Richland, WA (United States). Jul 1993. 116p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93019983. Source: OSTI; NTIS; GPO Dep.

This report describes the 1992 Westinghouse Hanford Company/US Department of Energy Environmental Summer Science Camp. The objective of the "camp" was to motivate sixth and seventh graders to pursue studies in math, science, and the environment. This objective was accomplished through hands-on fun activities while studying the present and future challenges facing our environment. The camp was funded through Technical Task Plan, 424203, from the US Department of Energy-Headquarters, Office of Environmental Restoration and Waste Management, Technology Development, to Westinghouse Hanford Company's International Environmental Institute, Education and Internship Performance Group.

2585 (DOE/RL-93-63) Russian: United States Environmental Restoration Workshop. USDOE Richland Operations Office, WA (United States). Aug 1993. 59p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019579. Source: OSTI; NTIS; GPO Dep.

The Russian - United States Environmental Restoration Workshop, held in Washington, D.C., and Richland, Washington, from April 5 through 18, 1993, was the first extended collaborative information exchange between the US Department of Energy (DOE) and Russian scientists at the site level. In addition to the Russian scientists, workshop participants included scientists and staff from DOE, Pacific Northwest Laboratory (PNL), Westinghouse Hanford Company (WHC), the US Environmental Training Institute (USETI), universities, and the private sector. The first week (April 5 through 10) of the workshop took place in Washington, D.C., where the Russian and US participants were presented with a US perspective on environmental restoration and remediation issues from representatives in DOE and the US Environmental Protection Agency (EPA). The second week (April 11 through 18) occurred in Richland, Washington, where the participants were presented with site-specific environmental restoration and remediation issues related to Hanford Site cleanup. This report is a compilation of the presentations, discussions, and experiences shared during the second week of the workshop in Richland, Washington.

2586 (EGG-WTD-9911) Melter development needs assessment for RWMC buried wastes. Donaldson, A.D.; Carpenedo, R.J.; Anderson, G.L. EG and G Idaho, Inc., Idaho Falls, ID (United States). Feb 1992. 140p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92012365. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents a survey and initial assessment of the existing state-of-the-art melter technology necessary to thermally treat (stabilize) buried TRU waste, by producing a highly leach resistant glass/ceramic waste form suitable for final disposal. Buried mixed transuranic (TRU) waste at the Idaho National Engineering Laboratory (INEL) represents an environmental hazard requiring remediation. The Environmental Protection Agency (EPA) placed the INEL on the

National Priorities List in 1989. Remediation of the buried TRU-contaminated waste via the CERCLA decision process is required to remove INEL from the National Priorities List. A Waste Technology Development (WTD) Preliminary Systems Design and Thermal Technologies Screening Study identified joule-heated and plasma-heated melters as the most probable thermal systems technologies capable of melting the INEL soil and waste to produce the desired final waste form [Iron-Enriched Basalt (IEB) glass/ceramic]. The work reported herein then surveys the state of existing melter technology and assesses it within the context of processing INEL buried TRU wastes and contaminated soils. Necessary technology development work is recommended.

2587 (EGG-WTD-9928) Buried waste integrated demonstration technology integration process. Ferguson, J.S.; Ferguson, J.E. EG and G Idaho, Inc., Idaho Falls, ID (United States). Apr 1992. 61p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92018001. Source: OSTI; NTIS; INIS; GPO Dep.

A Technology Integration Process was developed for the Idaho National Energy Laboratories (INEL) Buried Waste Integrated Demonstration (BWID) Program to facilitate the transfer of technology and knowledge from industry, universities, and other Federal agencies into the BWID; to successfully transfer demonstrated technology and knowledge from the BWID to industry, universities, and other Federal agencies; and to share demonstrated technologies and knowledge between Integrated Demonstrations and other Department of Energy (DOE) spread throughout the DOE Complex. This document also details specific methods and tools for integrating and transferring technologies into or out of the BWID program. The document provides background on the BWID program and technology development needs, demonstrates the direction of technology transfer, illustrates current processes for this transfer, and lists points of contact for prospective participants in the BWID technology transfer efforts. The Technology Integration Process was prepared to ensure compliance with the requirements of DOE's Office of Technology Development (OTD).

2588 (EGG-WTD-9989) Performance-Based Technology Selection Filter description report: INEL Buried Waste Integrated Demonstration System Analysis project. O'Brien, M.C.; Morrison, J.L.; Morneau, R.A.; Rudin, M.J.; Richardson, J.G. EG and G Idaho, Inc., Idaho Falls, ID (United States). May 1992. 57p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE92018000. Source: OSTI; NTIS; INIS; GPO Dep.

A formal methodology has been developed for identifying technology gaps and assessing innovative or postulated technologies for inclusion in proposed Buried Waste Integrated Demonstration (BWID) remediation systems. Called the Performance-Based Technology Selection Filter, the methodology provides a formalized selection process where technologies and systems are rated and assessments made based on performance measures, and regulatory and technical requirements. The results are auditable, and can be validated with field data. This analysis methodology will be applied to the remedial action of transuranic contaminated waste pits and trenches buried at the Idaho National Engineering Laboratory (INEL).

2589 (IS-5099) Uranium in soils integrated demonstration site characterization at Fernald, Ohio: Report of

uranium concentrations in soil determined by in situ LA-ICP-AES. Baldwin, D. (and others); Zamzow, D.; Bajic, S.J. Ames Lab., IA (United States). 2 Feb 1993. 33p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-82. Order Number DE94005571. Source: OSTI; NTIS; INIS; GPO Dep.

Laser ablation-inductively coupled plasma-atomic emission spectrometry was used for in situ determination of uranium and thorium concentrations in soil at 80 sampling sites in the Sewage Treatment Plant area. This work was performed by the Environmental Technology Development Program of the Ames Laboratory using a completely self-contained mobile laboratory. This laboratory, the mobile demonstration laboratory for environmental screening technologies and the robotic sampling accessory, were designed and constructed by the Ames Laboratory during FY 1992. The instrumentation is capable of analyzing each sample for twenty operator-defined elements simultaneously. Using the MDLEST/RSA, the uranium concentrations in the soil at the 80 sampling sites were found to range from <20 parts-per-million (ppM) (<13.5 pCi/g) to 303 ppM (205 pCi/g). The 95% confidence interval for these field determined values range from 80 to 110 ppM. Bore hole samples from two sites were analyzed. No measurable uranium concentration was detected below the one foot depth. Seven samples taken from sites within an area currently under remediation were analyzed and found to contain uranium concentrations ranging from 101 ppM (68.3 pCi/g) to 788 ppM (532 pCi/g). Soil samples were taken from twelve of the 80 sampling sites in the field, using conventional sampling techniques. These samples were prepared by microwave digestion, using the wet chemistry capability in the MDLEST, and field analyzed using solution nebulization ICP-AES. The laboratory procedure followed for microwave digestion required the samples to be diluted by a factor of 100. This dilution resulted in uranium intensities too low to be accurately quantitated in the field. Optimization of the instrumentation and sample preparation will make this field capability useful in determining near real-time the soil matrix, and enable the performance of this quality assurance process in the field with greater sensitivity and accuracy.

2590 (IS-5104) DNAPLs at DOE sites: Background and assessment of characterization technologies. Junk, G.A.; Haas, W.J. Jr. Ames Lab., IA (United States). Dec 1993. 46p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-82. Order Number DE94007459. Source: OSTI; NTIS; GPO Dep.

The Characterization, Monitoring, and Sensor Technology Integrated Program (CMST-IP) within the Office of Technology Development (OTD) has responsibility for identification, evaluation, and delivery of technologies needed for the work of the Department of Energy's Office of Environmental Restoration and Waste Management. This report addresses part of that responsibility by providing summary information on DNAPL site characterization. A dense nonaqueous phase liquid (DNAPL) is a source of contamination that can persist in the subsurface for decades before dissipating completely into the vapor phase and groundwater. The DNAPL chemicals of particular concern to the DOE are chlorinated volatile organic compounds (CI VOCs) such as carbon tetrachloride (CCl_4), trichloroethylene (TCE), and perchloroethylene (PCE). These CI VOCs were used in multiple ton quantities at DOE sites and were often released to the subsurface. The predicted fate of released CI VOC liquid is downward movement through the soil under the force of gravity. As it moves, some of the CI VOC liquid becomes trapped in the

soil pores as residual saturation. The liquid also moves rapidly downward if small fractures are present. This migration continues until an impermeable or semi-permeable layer is encountered. Then lateral movement or spreading occurs. The downward and lateral migration in the subsurface leads to DNAPL pools, lenses, and residual saturation that can cause long-term contamination of groundwater at levels well above drinking water standards. Although CI VOCs have been detected as dissolved components in the groundwater and as vapor in the soil gas at several DOE sites, direct evidence of their presence as DNAPL is sparse and no measurements of the amounts of DNAPL present within a given volume of subsurface have been made. Consequently, unresolved DNAPL issues exist at DOE sites.

2591 (LA-UR-92-662) Integrating environmental restoration management within DOE using an alternative identification and evaluation procedure: A methodology and a case history. Devaurs, M.; Brooks, D.; Kelly, E.; Wagner, S.; Vocke, R. Los Alamos National Lab., NM (United States). [1992]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-920307-31: Waste management '92, Tucson, AZ (United States), 1-5 Mar 1992). Order Number DE92008479. Source: OSTI; NTIS; INIS; GPO Dep.

The process of identifying and evaluating alternative corrective measures is a fundamental integrating part of Environmental Restoration (ER) activities. The process used in the Los Alamos National Laboratory (the Laboratory) ER Program is based on principles and tools from multiattribute decision analysis, a well-developed and proven method for evaluating options in decision situations involving multiple objectives, uncertainty, multiple interested stakeholders in the final decision, and the need for technical input from disparate disciplines. The process provides a methodology that has been extensively developed and reviewed over the past five decades; it provides a methodological structure for incorporating the concepts espoused in the streamlined approach as well as more specific guidelines such as data quality objectives (DQOs). The application of this methodology to the ER Program at Los Alamos is described in this paper.

2592 (ORNL/FTR-4194) Travel to Karlsruhe, Germany to exchange information on the in situ destruction of volatile organic compounds: Foreign trip report, February 10-16, 1992. Siegrist, R.L. Oak Ridge National Lab., TN (United States). 16 Mar 1992. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93011104. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The objective of the detailed trip was to meet with researchers at the University of Karlsruhe and their private industry partners to discuss and to exchange information on the in situ destruction of volatile organic compounds and to refine a project plan for the DOE International Technology Exchange Program (ITEP).

2593 (ORNL/FTR-4208) The initiation of an environmental restoration project incorporating the bidirectional (US-Germany) transfer of environmental management technologies: Foreign trip report, February 23-29, 1992. Faison, B.D. Oak Ridge National Lab., TN (United States). 16 Mar 1992. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93011105. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The traveler attended meetings at Rossendorf to formalize a cooperative agreement with Ogden Environmental and Energy Services, Inc. (a US company) aimed at the restoration of sites contaminated by uranium milling activities near Crossen. Technologies developed at ORNL to be implemented in the restoration were described, with emphasis on biosorption for removal of dissolved uranium from tailings ponds. The goals of the International Technology Exchange Program, which funds ORNL's participation, and MMES were explained. Organizational ties were established with WISMUT and STEAG, the site operators. German technologies relevant to the uranium fuel cycle and/or the restoration of US sites were reviewed. Cooperation with three German national laboratories – Rossendorf (ZFK), Karlsruhe (KFK), and Leipzig-Halle (UFZ) – was initiated. A meeting was held at the demonstration site at Crossen to exchange technical data, followed by a tour of the site.

2594 (ORNL/FTR-4358) [Travel to Japan to review PNC's activities in separations and transmutation]: Foreign trip report, July 19–24, 1992. Bell, J.T. Oak Ridge National Lab., TN (United States). 21 Aug 1992. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93013008. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This travel was arranged by the US Department of Energy (DOE) Office of Environmental Restoration and Waste Management, Office of Research and Development, EM-54, and was in response to a previous trip by the Japanese to the EM area of DOE. Teresa Fryberger, EM-54, arranged and led the trip. The primary subject was chemical separations, and the visits included a wide area of nuclear facilities and staff. The Chemical Separations group (Table 1) traveled jointly with the Remote Technology group, which was led by Lynn Yarbavoy, EM-50. Introductory comments on daily ventures were shared jointly, but the two groups separated for specific discussions and visits. A primary interest was to become acquainted with Japanese efforts that are included in the EM interests and to prepare a document that expresses DOE/EM interests in the Japanese efforts. The primary interests identified by the Chemical Separations group were areas of transuranium (TRU) elements removal from process waste streams and the removal of platinum group elements. A document stating this interest was signed by Teresa Fryberger.

2595 (ORNL/FTR-4562) [Workshops concerning environmental carbon dioxide and terrestrial carbon]: Foreign trip report, February 27–March 6, 1993. Wright, L.L.; Luxmoore, R.J. Oak Ridge National Lab., TN (United States). 1 Apr 1993. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93011817. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The travelers each presented an invited paper at the workshop, peer reviewed several manuscripts that were provided by participants, and participated in two of eight work groups. The work groups and the invited presentations were focused on global terrestrial ecosystems from tundra to tropical, as well as potential approaches for mitigating rising atmospheric carbon dioxide through agricultural and forestry practices. The workshop efforts were broad ranging and included policy implications of the scientific findings. Summaries of selected presentations of particular interest are provided along with an outline of the scientific synthesis findings and policy implications from the eight work groups. The prepared papers from participants and synthesis reports

will be published in a special issue of the journal *Water, Air and Soil Pollution*. These proceedings will be of value to the US Department of Energy programs in Carbon Dioxide Research and Biofuels Systems. The findings from the workshop will be offered to the InterGovernmental Panel on Climate Change.

2596 (ORNL/FTR-4601) Participation in the fourth international KfK/TNO conference on contaminated soil: Foreign trip report, May 1–8, 1993. Berry, J.B. Oak Ridge National Lab., TN (United States). 12 May 1993. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93014637. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The traveler participated in the Fourth International KfK/TNO Conference on Contaminated Soil, Berlin, Germany. The traveler also presented a paper entitled, "The US Department of Energy, Office of Technology Development, Mixed Waste Integrated Program." A site visit was made to BUNA AG-Schopau, where demolition of a chlorine electrolysis plant and remediation of waste piles are in progress.

2597 (ORNL/FTR-4611) An environmental restoration project incorporating the bidirectional (US-Germany) transfer of environmental management technologies and inspection of the confirmed technology demonstration site: Foreign trip report, April 12–18, 1993. Faison, B.D. Oak Ridge National Lab., TN (United States). 17 May 1993. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93014660. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The traveler attended meetings at Chemnitz and Leipzig to formalize a cooperative agreement with Ogden Environmental and Energy Services, Inc. (a US company) aimed at the restoration of sites contaminated by uranium milling activities near Ronneburg. Technologies developed at ORNL and DFA to be implemented in the restoration were described, with emphasis on biosorption to remove dissolved uranium from mine drainage (ORNL) and bioprecipitation to remove dissolved sulfate and heavy metals from the treated water (DFA). Organizational ties were established with WISMUT, the site operator, to facilitate work at this specific site. Specific roles for DFA and Ogden were confirmed. A basis for cooperation with a German national laboratory – Leipzig-Halle (UFZ) – was discussed.

2598 (ORNL/FTR-4655) Travel to England for conference on nuclear transport systems: Foreign trip report, June 7–10, 1993. Shappert, L.B. Oak Ridge National Lab., TN (United States). 28 Jun 1993. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93017236. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report discuss travel to England to attend an international 2-day conference on nuclear transport systems. In addition, the traveler participated in a 2-day meeting sponsored by the International Standards Organization, whose working group is developing a standard entitled "Trunnions for Spent Fuel Element Transport Packages." The standard had previously been submitted for ballot to member countries, and the United States cast the only negative vote. The US position was discussed, and revision to the standard was initiated.

2599 (ORNL/FTR-4832) Travel to Austria to participate in the International Atomic Energy Agency's International Radioactive Waste Management Advisory

Committee Subgroup on Principles and Criteria for Radioactive Waste Disposal: Foreign trip report, October 16-22, 1993. Kocher, D.C. Oak Ridge National Lab., TN (United States). 5 Nov 1993. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94003557. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The traveler attended the third meeting of the International Radioactive Waste Management Advisory Committee Subgroup on Principles and Criteria for Radioactive Waste Disposal as a representative of the US Department of Energy. The primary purpose of the Subgroup is to develop consensus recommendations on fundamental issues related to long-term safety principles and criteria for radioactive waste disposal systems.

2600 (ORNL/FTR-4833) Travel to Austria to attend the International Atomic Energy Agency's Technical Committee Meeting on Issues related to Low Specific Activity Materials and Surface Contaminated Objects: Foreign trip report, October 8-16, 1993. Pope, R.B.; Rawl, R.R. Oak Ridge National Lab., TN (United States). 15 Nov 1993. 79p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94003541. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The travelers participated in an International Atomic Energy Agency (IAEA)-sponsored technical committee meeting on Low Specific Activity Materials and Surface Contaminated Objects (LSA/SCO), which was convened to address and make recommendations on issues that have been identified relative to LSA/SCO provisions in the IAEA's Regulations for the Safe Transport of Radioactive Material, Safety Series No. 6 (SS No. 6). This meeting was preceded by three earlier Consultants Services Meetings on the same subject. Mr. Rawl represented the United States in the first and third of these, and Mr. Pope represented the United States at the second. At this latest technical committee meeting, all aspects of the provisions in the areas of routine conditions of transport, normal conditions of transport, and accident conditions of transport were addressed, and recommendations were made for modifications not only to SS No. 6, but also to the supportive explanatory and advisory documents. Recommendations were also made by the technical committee on additional efforts which are needed by the IAEA to address fully the LSA/SCO issues in the forthcoming 1996 revision to SS No. 6.

2601 (ORNL/FTR-4921) Travel to Austria to participate in the IAEA's Seminar on Developments in Radioactive Waste Transport: Foreign trip report, February 21-25, 1994. Pope, R.B. Oak Ridge National Lab., TN (United States). 14 Mar 1994. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE94008749. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The traveler participated in and presented two papers at an International Agency (IAEA)-sponsored Seminar on Developments in Radioactive Waste Transport, which was convened with a major purpose of defining the characteristics of radioactive materials and waste which are expected to be transported in the future worldwide. The seminar was also convened to provide an open forum for discussing issues relating to the IAEA's Regulations for the Safe Transport of Radioactive Material (Safety Series No. 6). This seminar resulted in 40 papers being presented by participants from 16 countries and 2 international organizations.

One major result of the presentations made by Mr. Pope was that the US Department of Energy-Headquarters (DOE-HQ) personnel became more aware of the issues facing them in performing future environmental restoration and waste management activities and that, as a result, Mr. Pope was requested to prepare and submit to EM-56 a proposal for addressing low-level waste issues relating to packaging and transportation of these materials.

2602 (PNL-SA-19337-Vol.1) Proceedings of waste stream minimization and utilization innovative concepts—An experimental technology exchange: Volume 1, Mining and metals remediation. Lee, V.E. (ed.). Pacific Northwest Lab., Richland, WA (United States). Apr 1991. 80p. Sponsored by USDOE, Washington, DC (USA). DOE Contract AC06-76RL01830. (CONF-9104142-Vol.1: Waste stream minimization and utilization innovative concepts: an experimental technology exchange, Washington, DC (United States), 25-26 Apr 1991). Order Number DE91010717. Source: OSTI; NTIS; GPO Dep.

This two-volume proceeding summarizes the results of fifteen innovations that were funded through the US Department of Energy's Innovative Concept Program. The fifteen innovations were presented at the fifth Innovative Concepts Fair, held in Washington, DC, on April 25-26, 1991. The concepts in this year's fair address innovations that can substantially reduce or use waste streams. Each paper describes the need for the proposed concept, the concept being proposed, and the concept's economics and market potential, key experimental results, and future development needs. The papers are divided into two volumes; Volume 1 addresses innovations for mining and metals remediation that can reduce or use waste streams, and Volume 2 addresses general industrial innovations that can reduce or use waste streams. Individual papers have been cataloged separately.

2603 (PNL-SA-19337-Vol.2) Proceedings of waste stream minimization and utilization innovative concepts: An experimental technology exchange: Volume 2, General industrial. Lee, V.E. (ed.). Pacific Northwest Lab., Richland, WA (United States). Apr 1991. 95p. Sponsored by USDOE, Washington, DC (USA). DOE Contract AC06-76RL01830. (CONF-9104142-Vol.2: Waste stream minimization and utilization innovative concepts: an experimental technology exchange, Washington, DC (United States), 25-26 Apr 1991). Order Number DE91010718. Source: OSTI; NTIS; GPO Dep.

This two-volume proceedings summarizes the results of fifteen innovations that were funded through the US Department of Energy's Innovative Concept Program. The fifteen innovations were presented at the fifth Innovative Concepts Fair, held in Washington, DC, on April 25-26, 1991. The concepts in this year's fair address innovations that can substantially reduce or use waste streams. Each paper describes the need for the proposed concept, the concept being proposed, and the concept's economics and market potential, key experimental results, and future development needs. The papers are divided into two volumes; Volume 1 addresses innovations for mining and metals remediation that can reduce or use waste streams, and Volume 2 addresses general industrial innovations that can reduce or use waste streams. Individual papers have been cataloged separately.

2604 (PNL-SA-19718) The degradation of organic dyes by corona discharge. Goheen, S.C.; McCulloch, M.;

Durham, D.E.; Heath, W.O. Pacific Northwest Lab., Richland, WA (United States). Feb 1992. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-920272-2: Chemical oxidation technology for the nineties symposium, Nashville, TN (United States), 19-21 Feb 1992). Order Number DE92010865. Source: OSTI; NTIS; GPO Dep.

Several dyes in water were individually exposed to corona discharge. Light absorbance decreased for all organic dyes with time. Absorbance losses with methylene blue, malachite green, and new cocine were studied. The loss of color was followed using an in situ colorimeter and the effects of varying the current, voltage, gas phase, stirring rates, salinity, and electrode spacing were investigated. The highest reaction rates were observed using the highest current, highest voltage (up to 10kV), highest stirring rate, lowest salinity, smallest electrode spacing, and an environment containing enhanced levels of oxygen. Current was higher in the presence of nitrogen than in the presence of oxygen (for the same voltage), but the reaction of methylene blue did not proceed unless oxygen was present. These results help identify conditions using corona discharge in which dyes, and potentially other organics, can be destroyed. 22 refs., 5 figs.

2605 (PNL-SA-20059) Resolution of regulatory issues facing the DOE in situ vitrification program. Corathers, L.A. Pacific Northwest Lab., Richland, WA (United States). Mar 1992. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-920307-54: Waste management '92, Tucson, AZ (United States), 1-5 Mar 1992). Order Number DE92010493. Source: OSTI; NTIS; INIS; GPO Dep.

In situ vitrification (ISV) is being developed by researchers at the Pacific Northwest Laboratory (PNL), Idaho National Engineering Laboratory (INEL), and Oak Ridge National Laboratory (ORNL) as a technology for remediating soils, underground storage tank residuals, and buried materials that have been contaminated with hazardous, radioactive, and mixed wastes (i.e., wastes containing both radioactive and hazardous wastes) at US Department of Energy (DOE) facilities. The goal of the DOE ISV technology development program (i.e., the ISV Integrated Program) is to ensure that ISV is a workable technology for environmental restoration applications for DOE and other agencies. A DOE complex-wide plan was prepared during Fiscal Year 1991 to coordinate all levels of activities associated with the deployment of ISV. As part of this plan, a programmatic regulatory strategy was developed which focused on the federal environmental, health, safety, and nuclear regulations, including the US Environmental Protection Agency (EPA) and DOE regulations, believed to have the most significant near-term impact on the use of ISV as a remediation technology. The portion of the programmatic regulatory strategy addressing compliance with the Comprehensive Environmental Response, Compensation and Liability Act, as amended, and the Resource Conservation and Recovery Act, as amended, is presented in this paper.

2606 (PNL-SA-20526) Innovative technology demonstrations. Anderson, D.B.; Hartley, J.N.; Luttrell, S.P. Pacific Northwest Lab., Richland, WA (United States). Apr 1992. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE92015617. Source: OSTI; NTIS; INIS; GPO Dep.

Currently, several innovative technologies are being demonstrated at Tinker Air Force Base (TAFB) to address

specific problems associated with remediating two contaminated test sites at the base. Cone penetrometer testing (CPT) is a form of testing that can rapidly characterize a site. This technology was selected to evaluate its applicability in the tight clay soils and consolidated sandstone sediments found at TAFB. Directionally drilled horizontal wells have been successfully installed at the US Department of Energy's (DOE) Savannah River Site to test new methods of in situ remediation of soils and ground water. This emerging technology was selected as a method that may be effective in accessing contamination beneath Building 3001 without disrupting the mission of the building, and in enhancing the extraction of contamination both in ground water and in soil. A soil gas extraction (SGE) demonstration, also known as soil vapor extraction, will evaluate the effectiveness of SGE in remediating fuels and TCE contamination contained in the tight clay soil formations surrounding the abandoned underground fuel storage vault located at the SW Tanks Site. In situ sensors have recently received much acclaim as a technology that can be effective in remediating hazardous waste sites. Sensors can be useful for determining real-time, in situ contaminant concentrations during the remediation process for performance monitoring and in providing feedback for controlling the remediation process. A demonstration of two in situ sensor systems capable of providing real-time data on contamination levels will be conducted and evaluated concurrently with the SGE demonstration activities. Following the SGE demonstration, the SGE system and SW Tanks test site will be modified to demonstrate bioremediation as an effective means of degrading the remaining contaminants in situ.

2607 (PNL-SA-21857) Transferring federally-funded technologies: New strategies for success. Stenshjem, E.J. Pacific Northwest Lab., Richland, WA (United States). Feb 1993. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-930205-44: Waste management '93, Tucson, AZ (United States), 28 Feb - 4 Mar 1993). Order Number DE93009811. Source: OSTI; NTIS; GPO Dep.

In almost every year of the post-war era, the federal government has spent more on research and development (R&D) than has US industry. These expenditures have been divided largely among the nation's federal laboratories and universities and, contrary to widely held beliefs, devoted in greater measure to applied R&D than basic research. As pointed out by Salvador, this federally-funded research has resulted in the development of "market/application oriented" technology that, for the most part, has failed to reach the commercial marketplace. This report discusses new strategies for a more success technology transfer.

2608 (PNL-SA-22649) Status of international environmental remediation activities: A report from the Prague conference. Slate, S.C.; Thornhill, C.K.; Allen, R.E. Pacific Northwest Lab., Richland, WA (United States). Oct 1993. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-931095-76: Department of Energy environmental remediation conference, Augusta, GA (United States), 24-28 Oct 1993). Order Number DE94004760. Source: OSTI; NTIS; INIS; GPO Dep.

The Prague Conference on nuclear waste management and environmental remediation provided extensive interchange of ideas and insight into new technologies and management approaches throughout the world. A variety of

environmental remediation technologies have potential application to Department of Energy facilities; others illustrate pitfalls to be avoided. This paper presents the highlights from the first environmental remediation (ER) technical program in the American Society of Mechanical Engineers' series of international nuclear waste management conferences. This program covers ER technologies, decontamination and decommissioning (D&D) technologies and experience, ER site characterization and modeling, management of and results from actual clean up actions, and data on several major international environmental problems. Focusing on direct benefits to the Department of Energy's (DOE) ER Program, this paper summarizes pertinent technical information, identifies useful technical papers, lists key technical contacts, and identifies specific actions to obtain additional information. US attendance at meetings like this is normally quite limited compared to attendance at North American meetings. The purpose of this paper then is to increase general awareness of this meeting in US technical circles and to broadly disseminate key information to US ER programs and contractors. To do this, the paper is organized to present background information on the conference itself, document the beneficial technical information, and outline ongoing information exchange activities.

2609 (PNL-SA-23921) Building a Collaboratory in Environmental and Molecular Science. Kouzes, R.T.; Myers, J.D.; Devaney, D.M.; Dunning, T.H.; Wise, J.A. Pacific Northwest Lab., Richland, WA (United States). Mar 1994. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9403113-1: Environmental and molecular sciences collaboratory conference, Richland, WA (United States), 17-19 Mar 1994). Order Number DE94011439. Source: OSTI; NTIS; INIS; GPO Dep.

A Collaboratory is a meta-laboratory that spans multiple geographical areas with collaborators interacting via electronic means. Collaboratories are designed to enable close ties between scientists in a given research area, promote collaborations involving scientists in diverse areas, accelerate the development and dissemination of basic knowledge, and minimize the time-lag between discovery and application. PNL is developing the concept of an Environmental and Molecular Sciences Collaboratory (EMSC) as a natural evolution of the EMSL project. The goal of the EMSC is to increase the efficiency of research and reduce the time required to implement new environmental remediation and preservation technologies. The EMSC will leverage the resources (intellectual and physical) of the EMSL by making them more accessible to remote collaborators as well as by making the resources of remote sites available to local researchers. It will provide a common set of computer hardware and software tools to support remote collaboration, a key step in establishing a collaborative culture for scientists in the theoretical, computational, and experimental molecular sciences across the nation. In short, the EMSC will establish and support an 'electronic community of scientists researching and developing innovative environmental preservation and restoration technologies.

2610 (SAND-92-0247C) The role that enviroTRADE will play in the cleanup of the DOE complex. Harlan, C.P.; Harrington, M.W. Sandia National Labs., Albuquerque, NM (United States). [1992]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-920466-8: Engineering and technology conference on waste management and environmental

restoration, San Juan (Puerto Rico), 9-11 Apr 1992). Order Number DE92011654. Source: OSTI; NTIS; INIS; GPO Dep.

In support of the US Department of Energy's commitment to the remediation of waste sites throughout its complex, the DOE has recognized that it can accelerate its technology development efforts and leverage the expenditure of available funds through an international cooperation among government entities, private industry, and educational institutions. To support the technology transfer of environmental information, the DOE has sponsored the development of EnviroTRADE - an international information system that will facilitate the exchange of environmental restoration and waste management technologies worldwide. The system will contain profiles on both environmental restoration/waste management needs and foreign/domestic technologies. Users will be able to identify matches between worldwide needs and available or emerging technologies. Where matches between needs and existing technologies are not found, the system will identify the potential for development of new and innovative technologies to address environmental problems. EnviroTRADE will also provide general information on international environmental restoration and waste management organizations, sites, activities, and contacts.

2611 (SAND-92-0959C) International technology transfer to support the environmental restoration needs of the DOE complex. DuCharme, A.R. (Sandia National Labs., Albuquerque, NM (United States)); Jimenez, R.D.; Roberds, W.J. Sandia National Labs., Albuquerque, NM (United States). [1992]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-920851-6: Spectrum '92: nuclear and hazardous waste management international topical meeting, Boise, ID (United States), 23-27 Aug 1992). Order Number DE92013663. Source: OSTI; NTIS; INIS; GPO Dep.

One of the principal objectives of the International Technology Exchange Program (ITEP) is the exchange of waste management and environmental restoration (WM/ER) technologies between the US and other nations. The current emphasis of ITEP is the transfer of technologies to the US that could provide better, faster, cheaper, or safer solutions to the needs of the DOE complex. The 10 candidate technologies that have been identified thus far by ITEP are discussed. The highlights of preliminary evaluations of these technologies through a systems approach are also described. The technologies have been evaluated by a screening process to determine their applicability to the leading WM/ER needs of the DOE complex. The technologies have been qualitatively compared with the known or anticipated capabilities of domestic, base case technologies.

2612 (SAND-92-1690C) DOE International Technology Exchange Program (ITEP): Technical integration of sensor technology development. DuCharme, A.R. (Sandia National Labs., Albuquerque, NM (United States)); Silva, R.J.; Bickford, D.F. Sandia National Labs., Albuquerque, NM (United States). [1992]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-920791-6: Information exchange meeting on characterization sensors and monitoring technologies, Dallas, TX (United States), 15-16 Jul 1992). Order Number DE92018819. Source: OSTI; NTIS; INIS; GPO Dep.

To achieve the goal of remediating waste sites throughout its complex and of bringing its facilities into full compliance by the year 2019, the DOE has established the Office of Environmental Restoration and Waste Management (E). Within

E, the Office of Technology Development (OTD) has been created to develop technologies that will support DOE's cleanup goal. The OTD is accelerating remediation technology application by leveraging the expenditure of available funds through international technology development and demonstration projects. These projects will address EM's environmental restoration and waste management needs. For this reason, the OTD has created the International Technology Exchange Program (ITEP) whose primary objective is to effect collaboration among governments, industries, and educational institutions to identify worldwide technologies suitable for this purpose. These technologies should also meet US commercial needs. The ITEP will also serve as a mechanism for transferring technologies developed under DOE sponsorship to US industry for ultimate application in the international arena.

2613 (SAND-92-1952) In situ permeable flow sensors at the Savannah River Integrated Demonstration: Phase 1 results. Ballard, S. Sandia National Labs., Albuquerque, NM (United States). Oct 1992. 35p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93003226. Source: OSTI; NTIS; GPO Dep.

The In Situ Permeable Flow Sensor, a new technology which uses a thermal perturbation technique to directly measure the 3-dimensional groundwater flow velocity vector at a point in permeable, unconsolidated geologic formations, has been used to monitor changes in the groundwater flow regime around an experimental air stripping waste remediation activity. While design flaws in the first version of the technology, which were used during the experiment being reported here, precluded measurements of the horizontal component of the flow velocity, measurements of the vertical component of the flow velocity were obtained. Results indicate that significant changes in the vertical flow velocity were induced by the air injection system. One flow sensor, MHM6, measured a vertical flow velocity of 4 m/yr or less when the air injection system was not operating and 25 m/yr when the air injection system was on. This may be caused by air bubbles moving past the probes or may be the result of the establishment of a more widespread flow regime in the groundwater induced by the air injection system. In the latter case, significantly more groundwater would be remediated by the air stripping operation since groundwater would be circulated through the zone of influence of the air injection system. Newly designed flow sensors, already in the ground at Savannah River to monitor Phase II of the project, are capable of measuring horizontal as well as vertical components of flow velocity.

2614 (SAND-93-2231C) EnviroTRADE: An International Environmental Restoration and Waste Management Information System. Johnson, S.W. (US-DOE, Washington, DC (United States)); Harlan, C.P.; Harrington, M.W.; Bergeron, K.D.; Rehorn, A.S. Sandia National Labs., Albuquerque, NM (United States). [1993]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-940225-9: Waste management '94, Tucson, AZ (United States), 27 Feb - 3 mar 1994). Order Number DE94006196. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy (DOE) has collected, and will continue to collect, large amounts of information on its environmental waste sites and associated technology development efforts. This information is being gathered in a

variety of formats for various purposes. Integration and delivery of this information WW benefit decision makers, waste site managers, technology developers, regulators, and the private sector. No computer system currently exists that acts as an easy-to-use computer umbrella over all of the DOE's environmental information. The EnviroTRADE Information System, currently under development for the DOE's Environmental Restoration and Waste Management's (EM's) Office of Technology Development, provides access to a wide variety of information within a single architecture. Ongoing system development is expected to result in an extensive, networked interface to EM's diverse data benefiting a variety of users. This paper discusses the present status of the EnviroTRADE Information System as well as current and future development activities.

2615 (SAND-93-3966C) An approach to establishing cooperative R&D projects with Russian Institutes. Hunter, T. (Sandia National Labs., Albuquerque, NM (United States)); Albert, T.; Fryberger, T.; Romanovsky, V. Sandia National Labs., Albuquerque, NM (United States). [1993]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. (CONF-940225-54: Waste management '94, Tucson, AZ (United States), 27 Feb - 3 mar 1994). Order Number DE94007730. Source: OSTI; NTIS; INIS; GPO Dep.

An important part of technology exchange between the US and the former Soviet Union is the identification and implementation of cooperative projects that benefit both Russia and the US. The US Department of Energy and its laboratories have established an approach to identify potential technologies that can contribute to solving US environmental problems and to establish projects for enhancing technology development. This approach consists of screening technologies for US applications, conducting small-scale pilot projects with Russian scientists to evaluate the validity of mechanisms for larger projects, helping develop direct communication between US and Russian scientists who are developing these technologies, and implementing major projects in specific technology development areas. A recent example of this approach is the initiation of projects between the Khlopin Radium Institute and DOE through Sandia National Laboratories and SAIC. This effort has resulted in not only enhanced technology for the US but has also provided an example for future cooperative projects.

2616 (SAND-93-3987C) Environmental remediation and waste management information systems. Harrington, M.W.; Harlan, C.P. Sandia National Labs., Albuquerque, NM (United States). [1993]. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-94AL85000. Order Number DE94006140. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this paper is to document a few of the many environmental information systems that currently exist worldwide. The paper is not meant to be a comprehensive list; merely a discussion of a few of the more technical environmental database systems that are available. Regulatory databases such as US Environmental Protection Agency's (EPA's) RODS (Records of Decision System) database [EPA, 1993] and cost databases such as EPA's CORA (Cost of Remedial Action) database [EPA, 1993] are not included in this paper. Section 2 describes several US Department of Energy (DOE) Environmental Restoration and Waste Management (EM) information systems and databases. Section 3 discusses several US EPA information systems on waste sites and technologies. Section 4 summarizes a few of the

European Community environmental information systems, networks, and clearinghouses. And finally, Section 5 provides a brief overview of Geographical Information Systems. Section 6 contains the references, and the Appendices contain supporting information.

2617 (SAND-93-8010) Environmental Monitoring Program Quality Assurance Project Plan. Holland, R.C. Sandia National Labs., Livermore, CA (United States). Jun 1993. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DR00789. Order Number DE93016331. Source: OSTI; NTIS; INIS; GPO Dep.

The Quality Assurance Project Plan (QAPP) is intended to document the quality assurance of the Environmental Monitoring Program. The Quality Assurance Project Plan has two parts and is written to become a chapter in the Environmental Monitoring Plan. Part A describes the management responsibilities and activities performed to assure the quality of the Environmental Monitoring Program. Part B covers the documentation requirements for changes in the Monitoring Program, and provides details on control of the design and implementation of quality assurance activities.

2618 (UCRL-ID-115789) DOE In Situ Remediation Integrated Program: In situ manipulation technologies subprogram plan. Yow, J.L. Jr. Lawrence Livermore National Lab., CA (United States). 22 Dec 1993. 40p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE94012987. Source: OSTI; NTIS; INIS; GPO Dep.

The In Situ Remediation Integrated Program (ISRP) supports and manages a balanced portfolio of applied research and development activities in support of DOE environmental restoration and waste management needs. ISRP technologies are being developed in four areas: containment, chemical and physical treatment, in situ bioremediation, and in situ manipulation (including electrokinetics). The focus of containment is to provide mechanisms to stop contaminant migration through the subsurface. In situ bioremediation and chemical and physical treatment both aim to destroy or eliminate contaminants in groundwater and soils. In situ manipulation (ISM) provides mechanisms to access contaminants or introduce treatment agents into the soil, and includes other technologies necessary to support the implementation of ISR methods. Descriptions of each major program area are provided to set the technical context of the ISM subprogram. Typical ISM needs for major areas of in situ remediation research and development are identified.

2619 (WHC-EP-0588) Smart card technology. Nelson, R.A. Westinghouse Hanford Co., Richland, WA (United

States). Sep 1992. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93004490. Source: OSTI; NTIS; GPO Dep.

This report describes smart card technology and applications, including the use of smart cards as smart badges. The paper illustrates that smart cards are designed with security features, which makes them suitable for security applications. But smart cards also provide multiple functions, so they can support additional applications. The goal of this paper is to inform about the technology, and to inspire thought about possible applications that would benefit if a smart badge were implemented.

2620 (WHC-SA-1753) Developing waste disposal options in the underground storage tank - integrated demonstration program. Cruse, J.M.; Gilchrist, R.L. Westinghouse Hanford Co., Richland, WA (United States). Jun 1993. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930913-18: Global '93: future nuclear systems - emerging fuel cycles and waste disposal options, Seattle, WA (United States), 12-17 Sep 1993). Order Number DE93019124. Source: OSTI; NTIS; INIS; GPO Dep.

The principal objective of the Underground Storage Tank - Integrated Demonstration (UST-ID Program) is the demonstration and continued development of technologies suitable for the remediation of USTs. The most promising new technologies from industry, universities, national laboratories, and other government agencies are selected for demonstration, testing, and evaluation. The objective is the eventual transfer of new technologies as part of a system to full-scale remediation at US Department of Energy (DOE) sites and alternately into the private sector. Technologies under development in the UST-ID Program are targeted toward use in remediation actions at the following five DOE participant sites: Hanford, Fernald, Idaho, Oak Ridge, and Savannah River. Combined, these participant sites have more than 300 USTs containing more than 381,800 m³ (100 Mgal) of high-level and low-level radioactive liquid waste. This paper focuses on the Low-Level Waste Disposal area of the UST-ID, summarizing the two currently funded technology development projects: the Nitrate to Ammonia and Ceramic (NAC) Process and Polyethylene Encapsulation. Both technologies are considered options to the current baseline disposal approaches being developed at the participant sites. For the Hanford Site, this baseline is a grout waste form that is nearing implementation for disposal of low-level liquid tank wastes.

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	MK-Ferguson Co., Albuquerque, NM (United States)		AC05-76OR00033	94:266	ES/ER/TM-89
	94:1929	DOE/UMTRA-3050-93-1235-Vol.1		94:852	ES/ER/TM-54
	94:2180	DOE/UMTRA-3050-93-1235-Vol.2		94:2202	ES/ESH-36
				94:2203	ES/ESH-37
				Florida Univ., Gainesville, FL (United States). Dept. of Nuclear Engineering Sciences	
				94:752	DOE/OR/00033-T517
				Oak Ridge K-25 Site, TN (United States)	
				94:733	DOE/MWIP-15
				Oak Ridge Inst. for Science and Education, TN (United States)	
				94:130	DOE/OR/00033-T514
				94:753	DOE/OR/00033-T558
				94:2241	ORISE-92/E-41
			AC05-76OU00001	Paducah Gaseous Diffusion Plant, KY (United States)	
				94:288	KY/ER-15
			AC05-84OR21400	Ames Lab., IA (United States)	
				94:858	IS-M-705
AC04-94AL85000	Sandia National Labs., Albuquerque, NM (United States)			Oak Ridge National Lab., TN (United States)	
	94:407	SAND-93-1244C		94:33	CONF-901286-1-Vugraphs
	94:408	SAND-93-2765		94:34	CONF-9103114-3
	94:409	SAND-93-3846C		94:36	CONF-910981-9
	94:410	SAND-93-7077C		94:37	CONF-9109234-2
	94:411	SAND-93-7112C		94:38	CONF-9109234-5
	94:412	SAND-93-7113C		94:39	CONF-9109234-6
	94:414	SAND-94-0214		94:40	CONF-9109234-7
	94:415	SAND-94-0537C		94:41	CONF-911133-4
	94:416	SAND-94-0797C		94:43	CONF-920307-7
	94:986	SAND-93-2330/1		94:44	CONF-9205121-2
	94:987	SAND-93-2330/2		94:45	CONF-9206116-5
	94:988	SAND-93-7040		94:46	CONF-920851-19
	94:1403	SAND-94-0065		94:47	CONF-920883-1
	94:1404	SAND-94-0680C		94:48	CONF-921029-10
	94:1764	SAND-94-0488C		94:50	CONF-930160-15
	94:1765	SAND-94-0982C		94:51	CONF-930205-73
	94:1766	SAND-94-1202C		94:52	CONF-9306100-1
	94:2110	SAND-93-2380C		94:53	CONF-931043-7
	94:2111	SAND-93-2742C		94:55	CONF-940159-1
	94:2112	SAND-94-1111C		94:57	CONF-940225-109
	94:2400	SAND-93-1577C		94:58	CONF-9403102-1
	94:2401	SAND-93-2090C		94:125	DOE/MWIP-1
	94:2402	SAND-93-2250C		94:129	DOE/OR-01-1136
	94:2403	SAND-93-2670C		94:256	ES/ER/TM-1/R2
	94:2404	SAND-93-3884		94:257	ES/ER/TM-2
	94:2405	SAND-93-4075C		94:258	ES/ER/TM-4/R2
	94:2406	SAND-94-0276C		94:259	ES/ER/TM-18
				94:260	ES/ER/TM-38

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	94:261	ES/ER/TM-52		94:606	CONF-920851-11
	94:262	ES/ER/TM-59		94:607	CONF-9209165-1
	94:263	ES/ER/TM-60		94:608	CONF-921029-4
	94:264	ES/ER/TM-61		94:609	CONF-921029-5
	94:265	ES/ER/TM-75		94:610	CONF-921029-11
	94:268	ES/ER/TM-92		94:611	CONF-921029-13
	94:304	ORNL-6762		94:612	CONF-921029-15
	94:305	ORNL/ER-23		94:613	CONF-921137-2
	94:307	ORNL/ER-30		94:614	CONF-921137-4
	94:308	ORNL/ER-46		94:615	CONF-921137-5
	94:309	ORNL/ER-59		94:616	CONF-921137-14
	94:312	ORNL/ER-63		94:617	CONF-930205-1
	94:313	ORNL/ER-65		94:618	CONF-930205-13
	94:314	ORNL/ER-82		94:619	CONF-930205-75
	94:315	ORNL/ER-85		94:620	CONF-930205-76
	94:316	ORNL/ER-90		94:621	CONF-930255-1
	94:317	ORNL/ER-116		94:622	CONF-930304-12
	94:318	ORNL/ER-117		94:623	CONF-930364-1
	94:319	ORNL/ER-125		94:624	CONF-930396-9
	94:320	ORNL/ER-126		94:625	CONF-930403-15
	94:321	ORNL/ER-134		94:627	CONF-930589-1
	94:323	ORNL/ER-143		94:628	CONF-930873-26
	94:324	ORNL/ER-150		94:629	CONF-9308150-5
	94:325	ORNL/ER-154		94:630	CONF-931043-6
	94:327	ORNL/ER-165		94:631	CONF-931119-2
	94:328	ORNL/ER-166		94:632	CONF-940212-3
	94:329	ORNL/ER-169		94:633	CONF-940225-82
	94:330	ORNL/ER-169/S1		94:634	CONF-940225-111
	94:331	ORNL/ER-173		94:635	CONF-940433-6
	94:332	ORNL/ER-186		94:636	CONF-940501-2
	94:333	ORNL/ER-199		94:723	DOE/MWIP-2
	94:334	ORNL/ER-200		94:726	DOE/MWIP-4
	94:335	ORNL/ER-209		94:727	DOE/MWIP-8-Vol.1
	94:336	ORNL/ER/Sub- 87/99053/5/V1		94:728	DOE/MWIP-9
	94:337	ORNL/ER/Sub- 87/99053/5/V2		94:729	DOE/MWIP-10
	94:338	ORNL/ER/Sub- 87/99053/5/V3		94:731	DOE/MWIP-13
	94:339	ORNL/ER/Sub- 87/99053/5/V4		94:732	DOE/MWIP-14
	94:340	ORNL/ER/Sub- 87/99053/5/V5		94:741	DOE/OR-01-1129-D1
	94:341	ORNL/ER/Sub- 87/99053/5/V6		94:742	DOE/OR-01-1135-D2
	94:343	ORNL/ER/Sub-87- 99053/64		94:743	DOE/OR-01-1138-D1
	94:344	ORNL/ER/Sub-90-KA931/2		94:744	DOE/OR-01-1159-D1
	94:346	ORNL/GWPO-006		94:745	DOE/OR-01-1167-D1
	94:347	ORNL/M-3183		94:746	DOE/OR-01-1168-D1
	94:348	ORNL/TM-11793		94:751	DOE/OR-03-1195-D1
	94:349	ORNL/TM-11838		94:754	DOE/OR-1047-D1
	94:350	ORNL/TM-11979		94:850	ES/ER-17-D1
	94:351	ORNL/TM-11980		94:851	ES/ER/TM-41
	94:352	ORNL/TM-12017		94:888	ORNL-6485
	94:354	ORNL/TM-12169		94:889	ORNL/ER-12
	94:355	ORNL/TM-12177		94:890	ORNL/ER-19
	94:356	ORNL/TM-12201		94:891	ORNL/ER-52
	94:357	ORNL/TM-12217		94:892	ORNL/ER-55
	94:358	ORNL/TM-12235		94:893	ORNL/ER-80
	94:359	ORNL/TM-12260		94:894	ORNL/ER-118
	94:596	CONF-910849-5		94:896	ORNL/ER-142
	94:597	CONF-9110229-1		94:897	ORNL/ER-148
	94:598	CONF-911114-8		94:899	ORNL/M-1528
	94:599	CONF-920107-2		94:903	ORNL/TM-10352
	94:600	CONF-920307-13		94:904	ORNL/TM-11536
	94:601	CONF-920466-4		94:905	ORNL/TM-11654
	94:602	CONF-920466-7		94:906	ORNL/TM-11785
	94:603	CONF-920501-2		94:907	ORNL/TM-11795
	94:604	CONF-920527-2		94:908	ORNL/TM-11799
	94:605	CONF-920527-6		94:909	ORNL/TM-11824
				94:910	ORNL/TM-11853/R1
				94:911	ORNL/TM-11864
				94:912	ORNL/TM-11867
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				94:914	ORNL/TM-11999
				94:915	ORNL/TM-12031
				94:916	ORNL/TM-12036

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	94:918	ORNL/TM-12152		94:2037	CONF-920307-19
	94:919	ORNL/TM-12243		94:2038	CONF-9207102-60
	94:920	ORNL/TM-12272		94:2039	CONF-920851-2
	94:921	ORNL/TM-12283		94:2041	CONF-9210168-1
	94:922	ORNL/TM-12297		94:2042	CONF-9210174-1
	94:923	ORNL/TM-12315		94:2043	CONF-921102-9- Extd. Abst.
	94:924	ORNL/TM-12317		94:2044	CONF-921102-10
	94:925	ORNL/TM-12329		94:2045	CONF-930257-3
	94:926	ORNL/TM-12403		94:2046	CONF-930403-4
	94:927	ORNL/TM-12437/V1		94:2047	CONF-930403-8
	94:928	ORNL/TM-12437/V2		94:2048	CONF-930403-31
	94:929	ORNL/TM-12449		94:2049	CONF-930403-33
	94:930	ORNL/TM-12638		94:2050	CONF-930403-34
	94:931	ORNL/TM-12642		94:2051	CONF-930403-35
	94:932	ORNL/TM-12656		94:2052	CONF-930403-37
	94:933	ORNL/TM-12657		94:2053	CONF-930403-38
	94:934	ORNL/TM-12679		94:2054	CONF-930403-39
	94:935	ORNL/TM-12687		94:2055	CONF-930403-40
	94:1308	CONF-930572-7		94:2056	CONF-930403-41
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	94:1310	CONF-9308180-1		94:2058	CONF-930403-48
	94:1311	CONF-931043-3		94:2059	CONF-930403-54
	94:1312	CONF-931136-1		94:2060	CONF-930445-15
	94:1313	CONF-940225-110		94:2061	CONF-930519-6
	94:1314	CONF-940553-25		94:2062	CONF-930519-8
	94:1348	ORNL/ER-121		94:2063	CONF-930570-2
	94:1349	ORNL/TM-12417		94:2065	CONF-940353-3
	94:1670	CONF-900525-4		94:2066	CONF-940550-8
	94:1671	CONF-930160-2		94:2090	ORNL/TM-12185
	94:1753	ES/ER/TM-7		94:2091	ORNL/TM-12198
	94:1756	ORNL/ER-36		94:2092	ORNL/TM-12251
	94:1757	ORNL/ER-87		94:2093	ORNL/TM-12337
	94:1801	CONF-910277-12		94:2147	CONF-9002111-3
	94:1802	CONF-9108124-2		94:2148	CONF-911107-50
	94:1803	CONF-9110168-8		94:2149	CONF-9111105-1
	94:1804	CONF-9111188-1		94:2150	CONF-920606-8
	94:1805	CONF-920307-15		94:2151	CONF-920606-11
	94:1806	CONF-920577-1		94:2153	CONF-9207100-2
	94:1807	CONF-920851-22		94:2154	CONF-930482-11
	94:1808	CONF-921029-1		94:2155	CONF-930570-4
	94:1809	CONF-921029-3		94:2156	CONF-9307141-1
	94:1810	CONF-921029-7		94:2157	CONF-9310205-1
	94:1811	CONF-921029-12		94:2158	CONF-940178-1
	94:1812	CONF-930160-4		94:2159	CONF-940225-99
	94:1813	CONF-930205-55		94:2160	CONF-940386-3
	94:1856	DOE/OR-01-1111-D1		94:2178	DOE/RW-0006-Rev.7
	94:1861	DOE/OR-01-1175/V1		94:2179	DOE/RW-0006-Rev.8
	94:1862	DOE/OR-01-1175/V2		94:2193	ES/ER/TM-26/R1
	94:1863	DOE/OR-01-1175-V3		94:2194	ES/ER/TM-33
	94:1864	DOE/OR-01-1192-D1		94:2195	ES/ER/TM-62
	94:1867	DOE/OR-01-1254-D1		94:2196	ES/ER/TM-78
	94:1870	DOE/OR-1070-D2		94:2197	ES/ER/TM-85
	94:1871	DOE/OR-1077		94:2199	ES/ER/TM-95
	94:1965	KY/ER-11		94:2200	ES/ER/TM-96
	94:1969	ORNL/ER-17		94:2201	ES/ER/TM-97
	94:1970	ORNL/ER-25		94:2242	ORNL-6638
	94:1972	ORNL/ER-51		94:2243	ORNL/ER-7
	94:1973	ORNL/ER-60		94:2244	ORNL/ER-8
	94:1974	ORNL/ER-61		94:2245	ORNL/ER-9
	94:1975	ORNL/ER-119		94:2247	ORNL/ER-37
	94:1976	ORNL/ER-130		94:2248	ORNL/ER-45
	94:1978	ORNL/ER-208		94:2249	ORNL/ER-53
	94:1979	ORNL/ER-219		94:2250	ORNL/ER-81
	94:1980	ORNL/ER/Sub-87- 99053/49		94:2251	ORNL/ER-91
	94:1981	ORNL/M-1814		94:2252	ORNL/ER-93
	94:1982	ORNL/M-1851		94:2254	ORNL/ER-124
	94:2033	CONF-910223-1		94:2255	ORNL/ER-135
	94:2034	CONF-910223-8		94:2256	ORNL/ER-137
	94:2035	CONF-911107-25		94:2257	ORNL/ER-138

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	94:2261	ORNL/ER-180		94:2594	ORNL/FTR-4358
	94:2264	ORNL/ER-204		94:2595	ORNL/FTR-4562
	94:2265	ORNL/ER-220		94:2596	ORNL/FTR-4601
	94:2266	ORNL/ER-223		94:2597	ORNL/FTR-4611
	94:2267	ORNL/ER/Sub-87-99053/50		94:2598	ORNL/FTR-4655
	94:2269	ORNL/ER/Sub-87-99053/69		94:2599	ORNL/FTR-4832
	94:2270	ORNL/ER/Sub-87-99053/70		94:2600	ORNL/FTR-4833
	94:2272	ORNL/M-1871		94:2601	ORNL/FTR-4921
	94:2275	ORNL/RASA-90/7	Paducah Gaseous Diffusion Plant, KY (United States)		
	94:2276	ORNL/RASA-91/7		94:288	KY/ER-15
	94:2277	ORNL/RASA-91/8		94:1964	KY/ER-8
	94:2278	ORNL/RASA-91/9	Oak Ridge Y-12 Plant, TN (United States)		
	94:2279	ORNL/RASA-91/10		94:565	Y/ER/Sub-91-ALV96/1
	94:2280	ORNL/RASA-91/11		94:1853	DOE/OR-01-1100-D2
	94:2281	ORNL/RASA-91/12		94:1865	DOE/OR-01-1214-D1
	94:2282	ORNL/RASA-91/13	Oak Ridge National Lab., TN (United States). Environmental Sciences Div.		
	94:2283	ORNL/RASA-91/14		94:306	ORNL/ER-24
	94:2284	ORNL/RASA-91/15		94:326	ORNL/ER-155
	94:2285	ORNL/RASA-91/16	Oak Ridge National Lab., TN (United States). Health and Safety Research Div.		
	94:2286	ORNL/RASA-91/17		94:2274	ORNL/RASA-89/18
	94:2287	ORNL/RASA-91/18	Oak Ridge National Lab., TN (United States). HAZWRAP Support Contractor Office		
	94:2288	ORNL/RASA-91/19		94:666	DOE/HWP-116
	94:2289	ORNL/RASA-91/20		94:1322	DOE/HWP-99
	94:2290	ORNL/RASA-91/21		94:1838	DOE/HWP-139
	94:2291	ORNL/RASA-91/22	BDM Corp., McLean, VA (United States)		
	94:2292	ORNL/RASA-91/23		94:725	DOE/MWIP-3-Vol.2
	94:2293	ORNL/RASA-91/24	EG and G Idaho, Inc., Idaho Falls, ID (United States)		
	94:2294	ORNL/RASA-91/25		94:788	EGG-M-91394
	94:2295	ORNL/RASA-91/26		94:792	EGG-M-91481
	94:2296	ORNL/RASA-91/27	Pacific Northwest Lab., Richland, WA (United States)		
	94:2297	ORNL/RASA-91/28		94:384	PNL-SA-21257
	94:2298	ORNL/RASA-91/29		94:392	PNL-SA-21987
	94:2299	ORNL/RASA-91/30	USDOE Oak Ridge Operations Office, TN (United States)		
	94:2300	ORNL/RASA-92/1		94:747	DOE/OR-01-1168-D2
	94:2301	ORNL/RASA-92/2		94:1323	DOE/HWP-104
	94:2302	ORNL/RASA-92/3		94:1839	DOE/HWP-147
	94:2303	ORNL/RASA-92/4	Bechtel National, Inc., Oak Ridge, TN (United States)		
	94:2304	ORNL/RASA-92/5		94:898	ORNL/ER/Sub-87-99053/55
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	94:2306	ORNL/RASA-92/7	Martin Marietta Energy Systems, Inc., Oak Ridge, TN (United States)		
	94:2307	ORNL/RASA-92/8		94:54	CONF-931136-3
	94:2308	ORNL/RASA-92/9		94:266	ES/ER/TM-89
	94:2309	ORNL/RASA-92/12		94:267	ES/ER/TM-90
	94:2310	ORNL/RASA-92/14		94:269	ES/ER/TM-102
	94:2311	ORNL/RASA-93/1		94:626	CONF-930483-10
	94:2312	ORNL/RASA-93/3		94:852	ES/ER/TM-54
	94:2313	ORNL/RASA-93/4		94:1855	DOE/OR-01-1110-D2
	94:2314	ORNL/RASA-93/5		94:1954	ES/ER/TM-20
	94:2315	ORNL/RASA-93/7		94:1955	ES/ER/TM-25
	94:2316	ORNL/RASA-94/1		94:1956	ES/ER/TM-48/Pt.1
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	94:2320	ORNL/TM-11817		94:2198	ES/ER/TM-91
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	94:750	DOE/OR-03-1150-D1		94:2537	Y/TS-1016
	USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). Office of Technology Development			Martin Marietta Energy Systems, Inc., Oak Ridge, TN (United States)	
	94:724	DOE/MWIP-3-Vol.1		94:748	DOE/OR-01-1169-D1
	94:730	DOE/MWIP-11		94:1797	CAPE-3063
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	94:853	ES/ER/TM-55		94:2535	Y/ER/Sub-90/97777/2
	94:854	ES/ER/TM-101		Science Applications International Corp., Oak Ridge, TN (United States)	
	94:900	ORNL/M-2751/ES		94:128	DOE/OR-01-1115-D3
	94:901	ORNL/M-2751/V1/Pt.C		94:1860	DOE/OR-01-1161-V1-D1
	94:902	ORNL/M-2751/V2/Pt.C		CDM Federal Programs Corp., Oak Ridge, TN (United States)	
	94:1983	ORNL/M-2751/I		94:749	DOE/OR-01-1173-D1
	94:1984	ORNL/M-2751/V1/Pt.A		Oak Ridge National Lab., TN (United States). HAZWRAP Support Contractor Office	
	94:1985	ORNL/M-2751/V2/Pt.A		94:1836	DOE/HWP-69/R1
	Oak Ridge National Lab., TN (United States). Environmental Restoration Div.			94:1837	DOE/HWP-102
	94:310	ORNL/ER-62		Martin Marietta Energy Systems, Inc., Oak Ridge, TN (United States)	
	94:311	ORNL/ER-62/R1		94:755	DOE/OR-1051
	94:322	ORNL/ER-136		Oak Ridge K-25 Site, TN (United States)	
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	94:1971	ORNL/ER-39		94:283	K-2073-Vol.3B
	94:1977	ORNL/ER-141		94:284	K/ER-40
	94:2246	ORNL/ER-35		94:285	K/ER-47
	94:2253	ORNL/ER-123		94:286	K/QT-407
	94:2258	ORNL/ER-139		94:287	K/TCD-1054
	94:2262	ORNL/ER-192		94:663	DOE/HWP-106-Vol.1
	94:2263	ORNL/ER-203		94:664	DOE/HWP-106-Vol.2
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	USDOE Oak Ridge Field Office, TN (United States)			94:733	DOE/MWIP-15
	94:2578	DOE/FTR-93018609		94:734	DOE/MWIP-19
	Oak Ridge National Lab., Grand Junction, CO (United States)			94:859	K/HWP-1
	94:353	ORNL/TM-12101		94:860	K/TCD-1080
	94:2323	ORNL/TM-12139		94:1961	K/TCD-1076
	MK-Ferguson of Oak Ridge Co., TN (United States)			94:1962	K/TCD-1089
	94:1857	DOE/OR-01-1122-D3		94:1963	K/TCD-1090
	Oak Ridge National Lab., TN (United States)			94:2214	K/ER-56
	94:2028	Y/ER-17		94:2273	ORNL/M-2563
	Oak Ridge Y-12 Plant, TN (United States)			D and D Integrated Demonstration Technical Support Group (United States)	
	94:127	DOE/OR-01-1115-D2		94:740	DOE/NBM-1101
	94:559	Y/ER-16	USDOE Weldon Spring Site Remedial Action Project, MO (United States)		
	94:560	Y/ER-20/V2	94:1873	DOE/OR/21548-243	
	94:561	Y/ER-21	USDOE Oak Ridge Field Office, TN (United States)		
	94:562	Y/ER-29	94:640	DOE/EIS-0185D-091	
	94:563	Y/ER-50	94:643	DOE/EIS-0185D-160	
	94:564	Y/ER/Sub-90/VK168/4-D1	USDOE Oak Ridge Field Office, TN (United States). Weldon Spring Site Remedial Action Project		
	94:756	DOE/OR-1054-D1	94:638	DOE/EIS-0185D-074-Vol.1	
	94:757	DOE/OR-1054-D2	94:639	DOE/EIS-0185D-074-Vol.2	
	94:1854	DOE/OR-01-1100-D3	94:641	DOE/EIS-0185D-148-Vol.1	
	94:1859	DOE/OR-01-1151-D1	94:642	DOE/EIS-0185D-148-Vol.2	
	94:1866	DOE/OR-01-1214-D2	94:1798	CAPE-3064	
	94:1868	DOE/OR-1060-D1	Westinghouse Environmental Management Co. of Ohio, Cincinnati, OH (United States). Fernald Environmental Management Project		
	94:1869	DOE/OR-1060-D3	94:270	FEMP-2248	
	94:1872	DOE/OR-1152-D1			
	94:2027	Y/ER-10			
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	94:274	FEMP-93010810		94:1370	PNL-9428
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	94:332	ORNL/ER-186		94:440	WHC-EP-0418
94:751	DOE/OR-03-1195-D1	94:441		WHC-EP-0423	
Ebasco Services, Inc., Oak Ridge, TN (United States)		94:1137		WHC-SA-1005	
94:750	DOE/OR-03-1150-D1	94:1497		WHC-EP-0508-Vol.1	
Bechtel National, Inc., Oak Ridge, TN (United States)		94:2557		DOE/FTR-93010923	
94:1874	DOE/OR/21949-283	Pacific Northwest Lab., Richland, WA (United States)			
94:1875	DOE/OR/21949-284	94:361		PNL-7866	
94:1876	DOE/OR/21949-285	94:362		PNL-7872	
94:1877	DOE/OR/21949-286	94:363		PNL-8219	
94:1878	DOE/OR/21949-287	94:364		PNL-8294	
94:1879	DOE/OR/21949-288	94:365		PNL-8332	
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94:1882	DOE/OR/21949-341	94:368	PNL-8358		
94:1883	DOE/OR/21949-342	94:369	PNL-8478		
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94:1886	DOE/OR/21949-345	94:372	PNL-SA-19908		
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94:1888	DOE/OR/21949-364	94:374	PNL-SA-20486		
94:1889	DOE/OR/21949-365	94:375	PNL-SA-20508		
94:1890	DOE/OR/21949-366	94:376	PNL-SA-20510		
94:1891	DOE/OR/21949-367	94:377	PNL-SA-20547		
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94:1894	DOE/OR/21949-374	94:380	PNL-SA-20825		
94:1895	DOE/OR/21949-378	94:381	PNL-SA-20853		
94:1896	DOE/OR/21949-379	94:382	PNL-SA-20868		
AC05-92OR21972	Westinghouse Environmental Management Co. of Ohio, Cincinnati, OH (United States), Fernald Environmental Management Project		94:383	PNL-SA-20984	
	94:273	FEMP-2312	94:384	PNL-SA-21257	
	94:855	FEMP-2288	94:385	PNL-SA-21537	
	94:2087	FEMP/SUB-074	94:386	PNL-SA-21706	
	94:2208	FEMP-2334	94:387	PNL-SA-21710	
	Fernald Environmental Restoration Management Corp., Cincinnati, OH (United States), Fernald Environmental Management Project		94:388	PNL-SA-21730	
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	94:2085	FEMP-2267	94:390	PNL-SA-21763	
	94:2086	FEMP-2316	94:391	PNL-SA-21891	
	Fernald Environmental Restoration Management Corp., Cincinnati, OH (United States)		94:392	PNL-SA-21987	
	94:272	FEMP-2305	94:393	PNL-SA-22008	
	94:276	FEMP/SUB-068	94:394	PNL-SA-22070	
	94:1960	FEMP-2310	94:395	PNL-SA-22251	
	94:2207	FEMP-2301	94:396	PNL-SA-22817	
	Schafer (W.J.) Associates, Inc., Chelmsford, MA (United States)		94:397	PNL-SA-23164	
	94:131	DOE/OR/22000-1	94:398	PNL-SA-23721	
AC05-93OR22000	IIT Research Inst., Chicago, IL (United States)		94:936	PNL-6241-Rev.2	
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	94:1037	WHC-EP-0466-1-Rev.1		94:1103	WHC-EP-0683
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	94:1039	WHC-EP-0468		94:1105	WHC-EP-0697
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	94:1041	WHC-EP-0468-2		94:1107	WHC-EP-0737
	94:1042	WHC-EP-0469		94:1108	WHC-EP-0747
	94:1043	WHC-EP-0469-1		94:1109	WHC-EP-0757
	94:1044	WHC-EP-0470		94:1110	WHC-MR-0259
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	94:1055	WHC-EP-0474-08		94:1121	WHC-MR-0437
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	94:1062	WHC-EP-0476-Rev.1		94:1128	WHC-SA-0826
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	94:1148	WHC-SA-1350		94:1219	WHC-SA-2143
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	94:1153	WHC-SA-1423		94:1224	WHC-SD-W026-TRP-006
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	94:1457	WHC-EP-0365		94:1520	WHC-EP-0606
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	94:2456	WHC-EP-0342-Add.33		94:2527	WHC-SD-EN-TP-028
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	94:2458	WHC-EP-0359-Rev.1		94:2529	WHC-SD-EN-TP-031
	94:2459	WHC-EP-0366		94:2530	WHC-SD-EN-TP-033
	94:2460	WHC-EP-0394-1		94:2531	WHC-SD-EN-TP-038
	94:2461	WHC-EP-0394-2		94:2532	WHC-SD-EN-TP-039
	94:2462	WHC-EP-0394-3		94:2555	DOE/FTR-93010639
	94:2463	WHC-EP-0394-4		94:2557	DOE/FTR-93010923
	94:2464	WHC-EP-0394-5		94:2565	DOE/FTR-93013558
	94:2465	WHC-EP-0394-6		94:2566	DOE/FTR-93013560
	94:2466	WHC-EP-0394-7		94:2570	DOE/FTR-93014810
	94:2467	WHC-EP-0398		94:2582	DOE/FTR-94003794
	94:2468	WHC-EP-0400		94:2584	DOE/RL-93-59
	94:2469	WHC-EP-0402		94:2619	WHC-EP-0588
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	94:2471	WHC-EP-0408		Isuzu Motors Ltd., Southfield, MI (United States)	
	94:2472	WHC-EP-0445		94:534	WHC-SA-2439
	94:2473	WHC-EP-0448		Pacific Northwest Lab., Richland, WA (United States)	
	94:2474	WHC-EP-0500		94:2374	PNL-SA-22430
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	94:2476	WHC-EP-0526		USDOE Richland Operations Office, WA (United States)	
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	94:2482	WHC-EP-0644		94:1900	DOE/RL-90-08
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	94:2486	WHC-MR-0426		Westinghouse Savannah River Co., Aiken, SC (United States)	
	94:2487	WHC-MR-0441		94:1621	WHC-SA-1697
	94:2488	WHC-MR-0442		Westinghouse Hanford Co., Richland, WA (United States). Integration Dept.	
	94:2489	WHC-SA-1124		94:2175	DOE/RL-89-18-Rev.1
	94:2490	WHC-SA-1130		USDOE Richland Field Office, WA (United States)	
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	94:2497	WHC-SA-1456		94:1908	DOE/RL-92-20-Draft
	94:2498	WHC-SA-1460		94:1912	DOE/RL-92-71
	94:2499	WHC-SA-1665		United Engineers and Constructors, Inc., Englewood, CO (United States). Western Operations	
	94:2500	WHC-SA-1763		94:594	CAPE-3030
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	94:2502	WHC-SA-1792		94:772	DOE/RL/11946-1-Vol.3
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	94:781	DOE/RL/11946-T1-Vol.1		94:210	EGG-WTD-9868
	94:782	DOE/RL/11946-T1-Vol.2		94:211	EGG-WTD-9870-Rev.1
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AC06-92RL12434	USDOE Richland Field Office, WA (United States)			94:214	EGG-WTD-9901
	94:1333	HWVP-89-007-Rev.3		94:215	EGG-WTD-9916
AC07-76GJ01664	USDOE Albuquerque Operations Office, NM (United States). Uranium Mill Tailings Remedial Action Project Office			94:216	EGG-WTD-9925
	94:1716	DOE/UMTRA-050506-Vol.4		94:217	EGG-WTD-9985-Vol.1
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AC07-76ID01570	Idaho National Engineering Lab., Idaho Falls, ID (United States)			94:220	EGG-WTD-9993
	94:856	INEL/MISC-91107		94:221	EGG-WTD-10033
	EG and G Idaho, Inc., Idaho Falls, ID (United States). Idaho National Engineering Lab.			94:222	EGG-WTD-10035
	94:826	EGG-WM-10823		94:223	EGG-WTD-10092
	EG and G Idaho, Inc., Idaho Falls, ID (United States)			94:224	EGG-WTD-10129
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	94:108	DOE/ID-10432		94:226	EGG-WTD-10194
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	94:786	EGG-CIET-11061		94:1750	EGG-M-92186
	94:787	EGG-LLW-11140		94:1751	EGG-WM-10974
	94:789	EGG-M-91416		94:1752	EGG-WTD-9408
	94:790	EGG-M-91423		94:1842	DOE/ID-10253-FY94
	94:791	EGG-M-91476		94:1843	DOE/ID-10317-Rev.1
	94:793	EGG-M-91495		94:1950	EGG-2679(92)
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	94:809	EGG-M-93176		94:2188	EGG-WTD-10507
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	94:817	EGG-NRP-10991		94:2563	DOE/FTR-93012976
	94:818	EGG-PHY-10446		94:2586	EGG-WTD-9911
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	94:821	EGG-WM-10146		USDOE Idaho Operations Office, Idaho Falls, ID (United States)	
	94:822	EGG-WM-10496		94:2581	DOE/FTR-94003540
	94:823	EGG-WM-10533		EG and G Idaho, Inc., Idaho Falls, ID (United States). Low-Level Waste Management Program	
	94:824	EGG-WM-10630		94:693	DOE/LLW-137
	94:825	EGG-WM-10728		94:711	DOE/LLW-181
	94:827	EGG-WM-10823-Rev.1		EG and G Idaho, Inc., Idaho Falls, ID (United States). National Low-Level Waste Management Program	
	94:828	EGG-WM-11179		94:683	DOE/LLW-101
	94:829	EGG-WM-11205		94:687	DOE/LLW-117
	94:830	EGG-WMO-10244-App.A		94:688	DOE/LLW-118
	94:831	EGG-WMO-10244-App.B-Pt.1		94:689	DOE/LLW-119
	94:832	EGG-WMO-10244-App.B-Pt.2		94:690	DOE/LLW-120
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	94:835	EGG-WMO-10244-Vol.1-Vol.2		94:694	DOE/LLW-141
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	94:837	EGG-WTD-9194		94:699	DOE/LLW-151
	94:838	EGG-WTD-9214		94:701	DOE/LLW-159
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	94:840	EGG-WTD-9684		USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States)	
	94:841	EGG-WTD-9723		94:736	DOE/NBM-1100-Vol.2
	94:842	EGG-WTD-9935		94:737	DOE/NBM-1100-Vol.3
	94:843	EGG-WTD-10036		94:738	DOE/NBM-1100-Vol.4
	94:844	EGG-WTD-10037		94:739	DOE/NBM-1100-Vol.6
	94:845	EGG-WTD-10056		94:2166	DOE/EA-0499
	94:846	EGG-WTD-10058		USDOE Idaho Operations Office, Idaho Falls, ID (United States). Task Force	
	94:847	EGG-WTD-10254		94:672	DOE/ID-10253
	94:848	EGG-WTD-10443			
	94:849	EGG-WTD-10935			
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	USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). Office of Technology Development		AC08-89NV10630	Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV (United States). Environmental Restoration and Technology Development Dept.	
	94:2539	CONF-901285-		94:49	CONF-921137-7
	USDOE Idaho Field Office, Idaho Falls, ID (United States)		AC08-94NV11432	Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV (United States)	
	94:1840	DOE/ID-10253(FY92)		94:126	DOE/NV/11432-32
	94:1841	DOE/ID-10253-FY93	AC09-89SR18035	EG and G Idaho, Inc., Idaho Falls, ID (United States)	
	Colorado School of Mines, Golden, CO (United States). Dept. of Metallurgical and Materials Engineering			94:804	EGG-M-92605
	94:234	EGG-WTD-10429		Westinghouse Savannah River Co., Aiken, SC (United States)	
	MSE, Inc., Idaho Falls, ID (United States)			94:360	PATENTS-US-A7841108
	94:1325	DOE/ID-10409		94:553	WSRC-MS-91-290-Draft
AC07-81NE44139	Oak Ridge National Lab., TN (United States)			94:554	WSRC-MS-93-362
	94:2052	CONF-930403-37		94:555	WSRC-MS-93-362-Rev.1
	94:2053	CONF-930403-38		94:556	WSRC-MS-93-511
	Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (United States)			94:557	WSRC-MS-94-0233
AC07-84ID12435	94:551	WINCO-1182		94:558	WSRC-TR-93-565
	94:552	WINCO-11980	AC21-92MC29103	94:1260	WSRC-RP-93-610
	94:1236	WINCO-1127		94:2121	WSRC-MS-92-155
	94:1237	WINCO-1129		94:2533	WSRC-TR-93-459
	94:1238	WINCO-1130	AC21-92MC29106	Babcock and Wilcox Co., Alliance, OH (United States). Research Center	
	94:1239	WINCO-1131		94:123	DOE/MC/29103-3661
	94:1240	WINCO-1133	AC21-92MC29107	Coleman Research Corp., Columbia, MD (United States)	
	94:1241	WINCO-1136		94:124	DOE/MC/29106-3531
	94:1242	WINCO-1139		Delphi Research, Inc., Albuquerque, NM (United States)	
	94:1243	WINCO-1146		94:715	DOE/MC/29107-94/C0331
	94:1244	WINCO-1150		94:716	DOE/MC/29107-3701
	94:1245	WINCO-1153	AC21-92MC29109	ECO, Inc., Annapolis, MD (United States)	
	94:1246	WINCO-1164		94:719	DOE/MC/29109-3634
	94:1247	WINCO-1165		Engineering Computer Optecomics, Inc., Annapolis, MD (United States)	
	94:1248	WINCO-1171		94:717	DOE/MC/29109-3356
	94:1249	WINCO-1172		94:718	DOE/MC/29109-3392
	94:1250	WINCO-1173	AC21-92MC29112	Martin Marietta Astronautics Group, Littleton, CO (United States)	
	94:1252	WINCO-1177		94:2071	DOE/MC/29112-3641
	94:1253	WINCO-1178	AC21-92MC29113	Mechanical Technology, Inc., Latham, NY (United States)	
	94:1254	WINCO-1180		94:2072	DOE/MC/29113-3405
	94:1255	WINCO-1187		94:2073	DOE/MC/29113-3536
	94:1256	WINCO-1191		94:2074	DOE/MC/29113-3574
	94:1257	WINCO-11933		94:2075	DOE/MC/29113-3608
	94:1258	WINCO-11939		94:2076	DOE/MC/29113-3689
	94:1665	WINCO-1183	AC21-92MC29115	Clemson Univ., SC (United States)	
	94:1666	WINCO-1184		94:2077	DOE/MC/29115-93/C0190
	94:1667	WINCO-1192		Clemson Univ., SC (United States). Dept. of Electrical and Computer Engineering	
	94:1668	WINCO-11926		94:2078	DOE/MC/29115-94/C0274
	94:1669	WINCO-11935	AC21-92MC29116	SRI International, Menlo Park, CA (United States)	
	94:2025	WINCO-1132		94:720	DOE/MC/29116-3606
	94:2026	WINCO-1163		94:1845	DOE/MC/29116-3406
	94:2120	WINCO-1155		94:1846	DOE/MC/29116-3575
	Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (United States). Applied Technology Dept.		AC21-92MC29119	UTD, Inc., Newington, VA (United States)	
	94:1251	WINCO-1176		94:1847	DOE/MC/29119-3524
AC07-92ID13167	Jason Associates Corp., San Diego, CA (United States)			94:1848	DOE/MC/29119-3667
	94:122	DOE/ID/13167-T2	AC21-92MC29120	Vortec Corp., Collegeville, PA (United States)	
AC07-93ID13215	Coleman Energy and Environmental Systems, Golden, CO (United States). Blackhawk Geosciences Div.			94:1849	DOE/MC/29120-3498
	94:678	DOE/ID/13215-T1	AI01-92EW50616	Coleman Research Corp., Orlando, FL (United States)	
	94:679	DOE/ID/13215-T2		94:662	DOE/EW/50616-T13
	94:680	DOE/ID/13215-T2-Attach.			

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	94:1657 WHC-SD-WM-ES-219			94:1733	DOE/UMTRA-050510-GRNO-Vol.3
	Bureau of Mines, Pittsburgh, PA (United States), Pittsburgh Research Center		FC04-83AL19454	94:1796	CAPE-3054
	94:1329 DOE/RL/12253-T1			USDOE Albuquerque Operations Office, NM (United States), Uranium Mill Tailings Remedial Action Project Office	
AI08-86NV10583	94:1330 DOE/RL/12253-T3			94:1739	DOE/UMTRA-050515-0000-Vol.1
	Geological Survey, Denver, CO (United States)			USDOE Albuquerque Field Office, NM (United States), Uranium Mill Tailings Remedial Action Project Office	
	94:25 CONF-8909163-15			94:1740	DOE/UMTRA-050515-0000-Vol.2-App.F
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80027	94:1278	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94005478	MF-902
80028	94:1279	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94007699	MF-902
80123	94:1280	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94005920	MF-902
80310	94:4	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93041171	MF-902
80402	94:2538	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019767	MF-902
80571	94:569	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008464	MF-902; MF-940
80618	94:5	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040274	MF-940
80775	94:1281	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002362	MF-940
80854	94:6	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94006831	MF-902
80987	94:570	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008102	MF-902
81047	94:1282	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94011474	MF-901; MF-902
81229	94:1283	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94011475	MF-901
82230	94:571	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008458	MF-902; MF-940

ANL/CMT/PP-

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
ANL/CMT/PP-79479	94:2127	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94009804	MF-902
ANL/CP-70819	94:2128	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91010628	MF-902
71331	94:2129	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91010283	MF-902
71530	94:1284	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91010278	MF-902
71902	94:572	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003418	MF-902
72668	94:7	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91018544	MF-902
72946	94:8	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003450	MF-902
72972	94:2130	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003373	MF-902
72987	94:2131	OSTI; NTIS; GPO Dep.	E 1.99:	DE91018563	MF-902
73007	94:2132	OSTI; NTIS; GPO Dep.	E 1.99:	DE91018562	MF-902
73026	94:573	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91018561	MF-902
73172	94:9	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004142	MF-902
73319	94:1285	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92001924	MF-902
73431	94:1286	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92001923	MF-902
73611	94:1287	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005242	MF-902
74200	94:1288	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92010516	MF-902
74206	94:1289	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92010887	MF-902
74216	94:1290	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92009715	MF-902
74455	94:1770	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003407	MF-902
74663	94:1771	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003522	MF-940
75634	94:10	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92017092	MF-902
75814	94:11	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013062	MF-902
75817	94:574	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92016188	MF-902
76005	94:12	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041105	MF-902
ANL/DIS/CP-80919	94:575	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002363	MF-940
80940	94:1772	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94006827	MF-902
80955	94:576	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001476	MF-907
82018	94:577	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94007651	MF-902
ANL/EA/CP-78779	94:1773	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040823	MF-902
79850	94:2133	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001278	MF-902
79884	94:2134	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94003213	MF-902
79944	94:578	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001273	MF-902
79945	94:2135	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94003214	MF-902
79947	94:1774	OSTI; NTIS; GPO Dep.	E 1.99:	DE94003215	MF-902
79948	94:1775	OSTI; NTIS; GPO Dep.	E 1.99:	DE94003216	MF-902
79949	94:1776	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94003217	MF-902
79950	94:13	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94003218	MF-902
80790	94:1777	OSTI; NTIS; GPO Dep.	E 1.99:	DE94007646	MF-902
80824	94:1778	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94006829	MF-902
80825	94:1779	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94006823	MF-902
80956	94:1780	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94006825	MF-902
80957	94:1781	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94006536	MF-902; MF-940
80958	94:1291	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94006828	MF-902
80969	94:1782	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94006815	MF-902
80972	94:579	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94007674	MF-902; MF-940
80976	94:1783	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94007696	MF-902
80977	94:580	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94007655	MF-902
81474	94:2136	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94005121	MF-902
82020	94:581	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94007652	MF-902
82021	94:1784	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94006813	MF-902
82328	94:1785	OSTI; NTIS; GPO Dep.	E 1.99:	DE94009728	MF-902
ANL/EA/RP-80447	94:19	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019531	MF-902
ANL/EAD/TM-2	94:2137	OSTI; NTIS; GPO Dep.	E 1.99:	DE94004538	MF-902
9	94:1786	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94006424	MF-902
13	94:1787	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94011140	MF-902
ANL/EAIS-3	94:2138	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003356	MF-902
8	94:14	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93015606	MF-602
ANL/EAIS/CP-77680	94:2139	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93004202	MF-902
78705	94:15	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93012892	MF-630
79173	94:16	OSTI; NTIS; GPO Dep.	E 1.99:	DE93012909	MF-902

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79748	94:1788	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001292	MF-902
80710	94:2140	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94000468	MF-902
80858	94:582	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001293	MF-902
ANL/EAS/TM-					
103	94:1792	OSTI; NTIS; GPO Dep.	E 1.99:	DE94000632	MF-630
42	94:2141	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91011424	MF-902
77	94:17	OSTI; NTIS; GPO Dep.	E 1.99:	DE93005781	MF-902
78	94:1789	OSTI; NTIS; GPO Dep.	E 1.99:	DE93006033	MF-902
79	94:18	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93009610	MF-903
80	94:1790	OSTI; NTIS; GPO Dep.	E 1.99:	DE93004381	MF-902
94	94:1791	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93013113	MF-902
ANL/ER/CP-					
77595	94:2142	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010665	MF-902
79013	94:1793	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017705	MF-902
80564	94:1794	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002910	MF-902
ANL/ES/CP-					
79581	94:20	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93015551	MF-901; MF-902
81712	94:21	OSTI; NTIS; GPO Dep.	E 1.99:	DE94005484	MF-902
ANL/ESD/TM-					
32	94:22	OSTI; NTIS; GPO Dep.	E 1.99:	DE93002117	MF-902
ANL/ET/CP-					
80828	94:583	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94009818	MF-940
81294	94:584	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94010433	MF-902
ANL/EWM/CP-					
78035	94:585	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93004232	MF-902
80486	94:586	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019019	MF-902
ANL/EWM/VU-					
82273	94:2143	OSTI; NTIS; GPO Dep.	E 1.99:	DE94008463	MF-902
ANL/FC/CP-					
77558	94:2144	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017444	MF-902
ANL/MCT/CP-					
77586	94:587	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93008646	MF-902
ANL/RE-					
92/2	94:1292	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92017237	MF-906
ANL/RE/CP-					
78949	94:2145	OSTI; NTIS; GPO Dep.	E 1.99:	DE94001341	MF-900; MF-902
79030	94:1293	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93015547	MF-502; MF-903
BHARC-					
800/93/004	94:946	See PNL-8548			
BNL-					
46158	94:588	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005028	MF-902
46540	94:1294	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91018726	MF-902
47775	94:2146	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92040575	MF-902
48252	94:589	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93008563	MF-940
48363	94:1295	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93007272	MF-940
48749	94:23	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019471	MF-902; MF-940
48750	94:1296	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019470	MF-902; MF-940
48776	94:24	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93012520	MF-902
48777	94:1795	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93012535	MF-902
48921	94:590	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93015913	MF-901; MF-902
49709	94:591	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94005145	MF-902
49736	94:592	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008091	MF-940
49761	94:1297	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94011738	MF-902; MF-940
49841	94:593	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94005507	MF-900
52357	94:1298	OSTI; NTIS; GPO Dep.	E 1.99:	DE93008899	PC-406; PC-510
52361	94:1299	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93011793	PC-406; PC-510
52372	94:1300	OSTI; NTIS; GPO Dep.	E 1.99:	DE93013930	PC-406; PC-403
52378	94:1301	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017730	PC-406; PC-906

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52384	94:1302	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019775	PC-906
52402	94:1303	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94005933	PC-406
52417	94:1304	OSTI; NTIS; GPO Dep.	E 1.99:	DE94009948	PC-406
52420	94:1305	OSTI; NTIS; GPO Dep.	E 1.99:	DE94012619	PC-406
BNWL-MA-88-App.1	94:1987	See PNL-7008-Vol.2			
CAPE-					
3030	94:594	OSTI		TI92015016	ND-900
3035	94:595	OSTI		TI92019845	ND-900
3054	94:1796	OSTI		TI93012988	ND-902
3063	94:1797	OSTI		TI93017277	ND-902
3064	94:1798	OSTI		TI93003928	ND-902
3065	94:1799	OSTI		TI93017800	ND-940
CONF-8909163-		(5. symposium on containment of underground nuclear explosions; Santa Barbara, CA (United States); 19-21 Sep 1989)			
15	94:25	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004281	MF-903
16	94:26	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004280	MF-903
17	94:27	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004279	MF-903
18	94:28	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004278	MF-903
CONF-8911162-		(NWWA/API conference on petroleum hydrocarbons and organic chemicals in ground water; Houston, TX (United States); 15-17 Nov 1989)			
1	94:181	See EGG-M-89238			
CONF-900210-		(Waste management '90: working towards a cleaner environment: waste processing, transportation, storage and disposal, technical programs and public education; Tucson, AZ (United States); 25 Feb - 1 mar 1990)			
Vol.1	94:29	Arizona Board of Regents, University of Arizona, Tucson, AZ 85721			ND-900
Vol.2	94:1306	Arizona Board of Regents, University of Arizona, Tucson, AZ 85721			ND-900
CONF-9002111-		(Data analysis and interpretation for environmental surveillance conference; Lexington, KY (United States); 5-7 Feb 1990)			
3	94:2147	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91016284	MF-902; MF-721
CONF-9002121-		(4. U.S. Department of Energy Office of Environmental Restoration and Waste Management waste reduction workshop; Tampa, FL (United States); 6-7 Feb 1990)			
CONF-9004181-	94:1322	See DOE/HWP-99			
		(DOE remedial action under the environmental restoration and waste management five-year plan; Albuquerque, NM (United States); 16-19 Apr 1990)			
Vol.1	94:30	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91000103	MF-902
Vol.2	94:31	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91000104	MF-902
CONF-900525-		(2. international symposium on stabilization/solidification of hazardous, radioactive and mixed waste; Williamsburg, VA (United States); 29 May - 1 jun 1990)			
4	94:1670	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91007281	MF-902
CONF-900608-		(American Nuclear Society (ANS) annual meeting; Nashville, TN (United States); 10-14 Jun 1990)			
49	94:1127	See WHC-SA-0825			
CONF-9006199-		(United States delegation to the Soviet Union on environmental restoration and waste management conference; Moscow (USSR); 15-29 Jun 1990)			
2	94:1574	See WHC-SA-0937			
CONF-9006240-		(American Society for Testing and Materials (ASTM) symposium on water in the 1990's: meeting new challenges; Denver, CO (United States); 11-14 Jun 1990)			
1	94:1572	See WHC-SA-0646			

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CONF-900631-		(International conference on pollution prevention: clean technologies and clean products--the environmental challenge of the 1990's; Washington, DC (United States); 10-13 Jun 1990)			
2	94:1126	See WHC-SA-0818			
CONF-9006357-		(International symposium on mapping and geographic information systems (GIS); San Francisco, CA (United States); 21-22 Jun 1990)			
1	94:2364	See PNL-SA-17567			
CONF-9007109-		(Rocky Mountain analytical conference; Denver, CO (United States); 30 Jul 1990)			
2	94:1129	See WHC-SA-0872			
CONF-9007182-		(5. waste reduction workshop; Idaho Falls, ID (United States); 24-26 Jul 1990)			
	94:1323	See DOE/HWP-104			
CONF-9009116-		(Spectrum '90: radioactive waste technologies, decontamination, decommissioning and hazardous wastes; Knoxville, TN (United States); 30 Sep - 4 oct 1990)			
3	94:1128	See WHC-SA-0826			
CONF-9010166-		(6. annual Department of Energy model conference on waste management and environmental restoration; Oak Ridge, TN (United States); 29 Oct - 2 nov 1990)			
	94:32	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91010951	MF-902
CONF-9010186-		(HAZTECH international 1990 conference; Pittsburgh, PA (United States); 2 Oct 1990)			
2	94:1573	See WHC-SA-0880			
CONF-9010202-		(8. 1990 annual membrane technology/planning conference and 1. high-tech separations symposium; Newton, MA (United States); 15-17 Oct 1990)			
1	94:483	See WHC-SA-0993			
CONF-901101-		(American Nuclear Society (ANS) winter meeting; Washington, DC (United States); 11-16 Nov 1990)			
39	94:2115	See WHC-SA-0934			
40	94:1131	See WHC-SA-0935			
62	94:1132	See WHC-SA-0939			
84	94:1133	See WHC-SA-0963			
CONF-901285-		(USAF/DOE workshop on solvent substitution; Phoenix, AZ (United States); 4-7 Dec 1990)			
	94:2539	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003262	MF-902
CONF-901286-		(U.S. Department of Energy (DOE)/Environmental Protection Agency (EPA) workshop on methods for siting ground-water monitoring wells; Las Vegas, NV (United States); 11-13 Dec 1990)			
1-Vugraphs	94:33	OSTI; NTIS; GPO Dep.	E 1.99:	DE91010132	MF-902
CONF-910164-		(Mining workshop for nuclear waste cleanup; Colorado Springs, CO (United States); 24-25 Jan 1991)			
	94:1800	American Society of Mechanical Engineers, 345 East 47th St., New York, NY 10017			ND-902
CONF-9102116-		(6. waste reduction workshop; Atlanta, GA (United States); 6-7 Feb 1991)			
	94:665	See DOE/HWP-108			
CONF-910223-		(4. topical meeting on robotics and remote systems; Albuquerque, NM (United States); 24-28 Feb 1991)			
1	94:2033	OSTI; NTIS; GPO Dep.	E 1.99:	DE91001523	MF-902
8	94:2034	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91004515	MF-721
CONF-910252-		(1991 American Nuclear Society (ANS) meeting; Albuquerque, NM (United States); 24-28 Feb 1991)			
1	94:2116	See WHC-SA-1042			

CONF-910270-

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CONF-910270-		(Waste management '91; Tucson, AZ (United States); 24 Feb - 1 mar 1991)			
14	94:1136	See WHC-SA-1001			
27	94:1135	See WHC-SA-1000			
41	94:1142	See WHC-SA-1092			
42	94:859	See K/HWP-1			
57	94:1576	See WHC-SA-1017			
62	94:482	See WHC-SA-0990			
63	94:1575	See WHC-SA-0999			
CONF-910277-		(18. annual WATtec interdisciplinary technical conference and exhibition; Knoxville, TN (United States); 19-22 Feb 1991)			
12	94:1801	OSTI; NTIS; GPO Dep.	E 1.99:	DE91016944	MF-902
CONF-910278-		(2. international symposium on field screening methods for hazardous wastes and toxic chemicals; Las Vegas, NV (United States); 12-14 Feb 1991)			
7	94:2128	See ANL/CP-70819			
CONF-910287-		(National research and development conference on the control of hazardous materials; Anaheim, CA (United States); 20-22 Feb 1991)			
5	94:2129	See ANL/CP-71331			
CONF-910311-		(42. Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy; Chicago, IL (United States); 4-8 Mar 1991)			
2	94:1134	See WHC-SA-0975			
CONF-9103114-		(In situ and on-site bioreclamation: an international symposium; San Diego, CA (United States); 19-21 Mar 1991)			
3	94:34	OSTI; NTIS; GPO Dep.	E 1.99:	DE91010778	MF-902
CONF-9104142-		(Waste stream minimization and utilization innovative concepts: an experimental technology exchange; Washington, DC (United States); 25-26 Apr 1991)			
Vol.1	94:2602	See PNL-SA-19337-Vol.1			
Vol.2	94:2603	See PNL-SA-19337-Vol.2			
CONF-9104204-		(First engineering and technology conference on waste management; San Juan (Puerto Rico); 24-26 Apr 1991)			
4	94:290	See LA-UR-91-1295			
CONF-9104215-		(HAZMACON '91; Santa Clara, CA (United States); 16-18 Apr 1991)			
1	94:486	See WHC-SA-1035			
CONF-910422-		(International topical conference on methods and applications of radioanalytical chemistry II (MARC-2); Kona, HI (United States); 21-27 Apr 1991)			
4	94:1139	See WHC-SA-1019			
CONF-9104256-		(Symposium on nuclear waste management; Cincinnati, OH (United States); 28 Apr - 2 may 1991)			
2	94:1145	See WHC-SA-1240			
CONF-910430-		(93. annual meeting and exposition of the American Ceramic Society (ACerS); Cincinnati, OH (United States); 28 Apr - 2 may 1991)			
12	94:866	See LA-UR-91-1552			
CONF-910435-		(2. annual American Nuclear Society (ANS) international high level radioactive waste management conference; Las Vegas, NV (United States); 28 Apr - 3 may 1991)			
44	94:1137	See WHC-SA-1005			
61	94:1284	See ANL/CP-71530			
92	94:2383	See SAND-91-1988C			
CONF-9105175-		(Waste management: technology, technology transfer and training; San Juan (Puerto Rico); 24-26 May 1991)			
1	94:291	See LA-UR-91-1303			

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CONF-910559--		(10. annual international incineration conference; environmental concerns and controls; Knoxville, TN (United States); 13-17 May 1991)			
6	94:1141	See WHC-SA-1044			
CONF-910602--		(1991 American Society of Mechanical Engineers (ASME) pressure vessels and piping conference; San Diego, CA (United States); 23-28 Jun 1991)			
12	94:1997	See SAND-90-3065C			
19	94:485	See WHC-SA-1010			
21	94:1138	See WHC-SA-1008			
23	94:484	See WHC-SA-1006			
CONF-910603--		(Annual meeting of the American Nuclear Society (ANS); Orlando, FL (United States); 2-6 Jun 1991)			
21	94:1577	See WHC-SA-1071			
CONF-9106239--		(11. International Association for Impact Assessment (IAIA) annual meeting; Champaign, IL (United States); 7-11 Jun 1991)			
2	94:1770	See ANL/CP-74455			
CONF-9106248--		(Department of Energy national underground storage tank waste characterization needs assessment workshop; Hanford, WA (United States); 25-27 Jun 1991)			
	94:1071	See WHC-EP-0514			
CONF-910659--		(84. annual meeting and exhibition of the Air and Waste Management Association (AWMA); Vancouver (Canada); 16-21 Jun 1991)			
21	94:1144	See WHC-SA-1167			
34	94:572	See ANL/CP-71902			
CONF-9107139--		(1991 American Society of Civil Engineers (ASCE) national conference on environmental engineering; Reno, NV (United States); 8-10 Jul 1991)			
1	94:1992	See PNL-SA-18817			
CONF-9107153--		(1. Hanford separations workshop; Richland, WA (United States); 23-25 Jul 1991)			
	94:1993	See PNL-SA-21775			
3	94:963	See PNL-SA-19796			
CONF-910794--		(International symposium on lysimetry; Honolulu, HI (United States); 23-25 Jul 1991)			
1	94:1768	See WHC-SA-1158			
2	94:482	See WHC-SA-0990			
CONF-9108100--		(American Statistical Association (ASA) annual meeting; Atlanta, GA (United States); 18-22 Aug 1991)			
4	94:2489	See WHC-SA-1124			
CONF-9108113--		(1991 Nuclear Information and Records Management Association (NIRMA) symposium; Charlotte, NC (United States); 25-28 Aug 1991)			
2	94:481	See WHC-SA-0980			
CONF-9108124--		(7. DOE waste reduction workshop; Kansas City, MO (United States); 6-8 Aug 1991)			
2	94:1802	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92000733	MF-940
Summ.	94:666	See DOE/HWP-116			
CONF-910817--		(11. international conference on structural mechanics in reactor technology (SMIRT-11); Tokyo (Japan); 18-23 Aug 1991)			
14	94:1338	See LA-UR-91-2077			
CONF-9108226--		(Industrial needs workshop; Washington, DC (United States); 27-28 Aug 1991)			
Summ.	94:2540	OSTI; NTIS; GPO Dep.	E 1.99:	DE93005316	MF-902
CONF-910840--		(2. BMFT materials research symposium; Dresden (Germany); 26-29 Aug 1991)			
11	94:1749	See EGG-M-91419			

CONF-910849--

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CONF-910849--		(1. international mixed waste symposium; Baltimore, MD (United States); 26-29 Aug 1991)			
5	94:596	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91018846	MF-940
CONF-910852--		(Summer national meeting of the American Institute of Chemical Engineers (AIChE); Pittsburgh, PA (United States); 20-22 Aug 1991)			
8	94:867	See LA-UR-91-2408			
9	94:868	See LA-UR-91-2409			
CONF-9109234--		(4. Tennessee water resources symposium; Knoxville, TN (United States); 24-26 Sep 1991)			
2	94:37	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91016282	MF-902
5	94:38	OSTI; NTIS; GPO Dep.	E 1.99:	DE91018936	MF-902
6	94:39	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92000067	MF-902; MF-940
7	94:40	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003559	MF-902
CONF-9109259--		(1. international congress on environmentally conscious manufacturing; Santa Fe, NM (United States); 18 Sep 1991)			
2	94:976	See SAND-91-2090C			
CONF-9109268--		(OECD/NEA workshop on long-term observation of the geological environment: needs and techniques; Helsinki (Finland); 9-11 Sep 1991)			
1	94:975	See SAND-91-1738C			
CONF-9109305--		(Conference on low level radioactive waste management and disposal; Petersburg, VA (United States); 26 Sep 1991)			
1	94:791	See EGG-M-91476			
CONF-9109306--		(1991 GeoTech/Geochautauqua meeting; Denver, CO (United States); 21-24 Sep 1991)			
1	94:182	See EGG-M-91219			
CONF-910981--		(Environmental remediation '91 conference; Pasco, WA (United States); 8-11 Sep 1991)			
2	94:35	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010652	MF-902
4	94:495	See WHC-SA-1209			
9	94:7	See ANL/CP-72668			
15	94:36	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92000063	MF-902
18	94:372	See PNL-SA-19908			
19	94:1968	See LA-UR-91-2874			
25	94:292	See LA-UR-91-2875			
27	94:371	See PNL-SA-19646			
30	94:2493	See WHC-SA-1297			
31	94:497	See WHC-SA-1228			
32	94:1585	See WHC-SA-1218			
33	94:488	See WHC-SA-1182			
34	94:1583	See WHC-SA-1215			
38	94:1590	See WHC-SA-1304			
39	94:2008	See WHC-SA-1190			
42	94:1581	See WHC-SA-1189			
43	94:2365	See PNL-SA-19899			
45	94:1591	See WHC-SA-1306			
47	94:2130	See ANL/CP-72972			
48	94:8	See ANL/CP-72946			
50	94:1771	See ANL/CP-74663			
52	94:1586	See WHC-SA-1219			
53	94:1588	See WHC-SA-1222			
54	94:1587	See WHC-SA-1221			
55	94:1584	See WHC-SA-1216			
56	94:491	See WHC-SA-1204			
57	94:489	See WHC-SA-1202			
58	94:494	See WHC-SA-1207			
67	94:496	See WHC-SA-1224			
68	94:493	See WHC-SA-1206			
69	94:492	See WHC-SA-1205			
	94:2009	See WHC-SA-1191			

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CONF-9110105-		(18. annual meeting of the Federation of Analytical Chemistry and Spectroscopic Societies and the 30th Pacific conference on chemistry and spectroscopy; Anaheim, CA (United States); 6-11 Oct 1991)			
1	94:1143	See WHC-SA-1166			
CONF-9110122-		(Natural phenomena hazards mitigation conference; St. Louis, MO (United States); 15-18 Oct 1991)			
6	94:1294	See BNL-46540			
13	94:1580	See WHC-SA-1144			
CONF-9110168-		(Department of Energy model conference; Oak Ridge, TN (United States); 14-17 Oct 1991)			
7	94:1375	See PNL-SA-20048			
8	94:1803	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92002685	MF-910
CONF-9110190-		(Association of Engineering Geologists (AEG) national meeting; Chicago, IL (United States); 1-4 Oct 1991)			
1	94:2491	See WHC-SA-1155			
CONF-9110207-		(HazMat South '91: hazardous materials management conference and exhibition; Atlanta, GA (United States); 2-4 Oct 1991)			
1	94:573	See ANL/CP-73026			
CONF-9110209-		(1991 Electric Power Research Institute (EPRI) PCB seminar; Baltimore, MD (United States); 8-11 Oct 1991)			
1	94:2132	See ANL/CP-73007			
2	94:2131	See ANL/CP-72987			
CONF-9110227-		(American Chemical Society annual meeting; Atlanta, GA (United States); 1-3 Oct 1991)			
1	94:869	See LA-UR-91-2976			
CONF-9110229-		(International Atomic Energy Agency (IAEA) low level waste disposal conference; Paris (France); 1-4 Oct 1991)			
1	94:597	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92000434	MF-940
CONF-9110255-		(1991 international DADS users conference; Iowa City, IA (United States); 7-11 Oct 1991)			
1	94:2094	See PNL-SA-20018			
CONF-9110266-		(1991 all-Alberta applied statistics and biometrics workshop; Alberta (Canada); 21-22 Oct 1991)			
1	94:2366	See PNL-SA-20036			
CONF-9110277-		(Florida environmental chemistry conference; Palm Coast, FL (United States); 30 Oct - 1 nov 1991)			
1	94:793	See EGG-M-91495			
CONF-911040-		(International waste management conference; Seoul (Korea, Republic of); 21-26 Oct 1991)			
4	94:1140	See WHC-SA-1020			
CONF-9110457-		(Life cycle costing workshop; Oak Ridge, TN (United States); 14-18 Oct 1991)			
Summ.	94:318	See ORNL/ER-117			
CONF-911071-		(American Chemical Society (ACS) symposium on emerging technologies for hazardous waste management; Atlanta, GA (United States); 1-3 Oct 1991)			
1	94:2490	See WHC-SA-1130			
2	94:1578	See WHC-SA-1132			
3	94:1579	See WHC-SA-1133			
CONF-911107-		(1991 winter meeting of the American Nuclear Society (ANS); San Francisco, CA (United States); 10-15 Nov 1991)			
25	94:2035	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91016770	MF-902
50	94:2148	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004347	MF-902
59	94:2117	See WHC-SA-1269			
CONF-911109-		(Fall meeting of the European Materials Research Society (EMRS); Strasbourg (France); 5-8 Nov 1991)			
1	94:1285	See ANL/CP-73319			

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2 CONF-9111105-	94:1286	See ANL/CP-73431 (Caribbean Haztech conference; San Juan (Puerto Rico); 13-15 Nov 1991)			
1 CONF-9111114-	94:2149	OSTI; NTIS; GPO Dep. (13. annual DOE low-level waste management conference; Atlanta, GA (United States); 19-21 Nov 1991)	E 1.99:	DE92001671	MF-902
8 CONF-9111116-	94:598	OSTI; NTIS; INIS; GPO Dep. (ICALEPCS '91: International conference on accelerator and large experimental physics control systems; Tsukuba (Japan); 11-15 Nov 1991)	E 1.99:	DE92010291	MF-902
4 CONF-9111176-	94:1582	See WHC-SA-1196 (International symposium on artificial intelligence; Cancun (Mexico); 13-15 Nov 1991)			
1 CONF-9111188-	94:370	See PNL-SA-19511 (1991 Air, Water, and Waste Technologies (AWAWT) conference; Detroit, MI (United States); 11-14 Nov 1991)			
1 CONF-9111133-	94:1804	OSTI; NTIS; INIS; GPO Dep. (American Institute of Chemical Engineers (AIChE) annual meeting; Los Angeles, CA (United States); 17-22 Nov 1991)	E 1.99:	DE92008254	MF-902
4 8 13 CONF-911202-	94:41 94:9 94:42	OSTI; NTIS; INIS; GPO Dep. See ANL/CP-73172 OSTI; NTIS; INIS; GPO Dep. (Annual fall meeting of the Materials Research Society (MRS); Boston, MA (United States); 2-6 Dec 1991)	E 1.99: E 1.99:	DE92001959 DE93005393	MF-902 MF-902
16 CONF-911213-	94:1287	See ANL/CP-73611 (American Society of Mechanical Engineers (ASME) annual winter meeting; Atlanta, GA (United States); 1-6 Dec 1991)			
2 CONF-911231-	94:2036	OSTI; NTIS; INIS; GPO Dep. (Technology 2001: 2nd national technology transfer conference and exposition; San Jose, CA (United States); 3-5 Dec 1991)	E 1.99:	DE91013234	MF-900
3 CONF-911268-	94:588	See BNL-46158 (CERS '91: Chinese experts radwaste symposium; Taipei (China); 17-18 Dec 1991)			
1 CONF-911286-	94:1307	OSTI; NTIS; INIS; GPO Dep. (Pacific Northwest International Air and Waste Management Association conference; Kalispell, MT (United States); 4-6 Dec 1991)	E 1.99:	DE92003026	MF-902
1 2 CONF-920107-	94:490 94:2492	See WHC-SA-1203 See WHC-SA-1225 (25. midyear topical meeting of the Health Physics Society; Dearborn, MI (United States); 12-16 Jan 1992)			
2 CONF-9202121-	94:599	OSTI; NTIS; INIS; GPO Dep. (18. environmental symposium and exhibition; Alexandria, VA (United States); 24-27 Feb 1992)	E 1.99:	DE92002804	MF-902
1 CONF-920220-	94:795	See EGG-M-92097 (International specialty conference: in situ treatment of contaminated soil and water; Cincinnati, OH (United States); 4-6 Feb 1992)			
1 2 CONF-920251-	94:375 94:380	See PNL-SA-20508 See PNL-SA-20825 (HMC-SOUTH '92: Hazardous Materials Control Research Institute meeting; New Orleans, LA (United States); 26-28 Feb 1992)			
1 CONF-920272-	94:2226	See LA-UR-91-4069 (Chemical oxidation technology for the nineties symposium; Nashville, TN (United States); 19-21 Feb 1992)			
2	94:2604	See PNL-SA-19718			

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CONF-920302--		(43. Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy; New Orleans, LA (United States); 9-13 Mar 1992)			
4	94:1589	See WHC-SA-1288			
CONF-920307--		(Waste management '92; Tucson, AZ (United States); 1-5 Mar 1992)			
7	94:43	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92007252	MF-902
12	94:2227	See LA-UR-92-283			
13	94:600	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92007539	MF-907
15	94:1805	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92007675	MF-902
19	94:2037	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92008281	MF-906
21	94:1595	See WHC-SA-1369			
22	94:2498	See WHC-SA-1460			
24	94:1154	See WHC-SA-1426			
25	94:2494	See WHC-SA-1355			
26	94:1148	See WHC-SA-1350			
27	94:1160	See WHC-SA-1465			
30	94:870	See LA-UR-92-644			
31	94:2591	See LA-UR-92-662			
33	94:1339	See LA-UR-92-654			
34	94:1592	See WHC-SA-1328			
43	94:1290	See ANL/CP-74216			
50	94:2388	See SAND-92-0426C			
52	94:376	See PNL-SA-20510			
54	94:2605	See PNL-SA-20059			
55	94:1376	See PNL-SA-20489			
56	94:377	See PNL-SA-20547			
57	94:373	See PNL-SA-19974			
69	94:964	See PNL-SA-20057			
70	94:1149	See WHC-SA-1365			
71	94:1593	See WHC-SA-1343			
73	94:1600	See WHC-SA-1471			
74	94:1594	See WHC-SA-1364			
76	94:1156	See WHC-SA-1431			
77	94:1147	See WHC-SA-1322			
82	94:789	See EGG-M-91416			
83	94:792	See EGG-M-91481			
84	94:788	See EGG-M-91394			
85	94:790	See EGG-M-91423			
90	94:450	See WHC-EP-0548			
91	94:2542	See DOE/DP/48075-8			
94	94:419	See UCRL-JC-109902			
CONF-9203105--		(Department of Energy-Environmental Restoration and Waste Management (DOE-ERWM) technology development workshop; Charleston, SC (United States); 25 Mar 1992)			
3	94:574	See ANL/CP-75817			
CONF-9203138--		(Engineering Foundation conference on dispersion and aggregation; Palm Coast, FL (United States); 15-20 Mar 1992)			
3	94:1180	See WHC-SA-1713			
CONF-9203153--		(8. international conference on thermal insulations; San Francisco, CA (United States); 9-11 Mar 1992)			
1	94:1162	See WHC-SA-1505			
CONF-920367--		(Department of Defense (DOD) fiber optics conference; McLean, VA (United States); 25 Mar 1992)			
2	94:2096	See SAND-91-2775C			
5	94:1598	See WHC-SA-1411			
CONF-9204121--		(Innovative technologies for cleaning the environment: air, water, and soil; Erice (Italy); 22-29 Apr 1992)			
1	94:503	See WHC-SA-1511			
5	94:505	See WHC-SA-1529			

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CONF-9204175-		(3. international biannual symposium on sulfur; Washington, DC (United States); 1-4 Apr 1992)			
1	94:1750	See EGG-M-92186			
CONF-920430-		(3. international high level radioactive waste management (IHLRWM) conference; Las Vegas, NV (United States); 12-16 Apr 1992)			
4	94:2097	See SAND-91-2794C			
56	94:1157	See WHC-SA-1434			
59	94:1146	See WHC-SA-1318			
70	94:1288	See ANL/CP-74200			
73	94:1289	See ANL/CP-74206			
CONF-920431-		(Meeting on new horizons in radiation protection and shielding; Pasco, WA (United States); 26 Apr - 1 May 1992)			
5	94:498	See WHC-SA-1300			
CONF-920444-		(203. American Chemical Society (ACS) national meeting; San Francisco, CA (United States); 5-10 Apr 1992)			
29	94:1163	See WHC-SA-1520			
CONF-920448-		(94. annual meeting and exposition of the American Ceramic Society; Minneapolis, MN (United States); 12-16 Apr 1992)			
1	94:965	See PNL-SA-20212			
CONF-920459-		(Federal environmental restoration conference and exhibition; Washington, DC (United States); 15-17 Apr 1992)			
3	94:794	See EGG-M-92051			
CONF-920466-		(Engineering and technology conference on waste management and environmental restoration; San Juan (Puerto Rico); 9-11 Apr 1992)			
4	94:601	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011092	MF-940
7	94:602	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011785	MF-902
8	94:2610	See SAND-92-0247C			
9	94:2497	See WHC-SA-1456			
15	94:1159	See WHC-SA-1463			
CONF-920501-		(8. International Radiation Protection Association (IRPA) world congress; Vancouver (Canada); 10-22 May 1992)			
2	94:603	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92002803	MF-902
CONF-920508-		(14. symposium on biotechnology for fuels and chemicals; Gatlinburg, TN (United States); 11-15 May 1992)			
4	94:2369	See PNL-SA-20991			
CONF-9205121-		(Mediterranean conference on environmental geotechnology; Cesme (Turkey); 25-27 May 1992)			
2	94:44	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92008900	MF-902
CONF-9205148-		(Mid-America Chinese professional annual convention; Itasca, IL (United States); 29-31 May 1992)			
1	94:11	See ANL/CP-75814			
CONF-9205154-		(16. actinide separations conference; Golden, CO (United States); 11-14 May 1992)			
5	94:504	See WHC-SA-1516			
CONF-9205156-		(NATO-Advanced Study Institute summer school on migration and fate of pollutants in soils and subsoils; Basilicata (Italy); 24 May - 6 Jun 1992)			
1	94:2386	See SAND-92-0364			
CONF-9205174-		(7. international conference on multivariate statistics; University Park, PA (United States); 5-9 May 1992)			
1	94:374	See PNL-SA-20486			
CONF-920527-		(1992 incineration conference; Albuquerque, NM (United States); 11-15 May 1992)			
2	94:604	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013287	MF-902
6	94:605	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013860	MF-902

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9	94:1161	See WHC-SA-1504			
11	94:966	See PNL-SA-20802			
CONF-920559-		(4. international conference on the use of fly ash, silica fume, slag, and natural pozzolans in concrete; Istanbul (Turkey); 3-8 May 1992)			
1	94:487	See WHC-SA-1039			
CONF-920577-		(Interregional seminar on ageing, decommissioning and/or major refurbishment of research reactors; Bangkok (Thailand); 18-22 May 1992)			
1	94:1806	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92014500	MF-902
CONF-920606-		(American Nuclear Society annual meeting; Boston, MA (United States); 7-12 Jun 1992)			
7	94:2495	See WHC-SA-1384			
8	94:2150	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92007832	MF-940
10	94:1155	See WHC-SA-1427			
11	94:2151	OSTI; NTIS; GPO Dep.	E 1.99:	DE92008894	MF-900
27	94:2099	See SAND-92-1256C			
38	94:2370	See PNL-SA-21033			
CONF-9206116-		(9. international conference on computational methods in water resources; Denver, CO (United States); 9-12 Jun 1992)			
4	94:378	See PNL-SA-20622			
5	94:45	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93015433	MF-905; MF-906
CONF-920617-		(Annual meeting of the Health Physics Society; Columbus, OH (United States); 21-25 Jun 1992)			
13	94:1152	See WHC-SA-1418			
CONF-9206184-		(U.S. Department of Energy information exchange meeting on characterization, monitoring, and sensor technologies; Dallas, TX (United States); 3-4 Jun 1992)			
2	94:424	See UCRL-JC-110356			
CONF-9206189-		(Nuclear waste management conference: citizen ambassador delegation to Soviet Union; No City Given (Russian Federation); 13-27 Jun 1992)			
1	94:1164	See WHC-SA-1525			
CONF-9206233-		(16. annual army environmental quality R&D symposium; Williamsburg, VA (United States); 23-25 Jun 1992)			
1	94:293	See LA-UR-92-2071			
CONF-920631-		(American Society of Mechanical Engineers (ASME) pressure vessels and piping conference; New Orleans, LA (United States); 21-25 Jun 1992)			
20	94:1150	See WHC-SA-1396			
CONF-9206424-		(Chemical sensors technology development planning workshop; Dallas, TX (United States); 15-16 Jun 1992)			
CONF-920658-	94:2212	See IS-5093			
		(Eco-world exhibition and conference on ecology, economics and engineering; Washington, DC (United States); 14-17 Jun 1992)			
3	94:270	See FEMP-2248			
CONF-920702-		(10. international conference on solid state dosimetry; Washington, DC (United States); 13-17 Jul 1992)			
1	94:799	See EGG-M-92308			
CONF-9207100-		(8. annual waste testing and quality assurance symposium; Arlington, VA (United States); 13-17 Jul 1992)			
2	94:2153	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92016907	MF-940
CONF-9207102-		(Institute of Nuclear Materials Management (INMM) annual meeting; Orlando, FL (United States); 19-22 Jul 1992)			
60	94:2038	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92019945	MF-906
67	94:1171	See WHC-SA-1585			

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CONF-920791-		(Information exchange meeting on characterization sensors and monitoring technologies; Dallas, TX (United States); 15-16 Jul 1992)			
4	94:2152	OSTI; NTIS; GPO Dep.	E 1.99:	DE93005318	MF-900
5	94:2228	See LA-UR-92-1948			
6	94:403	See SAND-92-1541C			
	94:2612	See SAND-92-1690C			
CONF-920808-		(American Institute of Chemical Engineers (AIChE) summer national meeting; Minneapolis, MN (United States); 9-12 Aug 1992)			
3	94:1340	See LA-UR-92-2508			
8	94:1611	See WHC-SA-1600			
10	94:1382	See PNL-SA-21233			
11	94:969	See PNL-SA-21215			
CONF-9208125-		(Department of Energy (DOE) transportation management program workshop; Gaithersburg, MD (United States); 18-20 Aug 1992)			
	94:2040	OSTI; NTIS; GPO Dep.	E 1.99:	DE93002378	MF-900
CONF-920815-		(204. American Chemical Society (ACS) national meeting; Washington, DC (United States); 23-28 Aug 1992)			
7	94:1606	See WHC-SA-1540			
27	94:1609	See WHC-SA-1576			
28	94:1377	See PNL-SA-20608			
CONF-9208172-		(Rocky Mountain conference on analytical chemistry and applied spectroscopy; Denver, CO (United States); 2-6 Aug 1992)			
1	94:1130	See WHC-SA-0873			
CONF-920823-		(22. Department of Energy (DOE)/Nuclear Regulatory Commission (NRC) nuclear air cleaning and treatment conference; Denver, CO (United States); 24-27 Aug 1992)			
8	94:992	See UCRL-JC-109769			
6-Rev.1	94:991	See UCRL-JC-109768-Rev.1			
CONF-920851-		(Spectrum '92: nuclear and hazardous waste management international topical meeting; Boise, ID (United States); 23-27 Aug 1992)			
2	94:2039	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92010543	MF-906
4	94:871	See LA-UR-92-1312			
5	94:858	See IS-M-705			
6	94:2611	See SAND-92-0959C			
7	94:977	See SAND-92-0409C			
9	94:2389	See SAND-92-1072C			
10	94:872	See LA-UR-92-1383			
11	94:606	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013873	MF-902
12	94:277	See IS-M-709			
13	94:271	See FEMP-2266			
18	94:2088	See IS-M-708			
19	94:46	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92014800	MF-902
20	94:2387	See SAND-92-0387C			
22	94:1807	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92015085	MF-840
24	94:979	See SAND-92-1139C			
25	94:1165	See WHC-SA-1541			
28	94:2121	See WSRC-MS-92-155			
29	94:1605	See WHC-SA-1513			
30	94:1596	See WHC-SA-1405			
31	94:1597	See WHC-SA-1406			
32	94:1608	See WHC-SA-1549			
33	94:2496	See WHC-SA-1451			
37	94:1602	See WHC-SA-1492			
37-Rev.1	94:1603	See WHC-SA-1492-Rev.1			
38	94:502	See WHC-SA-1489			
39	94:2499	See WHC-SA-1665			
43	94:402	See SAND-92-1161C			
56	94:10	See ANL/CP-75634			
57	94:800	See EGG-M-92342			
59	94:798	See EGG-M-92301			
61	94:797	See EGG-M-92226			
73	94:1379	See PNL-SA-20912			

<i>Report Number</i>	<i>Abstract Number</i>	<i>Source of Availability</i>	<i>GPO Dep.</i>	<i>Order Number</i>	<i>Distribution Category</i>
75	94:1380	See PNL-SA-20941			
78	94:2368	See PNL-SA-20978			
79	94:796	See EGG-M-92121			
79	94:1378	See PNL-SA-20710			
81	94:382	See PNL-SA-20868			
82	94:379	See PNL-SA-20623			
85	94:2367	See PNL-SA-20937			
87	94:383	See PNL-SA-20984			
88	94:381	See PNL-SA-20853			
90	94:420	See UCRL-JC-110055			
91	94:2414	See UCRL-JC-109668			
94	94:423	See UCRL-JC-110353			
97	94:422	See UCRL-JC-110348			
CONF-920882-		(Transuranic waste characterization conference; Pocatello, ID (United States); 10-12 Aug 1992)			
4	94:2416	See UCRL-JC-110827			
5	94:993	See UCRL-JC-111345			
CONF-920883-		(Water Forum '92: American Society of Civil Engineers (ASCE) national conference; Baltimore, MD (United States); 3-5 Aug 1992)			
1	94:47	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013865	MF-902
CONF-920905-		(PATRAM '92: 10th international symposium on the packaging and transportation of radioactive materials; Yokohama (Japan); 13-18 Sep 1992)			
36	94:1170	See WHC-SA-1574			
37	94:507	See WHC-SA-1613			
CONF-9209108-		(3. annual meeting of USSR Nuclear Society: future of nuclear technology; St. Petersburg (Russian Federation); 14-18 Sep 1992)			
2	94:1381	See PNL-SA-21009			
3	94:1151	See WHC-SA-1416			
CONF-9209113-		(Sensors expo; Chicago, IL (United States); 29 Sep - 1 oct 1992)			
1	94:2098	See SAND-92-0374C			
CONF-9209159-		(Eurocourse: technologies for environmental cleanup - soil and groundwater; Ispra (Italy); 21-25 Sep 1992)			
7	94:2415	See UCRL-JC-110525			
CONF-9209164-		(New Mexico conference on the environment: toward a sustainable environment; Albuquerque, NM (United States); 13-15 Sep 1992)			
1	94:294	See LA-UR-92-2425			
4	94:980	See SAND-92-1364C			
CONF-9209165-		(65. annual conference of the water environment federation; New Orleans, LA (United States); 23 Sep 1992)			
1	94:607	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92019476	MF-902
CONF-9209184-		(The International Society for Optical Engineering (SPIE) meeting; Boston, MA (United States); 8-11 Sep 1992)			
6	94:1615	See WHC-SA-1669			
7-Rev.2	94:1599	See WHC-SA-1411-Rev.2			
CONF-9209226-		(American Chemical Society (ACS) special symposium on emerging technologies in hazardous waste management; Atlanta, GA (United States); 21-23 Sep 1992)			
3	94:1614	See WHC-SA-1668			
CONF-9209229-		(Industrial and engineering chemistry (I&EC) special symposium of the American Chemical Society (ACS); Atlanta, GA (United States); 21-23 Sep 1992)			
2	94:400	See SAND-92-0817C			
4	94:1610	See WHC-SA-1591			

CONF-9209261-

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-9209261-		(International conference on advances in liquid scintillation; Vienna (Austria); 14-18 Sep 1992)			
2	94:1168	See WHC-SA-1555			
CONF-9209296-		(International Association of Hydrodynamical Science (IAHS) conference of the international in-situ bioremediation; Ontario (Canada); 20-24 Sep 1992)			
1	94:994	See UCRL-JC-112062			
CONF-9209427-		(Michigan Biotechnology Institute symposium; Grand Rapids, MI (United States); 10-15 Sep 1992)			
1-Rev.1	94:555	See WSRC-MS-93-362-Rev.1			
CONF-921006-		(62. annual meeting of the Society of Exploration Geophysicists; New Orleans, LA (United States); 25-29 Oct 1992)			
2	94:421	See UCRL-JC-110327			
CONF-9210168-		(1992 American Nuclear Society (ANS) international conference; Chicago, IL (United States); 15-20 Oct 1992)			
1	94:2041	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041265	MF-902
CONF-9210174-		(1992 Korean automated control conference (KACC); Seoul (Korea, Republic of); 19-21 Oct 1992)			
1	94:2042	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000428	MF-906
CONF-9210194-		(International symposium on environmental contamination in Central and Eastern Europe; Budapest (Hungary); 12-16 Oct 1992)			
6	94:2393	See SAND-92-2254C			
7	94:401	See SAND-92-0818C			
9	94:2371	See PNL-SA-21471			
CONF-921020-		(Cement industry solutions to waste management; Calgary (Canada); 7-9 Oct 1992)			
1	94:500	See WHC-SA-1368			
2	94:499	See WHC-SA-1345			
CONF-921029-		(Annual Department of Energy model conference on waste management and environmental restoration; Oak Ridge, TN (United States); 19-22 Oct 1992)			
1	94:1808	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92019187	MF-940
3	94:1809	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92040870	MF-902
4	94:608	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000978	MF-902
5	94:609	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000433	MF-902
6	94:12	See ANL/CP-76005			
7	94:1810	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000438	MF-902
10	94:48	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001717	MF-902
11	94:610	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93003020	MF-902
12	94:1811	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93003021	MF-902
13	94:611	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93003025	MF-902
15	94:612	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93003030	MF-902
CONF-921090-		(International symposium on energetic materials technology: demilitarization; New Orleans, LA (United States); 4-7 Oct 1992)			
1	94:978	See SAND-92-0685C			
CONF-921101-		(16. Materials Research Society (MRS) fall meeting; Boston, MA (United States); 30 Nov - 5 dec 1992)			
111	94:995	See UCRL-JC-112832			
13	94:1267	See ANL/CMT/CP-76415			
31	94:1265	See ANL/CMT/CP-76241			
43	94:1169	See WHC-SA-1565			
71	94:1262	See ANL/CMT/CP-76238			
74	94:1263	See ANL/CMT/CP-76239			
75	94:1266	See ANL/CMT/CP-76242			
76	94:1264	See ANL/CMT/CP-76240			

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CONF-921102-		(Joint American Nuclear Society/European Nuclear Society (ANS/ENS) international meeting on fifty years of controlled nuclear chain reaction: past, present, and future; Chicago, IL (United States); 15-20 Nov 1992)			
10	94:2044	OSTI; NTIS; GPO Dep.	E 1.99:	DE92017158	MF-906
51	94:968	See PNL-SA-21166			
9-Extd.Abst.	94:2043	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92017133	MF-906
CONF-9211142-		(Society of Photo-Optical Instrumentation Engineers (SPIE) meeting; Boston, MA (United States); 15-20 Nov 1992)			
1	94:278	See IS-M-730			
CONF-9211150-		(8. international conference on solid waste management and secondary materials; Philadelphia, PA (United States); 15-18 Nov 1992)			
1	94:967	See PNL-SA-20888			
CONF-9211167-		(International low-level waste conference; Baltimore, MD (United States); 9-12 Nov 1992)			
1	94:1187	See WHC-SA-1741			
CONF-921119-		(American Society for Testing and Materials (ASTM) symposium on application of accelerated corrosion tests to life prediction of materials; Miami, FL (United States); 16-17 Nov 1992)			
2	94:1158	See WHC-SA-1450			
2-Rev.1	94:501	See WHC-SA-1450-Rev.1			
CONF-921137-		(14. low-level radioactive waste management conference; Phoenix, AZ (United States); 18-20 Nov 1992)			
2	94:613	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93004112	MF-902
4	94:614	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93004115	MF-940
5	94:615	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93004173	MF-902
6	94:585	See ANL/EWM/CP-78035			
7	94:49	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93004789	MF-902
8	94:1188	See WHC-SA-1756			
9	94:1176	See WHC-SA-1667			
11	94:804	See EGG-M-92605			
12	94:805	See EGG-M-92644			
14	94:616	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93005763	MF-902
CONF-921139-		(13. annual meeting of the Society of Environmental Toxicology and Chemistry; Cincinnati, OH (United States); 8-12 Nov 1992)			
1	94:1604	See WHC-SA-1501			
CONF-921181-		(ISRAM '92: 4th international symposium on robotics and manufacturing; Santa Fe, NM (United States); 11-13 Nov 1992)			
2	94:2113	See UCRL-JC-111199			
5	94:2099	See SAND-92-1256C			
CONF-921235-		(Hazardous Materials Control/Superfund '92: 13th annual conference and exhibition; Washington, DC (United States); 1-3 Dec 1992)			
1	94:2139	See ANL/EAIS/CP-77680			
CONF-9301118-		(Material handling focus '93 annual users conference; Ft. Lauderdale, FL (United States); 13-15 Jan 1993)			
1	94:2085	See FEMP-2267			
CONF-930116-		(Probabilistic safety assessment international topical meeting (PSA 93); Clearwater Beach, FL (United States); 27-29 Jan 1993)			
45	94:1166	See WHC-SA-1544			
CONF-930130-		(26. Health Physics Society midyear topical meeting on environmental health physics; Coeur d'Alene, ID (United States); 24-28 Jan 1993)			
11	94:506	See WHC-SA-1581			

CONF-930160-

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-930160-		(2. semi-annual Office of Technology Development (OTD) information meeting; Houston, TX (United States); 26-28 Jan 1993)			
1	94:982	See SAND-92-2737C			
2	94:1671	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93005152	MF-902
3	94:405	See SAND-92-2727C			
4	94:1812	OSTI; NTIS; GPO Dep.	E 1.99:	DE93006222	MF-902
5	94:406	See SAND-92-2773C			
7	94:387	See PNL-SA-21710			
8	94:389	See PNL-SA-21731			
9	94:388	See PNL-SA-21730			
10	94:386	See PNL-SA-21706			
15	94:50	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93015445	MF-902; MF-901
CONF-930166-		(DOE Office of Technology Development meeting; Washington, DC (United States); 26-28 Jan 1993)			
1	94:295	See LA-UR-92-4053			
CONF-930167-		(National symposium on measuring and interpreting VOCs in soils: state of the art and research needs; Las Vegas, NV (United States); 12-14 Jan 1993)			
1	94:2500	See WHC-SA-1763			
CONF-930188-		(Environmental restoration technology transfer symposium; Salt Lake City, UT (United States); 26-28 Jan 1993)			
1	94:296	See LA-UR-93-656			
CONF-930204-		('93 meeting on waste management; Tucson, AZ (United States); 28 Feb - 4 mar 1993)			
1	94:1341	See LA-UR-92-3977			
2	94:1178	See WHC-SA-1698			
3	94:1664	See WHC-SP-1689			
CONF-930205-		(Waste management '93; Tucson, AZ (United States); 28 Feb - 4 mar 1993)			
1	94:391	See PNL-SA-21891			
1	94:617	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93002342	MF-902
13	94:618	OSTI; NTIS; GPO Dep.	E 1.99:	DE93007819	MF-906
15	94:1177	See WHC-SA-1680			
18	94:1269	See ANL/CMT/CP-77655			
20	94:587	See ANL/MCT/CP-77586			
21	94:2123	See ANL/CMT/CP-77656			
22	94:2122	See ANL/CMT/CP-77587			
23	94:1342	See LA-UR-93-456			
25	94:2125	See ANL/CMT/CP-78935			
27	94:1268	See ANL/CMT/CP-77506			
28	94:1617	See WHC-SA-1673			
30	94:1626	See WHC-SA-1825			
31	94:1384	See PNL-SA-21463			
34	94:385	See PNL-SA-21537			
35	94:1175	See WHC-SA-1662			
42	94:1994	See PNL-SA-22047			
44	94:2607	See PNL-SA-21857			
50	94:1389	See PNL-SA-21856			
52	94:392	See PNL-SA-21987			
55	94:1813	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93009728	MF-902
59	94:1625	See WHC-SA-1770			
60	94:1197	See WHC-SA-1810			
61	94:1189	See WHC-SA-1772			
65	94:1153	See WHC-SA-1423			
66	94:1628	See WHC-SA-1837			
67	94:1622	See WHC-SA-1701			
68	94:1621	See WHC-SA-1697			
69	94:1179	See WHC-SA-1708			
70	94:1620	See WHC-SA-1694			
71	94:1616	See WHC-SA-1671			
72	94:1613	See WHC-SA-1661			
73	94:51	OSTI; NTIS; GPO Dep.	E 1.99:	DE93015482	MF-900
75	94:619	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93015206	MF-940
76	94:620	OSTI; NTIS; GPO Dep.	E 1.99:	DE93015461	MF-902
79	94:2144	See ANL/FC/CP-77558			

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Pt.1 CONF-9302160-	94:1568	See WHC-MR-0413 (Workshop on issues at the Fernald Environmental Management project; Cincinnati, OH (United States); 3-4 Feb 1993)			
CONF-9302174-	94:276	See FEMP/SUB-068 (Waste separations and pretreatment workshop; Salt Lake City, UT (United States); 3-5 Feb 1993)			
CONF-930247-	94:1093	See WHC-EP-0642 (Waste Management '93; Tucson, FL (United States); 28 Feb - 3 mar 1993)			
1 CONF-930255-	94:1618	See WHC-SA-1679 (Department of Energy's information exchange meeting on waste retrieval treatment and processing; Washington, DC (United States); Feb 1993)			
1 CONF-930257-	94:621	OSTI; NTIS; INIS; GPO Dep. (3. international symposium of field screening methods for hazardous wastes and toxic chemicals; Las Vegas, NV (United States); 24-26 Feb 1993)	E 1.99:	DE93007247	MF-902
3 CONF-930304-	94:2045	OSTI; NTIS; INIS; GPO Dep. (205. American Chemical Society national meeting; Denver, CO (United States); 28 Mar - 2 apr 1993)	E 1.99:	DE93009664	MF-901; MF-902
12 CONF-930313-	94:622	OSTI; NTIS; INIS; GPO Dep. (44. Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy; Atlanta, GA (United States); 8-12 Mar 1993)	E 1.99:	DE93009720	MF-901; MF-902
2 CONF-9303134-	94:1612	See WHC-SA-1637 (9. international conference on advanced science and technology; Schaumburg, IL (United States); 27 Mar 1993)			
1 CONF-930352-	94:1271	See ANL/CMT/CP-79163 (2. Japan Society of Mechanical Engineers (JSME)/American Society of Mechanical Engineers (ASME) joint international conference on nuclear engineering; San Francisco, CA (United States); 21-24 Mar 1993)			
14 CONF-930364-	94:1295	See BNL-48363 (Spring national meeting of the American Institute of Chemical Engineers; Houston, TX (United States); 28 Mar - 1 apr 1993)			
1 CONF-930395-	94:623	OSTI; NTIS; INIS; GPO Dep. (Computer simulation in waste management and environmental sciences; Washington, DC (United States); 29 Mar - 1 apr 1993)	E 1.99:	DE93010831	MF-940
1 4 CONF-930396-	94:1181 94:1623	See WHC-SA-1722 See WHC-SA-1723 (Waste management '93; Tucson, AZ (United States); 1-5 Mar 1993)			
1 7 9 CONF-930403-	94:1194 94:1201 94:624	See WHC-SA-1796 See WHC-SA-1833 OSTI; NTIS; INIS; GPO Dep. (5. topical meeting on robotics and remote systems; Knoxville, TN (United States); 26-29 Apr 1993)	E 1.99:	DE93010335	MF-902
4 7 8	94:2046 94:2100 94:2047	OSTI; NTIS; INIS; GPO Dep. See SAND-92-1570C OSTI; NTIS; INIS; GPO Dep.	E 1.99: E 1.99:	DE93003602 DE93004161	MF-906 MF-906; MF-902
14 15 25 30 31 33	94:2101 94:625 94:2103 94:2114 94:2048 94:2049	See SAND-92-1604C OSTI; NTIS; INIS; GPO Dep. See SAND-93-0207C See UCRL-JC-112985 OSTI; NTIS; INIS; GPO Dep. OSTI; NTIS; INIS; GPO Dep.	E 1.99: E 1.99: E 1.99: E 1.99:	DE93007249 DE93010341 DE93010340	MF-902 MF-906 MF-906

CONF-930403-

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34	94:2050	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010829	MF-906
35	94:2051	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010819	MF-906
37	94:2052	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010268	MF-940
38	94:2053	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010273	MF-940
39	94:2054	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010274	MF-906
40	94:2055	OSTI; NTIS; GPO Dep.	E 1.99:	DE93010275	MF-905
41	94:2056	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010822	MF-906
42	94:2057	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010339	MF-902; MF-906
48	94:2058	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010334	MF-906; MF-902
49	94:2081	See EGG-M-92580			
51	94:2106	See SAND-93-0678C			
54	94:2059	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002456	MF-906; MF-940

CONF-930408-

(10. international high-level radioactive waste management conference; Las Vegas, NV (United States); 25-29 Apr 1993)

43	94:2392	See SAND-92-2182C
63	94:1183	See WHC-SA-1731
64	94:1184	See WHC-SA-1733
66	94:1186	See WHC-SA-1738
67	94:2118	See WHC-SA-1735
71	94:1385	See PNL-SA-21511
76	94:1383	See PNL-SA-21452
80	94:1182	See WHC-SA-1729
82	94:1195	See WHC-SA-1807

CONF-9304109-

(SAGEEP '93: symposium on the application of geophysics to environmental and engineering problems; San Diego, CA (United States); 18-21 Apr 1993)

3	94:404	See SAND-92-2312C
4	94:2394	See SAND-92-2296C
5	94:803	See EGG-M-92598

CONF-9304117-

(International waste management conference; San Juan (Puerto Rico); 28 Apr - 1 May 1993)

2	94:513	See WHC-SA-1896
3	94:515	See WHC-SA-1921
4	94:2504	See WHC-SA-1908
5	94:2503	See WHC-SA-1907

CONF-9304128-

(Department of Energy (DOE) radiation protection conference; Las Vegas, NV (United States); 13-15 Apr 1993)

10	94:1627	See WHC-SA-1835
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CONF-9304144-

(2. international conference on laser ablation: mechanisms and applications; Knoxville, TN (United States); 19-22 Apr 1993)

9	94:394	See PNL-SA-22070
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CONF-9304242-

(Fernald Environmental Management Project (FEMP) industrial workshop on characterization of the Vadose Zone (Glacial Till); Cincinnati, OH (United States); 15-16 Apr 1993)

Summ.	94:2208	See FEMP-2334
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CONF-930438-

(95. annual meeting of the American Ceramic Society; Cincinnati, OH (United States); 18-22 Apr 1993)

7	94:1387	See PNL-SA-21560
10	94:1270	See ANL/CMT/CP-78025
12	94:3	See ANL/CMT/CP-79523
15	94:1386	See PNL-SA-21559
16	94:1392	See PNL-SA-22322
18	94:1391	See PNL-SA-22303
22	94:1272	See ANL/CMT/CP-79597
30	94:1257	See WINCO-11933
31	94:2398	See SAND-93-0489C

<i>Report Number</i>	<i>Abstract Number</i>	<i>Source of Availability</i>	<i>GPO Dep.</i>	<i>Order Number</i>	<i>Distribution Category</i>
CONF-930445--		(Society of Photo-Optical Instrumentation Engineers (SPIE) OE/aerospace science and sensing meeting; Orlando, FL (United States); 11-16 Apr 1993)			
15	94:2060	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93015439	MF-506; MF-906
CONF-930482--		(2. international symposium in situ and on-site bioreclamation; San Diego, CA (United States); 5-8 Apr 1993)			
4	94:302	See LBL-33252			
6	94:395	See PNL-SA-22251			
11	94:2154	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002489	MF-902
12	94:390	See PNL-SA-21763			
CONF-930483--		(9. waste minimization and pollution prevention conference; San Francisco, CA (United States); 13-15 Apr 1993)			
2	94:984	See SAND-93-0469C			
3	94:1204	See WHC-SA-1883			
4	94:985	See SAND-93-1027C			
8	94:983	See SAND-93-0466C			
10	94:626	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016234	MF-902
13	94:1205	See WHC-SA-1902			
CONF-930491--		(International robots and vision conference; Detroit, MI (United States); 6-8 Apr 1993)			
2	94:2102	See SAND-93-0003C			
CONF-9305166--		(American Filtration Society seminar and expo annual meeting; Chicago, IL (United States); 3-6 May 1993)			
3	94:426	See UCRL-JC-113854			
CONF-9305181--		(Transportation management workshop; Gaithersburg, MD (United States); 11-13 May 1993)			
	94:2064	OSTI; NTIS; INIS; GPO Dep. (EPRI workshop; Scottsdale, AZ (United States); 19-22 May 1993)	E 1.99:	DE94000411	MF-900
CONF-9305183--		See SAND-93-8558C			
1	94:413	(Institute of Electrical and Electronics Engineers international conference on robotics and automation; Atlanta, GA (United States); 2-7 May 1993)			
CONF-930519--					
6	94:2061	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93004619	MF-902
8	94:2062	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93005778	MF-905; MF-906
CONF-9305196--		(Center for applied development of environmental technology conference; Idaho Falls, ID (United States); 11-14 May 1993)			
1	94:809	See EGG-M-93176			
CONF-9305220--		(13. ESRI annual users conference; Palm Springs, CA (United States); 24-28 May 1993)			
1	94:2376	See PNL-SA-22530			
CONF-930523--		(18. National Association of Environmental Professionals (NAEP) annual conference on current and future priorities for environmental management; Raleigh, NC (United States); 24-26 May 1993)			
1	94:873	See LA-UR-93-998			
8	94:721	See DOE/METC/C-93/7063			
CONF-930561--		(39. international instrumentation symposium; Albuquerque, NM (United States); 2-6 May 1993)			
5	94:801	See EGG-M-92586			
CONF-930570--		(2. annual Federal environmental restoration conference and exhibition; Washington, DC (United States); 25-27 May 1993)			
2	94:2063	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93015435	MF-902
4	94:2155	OSTI; NTIS; GPO Dep.	E 1.99:	DE93015923	MF-902

CONF-930572--

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-930572--		(12. annual international symposium on thermal treatment technologies - incineration conference; Knoxville, TN (United States); 3-7 May 1993)			
5	94:1202	See WHC-SA-1866			
7	94:1308	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93015963	MF-901
12	94:2124	See ANL/CMT/CP-78043			
CONF-930585--		(2. USA/CIS joint conference on environmental hydrology and hydrogeology; Washington, DC (United States); 16-29 May 1993)			
2	94:2142	See ANL/ER/CP-77595			
CONF-930589--		(4. international conference on contaminated soil; Berlin (Germany); 3-7 May 1993)			
1	94:627	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93006214	MF-940
2	94:425	See UCRL-JC-112037			
3	94:970	See PNL-SA-21683			
4	94:2417	See UCRL-JC-113731			
CONF-930601--		(American Nuclear Society (ANS) annual meeting; San Diego, CA (United States); 20-24 Jun 1993)			
16	94:15	See ANL/EAS/CP-78705			
CONF-930608--		(Safewaste '93: the final disposal of nuclear waste; Avignon (France); 13-18 Jun 1993)			
2	94:1203	See WHC-SA-1867			
CONF-9306100--		(Zeolite 93: 4th international conference on the occurrence, properties, and utilization of natural zeolites; Boise, ID (United States); 20-28 Jun 1993)			
1	94:52	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93006622	MF-940
CONF-9306127--		(50. anniversary spring conference on experimental mechanics; Dearborn, MI (United States); 9 Jun 1993)			
1	94:2105	See SAND-93-0589C			
CONF-9306137--		(Geo confine 93: international symposium on geology and confinement of toxic wastes; Montpellier (France); 8-11 Jun 1993)			
1	94:509	See WHC-SA-1799			
CONF-9306143--		(Energy Facility Contractors Group safety analysis meeting; Denver, CO (United States); 16-18 Jun 1993)			
12	94:2011	See WHC-SA-1812			
13	94:2012	See WHC-SA-1831			
14	94:511	See WHC-SA-1846			
CONF-9306153--		(7. International Association for Mathematical and Computers in Simulation (IMACS) conference on computer methods for partial differential equations; New Brunswick, NJ (United States); 22-24 Jun 1993)			
1	94:2239	See LBL-32529			
CONF-9306158--		(1993 groundwater modeling conference; Boulder, CO (United States); 6-12 Jun 1993)			
2	94:16	See ANL/EAS/CP-79173			
CONF-9306184--		(GPS/GIS '93 trademarks meeting; Seattle, WA (United States); 21-25 Jun 1993)			
1	94:2505	See WHC-SA-1964			
CONF-9306199--		(American Defense Preparedness Association (ADPA) security technology symposium; Virginia Beach, VA (United States); 23 Jun 1993)			
2	94:971	See PNL-SA-22574			
CONF-930702--		(1993 ASME pressure vessel and piping conference; Denver, CO (United States); 25-29 Jul 1993)			
25	94:1624	See WHC-SA-1748			
33	94:1293	See ANL/RE/CP-79030			
CONF-930703--		(International cryogenic materials conference (ICMC); Albuquerque, NM (United States); 12-16 Jul 1993)			
14	94:298	See LA-UR-93-2516			

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CONF-9307101-		(9. annual waste testing and quality assurance symposium; Arlington, VA (United States); 12-16 Jul 1993)			
2	94:1793	See ANL/ER/CP-79013			
CONF-9307141-		(Mobile Analytical Laboratory workshop; Los Alamos, NM (United States); 20-21 Jul 1993)			
1	94:2156	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040606	MF-902
CONF-930736-		(1993 Institute of Electrical and Electronics Engineers/Robotics Society of Japan (IEEE/RSJ) international conference on intelligent robots and systems (IROS); Yokohama (Japan); 26-30 Jul 1993)			
2	94:2104	See SAND-93-0588C			
CONF-930746-		(Annual meeting of the Health Physics Society (HPS); Atlanta, GA (United States); 11-15 Jul 1993)			
2	94:1196	See WHC-SA-1808			
3	94:1773	See ANL/EA/CP-78779			
CONF-930749-		(34. annual meeting of the Institute of Nuclear Materials Management; Scottsdale, AZ (United States); 18-21 Jul 1993)			
2	94:1190	See WHC-SA-1773			
37	94:1343	See LA-UR-93-2584			
CONF-930794-		(25. Mid-Atlantic industrial waste conference; College Park, MD (United States); 7-9 Jul 1993)			
2	94:1850	See DOE/MC/29467-93/C0192			
CONF-930796-		(1993 Chinese American Academic and Professional convention; Chicago, IL (United States); 2-5 Jul 1993)			
1	94:20	See ANL/ES/CP-79581			
CONF-930797-		(4. international symposium on plasticity and its current applications; Baltimore, MD (United States); 19-23 Jul 1993)			
1	94:2395	See SAND-92-2630C			
2	94:2399	See SAND-93-0715C			
CONF-9308109-		(7. American water jet technology conference; Seattle, WA (United States); 28-31 Aug 1993)			
2	94:1394	See PNL-SA-22721			
CONF-9308125-		(Pollution prevention topical meeting; Seattle, WA (United States); 15-18 Aug 1993)			
1	94:520	See WHC-SA-1963			
CONF-9308137-		(1993 summer national American Institute of Chemical Engineers (AIChE) conference; Seattle, WA (United States); 15-18 Aug 1993)			
5	94:2010	See WHC-SA-1811			
6	94:510	See WHC-SA-1805			
8	94:552	See WINCO-11980			
10	94:393	See PNL-SA-22008			
11	94:396	See PNL-SA-22817			
CONF-9308150-		(Environmentally conscious manufacturing congress '93; Arlington, VA (United States); 30 Aug - 1 sep 1993)			
3	94:879	See LA-UR-93-3089			
5	94:629	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94000338	MF-904
CONF-9308152-		(ICRP-60: International Atomic Energy Agency interregional training course on management of radioactive waste from nuclear power plants; Argonne, IL (United States); 23 Aug - 17 sep 1993)			
3	94:5	See ANL/CMT/CP-80618			
CONF-9308159-		(SOAR 93: space operations, applications, and research conference; Houston, TX (United States); 3-5 Aug 1993)			
3	94:2378	See PNL-SA-22765			

CONF-9308171-

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-9308171-		(8. Institute of Electrical and Electronics Engineers (IEEE) international symposium on intelligent control; Chicago, IL (United States); 25-27 Aug 1993)			
1	94:2108	See SAND-93-1468C			
CONF-9308180-		(9. annual model conference on waste management and environmental restoration; Oak Ridge, TN (United States); 23-26 Aug 1993)			
1	94:1310	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94000334	MF-940
CONF-930826-		(9. international conference on Fourier transform spectroscopy; Calgary (Canada); 23-27 Aug 1993)			
1	94:1601	See WHC-SA-1482			
CONF-930830-		(National conference and exposition on heat transfer; Atlanta, GA (United States); 8-11 Aug 1993)			
24	94:802	See EGG-M-92597			
CONF-930873-		(2. international mixed waste symposium; Baltimore, MD (United States); 17-20 Aug 1993)			
2	94:876	See LA-UR-93-1206			
5	94:1191	See WHC-SA-1788			
6	94:875	See LA-UR-93-1205			
7	94:808	See EGG-M-93135			
9	94:874	See LA-UR-93-1204			
10	94:1192	See WHC-SA-1789			
11	94:806	See EGG-M-92702			
14	94:1193	See WHC-SA-1795			
15	94:1633	See WHC-SA-1920			
17	94:2077	See DOE/MC/29115-93/C0190			
18	94:1309	OSTI; NTIS; GPO Dep.	E 1.99:	DE93015212	MF-901
20	94:1207	See WHC-SA-1928			
22	94:586	See ANL/EWM/CP-80486			
26	94:628	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019165	MF-900
27	94:807	See EGG-M-92714			
30	94:1258	See WINCO-11939			
CONF-930889-		(2. U.S. National Congress on Computational Mechanics meeting; Washington, DC (United States); 16-18 Aug 1993)			
1	94:2391	See SAND-92-1537C			
CONF-930906-		('93 international conference on nuclear waste management and environmental remediation; Prague (Czech Republic); 5-11 Sep 1993)			
2	94:1200	See WHC-SA-1830			
4	94:1172	See WHC-SA-1608			
5	94:1173	See WHC-SA-1609			
6	94:1167	See WHC-SA-1551			
8	94:297	See LA-UR-93-1598			
9	94:1174	See WHC-SA-1630			
10	94:508	See WHC-SA-1623			
11	94:1668	See WINCO-11926			
12	94:1769	See ANL/CMT/CP-79432			
13	94:1393	See PNL-SA-22596			
16	94:384	See PNL-SA-21257			
17	94:1390	See PNL-SA-22076			
20	94:505	See WHC-SA-1529			
CONF-930907-		(ANS topical meeting on physics and methods in criticality safety; Nashville, TN (United States); 19-23 Sep 1993)			
5	94:996	See UCRL-JC-112934			
CONF-930913-		(Global '93: future nuclear systems - emerging fuel cycles and waste disposal options; Seattle, WA (United States); 12-17 Sep 1993)			
11	94:877	See LA-UR-93-2171			
18	94:2620	See WHC-SA-1753			
21	94:1198	See WHC-SA-1816			
39	94:568	See ANL/CMT/CP-78476			
43	94:1199	See WHC-SA-1821			

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CONF-9309139-		(20. American Society for Quality Control (ASQC) national energy and environmental annual conference; Indian Wells, CA (United States); 19-22 Sep 1993)			
5	94:2538	See ANL/CMT/CP-80402			
CONF-9309146-		(5. annual American Chemical Society (ACS) Industrial and Engineering Chemistry (I&EC) Division special symposium on emerging technologies for hazardous waste management; 11. ozone world congress; Atlanta, GA (United States); San Francisco, CA (United States); 27-29 Sep 1993; 1 sep 1993)			
1	94:878	See LA-UR-93-2377			
3	94:2	See ANL/CMT/CP-79321			
4	94:427	See UCRL-JC-114126			
6	94:410	See SAND-93-7077C			
8	94:554	See WSRC-MS-93-362			
CONF-9309199-		(Society of Photo-Optical Instrumentation Engineer's (SPIE) international symposium on optical tools for manufacturing and advanced automation; Boston, MA (United States); 7-10 Sep 1993)			
1	94:1402	See SAND-93-1403C			
10	94:428	See UCRL-JC-115005			
CONF-9309205-		(3. conference on the mechanical behavior of salt; Paliseau (France); 14-16 Sep 1993)			
1	94:2397	See SAND-93-0377C			
CONF-9309218-		(5. annual American Chemical Society (ACS) Industrial and Engineering Chemistry (I&EC) Division special symposium on emerging technologies for hazardous waste management; 11. ozone world congress; Atlanta, GA (United States); San Francisco, CA (United States); 27-29 Sep 1993; 1 sep 1993)			
1	94:878	See LA-UR-93-2377			
CONF-9309247-		(National Institute of Standards and Technology (NIST) workshop on gas sensors; Gaithersburg, MD (United States); 8-9 Sep 1993)			
3	94:279	See IS-M-774			
CONF-931002-		(Geological Society of America (GSA) annual meeting; Boston, MA (United States); 25-28 Oct 1993)			
1	94:2502	See WHC-SA-1792			
CONF-9310102-		(4. energy natural phenomena hazards mitigation conference; Atlanta, GA (United States); 19-22 Oct 1993)			
6	94:1631	See WHC-SA-1899			
9	94:1632	See WHC-SA-1911			
10	94:512	See WHC-SA-1880			
11	94:1629	See WHC-SA-1878			
12	94:1630	See WHC-SA-1881			
26	94:1209	See WHC-SA-2025			
CONF-9310135-		(32. Hanford symposium on health and the environment; Richland, WA (United States); 18-21 Oct 1993)			
2	94:519	See WHC-SA-1946			
CONF-9310157-		(Nuclear Information and Records Management Association (NIRMA) conference; Augusta, GA (United States); 1 Oct 1993)			
79	94:2509	See WHC-SA-2175			
CONF-9310160-		(Advanced ground penetrating radar: technologies and applications; Columbus, OH (United States); 26-28 Oct 1993)			
1	94:521	See WHC-SA-2018			
CONF-9310163-		(Environmental restoration and decontamination and decommissioning activities and energy facility contractors workshop; Albuquerque, NM (United States); 5-6 Oct 1993)			
1	94:2016	See WHC-SA-1997			

CONF-9310179-

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-9310179-		(CONEC '93: conference on environmental commerce; Chattanooga, TN (United States); 17-20 Oct 1993)			
1	94:4	See ANL/CMT/CP-80310			
CONF-9310205-		(7. annual Colorado Hazardous Waste Society conference and exhibition; Denver, CO (United States); 13-15 Oct 1993)			
1	94:2157	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002196	MF-940
CONF-9310210-		(Institute of Nuclear Materials Management annual meeting; Oak Ridge, TN (United States); 28-29 Oct 1993)			
1	94:272	See FEMP-2305			
CONF-9310215-		(Seminar on melting and recycling of metallic waste from decommissioning; Krefeld (Germany); 27-29 Oct 1993)			
1	94:575	See ANL/DIS/CP-80919			
CONF-9310216-		(7. Deneb robotics user group meeting; Troy, MI (United States); 12-15 Oct 1993)			
4	94:2111	See SAND-93-2742C			
CONF-9310228-		(39. annual conference on bioassay, analytical and environmental radiochemistry; Colorado Springs, CO (United States); 11-15 Oct 1993)			
1	94:2207	See FEMP-2301			
CONF-9310241-		(9. American Institute of Aeronautics and Astronautics (AIAA) computing in aerospace conference; San Diego, CA (United States); 19-21 Oct 1993)			
1	94:397	See PNL-SA-23164			
CONF-931043-		(8. symposium on separation science and technology for energy applications; Knoxville, TN (United States); 24-28 Oct 1993)			
3	94:1311	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94003495	MF-940
5	94:1281	See ANL/CMT/CP-80775			
6	94:630	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94003587	MF-940
7	94:53	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004245	MF-902
10	94:1388	See PNL-SA-21829			
CONF-931093-		(Conference on fossil plant construction; Palm Beach, FL (United States); 26-28 Oct 1993)			
1	94:2109	See SAND-93-1568C			
CONF-931095-		(Department of Energy environmental remediation conference; Augusta, GA (United States); 24-28 Oct 1993)			
4	94:722	See DOE/METC/C-93/7098			
7	94:2140	See ANL/EAIS/CP-80710			
8	94:1212	See WHC-SA-2078			
14	94:578	See ANL/EA/CP-79944			
15	94:556	See WSRC-MS-93-511			
16	94:517	See WHC-SA-1939			
17	94:1208	See WHC-SA-1935			
18	94:1788	See ANL/EAIS/CP-79748			
19	94:582	See ANL/EAIS/CP-80858			
20	94:576	See ANL/DIS/CP-80955			
22	94:2507	See WHC-SA-2058			
27	94:524	See WHC-SA-2059			
28	94:2506	See WHC-SA-2055			
29	94:516	See WHC-SA-1929			
30	94:523	See WHC-SA-2057			
31	94:407	See SAND-93-1244C			
32	94:2402	See SAND-93-2250C			
33	94:522	See WHC-SA-2056			
34	94:525	See WHC-SA-2064			
35	94:2508	See WHC-SA-2061			
39	94:2418	See UCRL-JC-113790			
41	94:518	See WHC-SA-1943			
42	94:2014	See WHC-SA-1941			
45	94:275	See FEMP/SUB-064			
50	94:273	See FEMP-2312			
51	94:855	See FEMP-2288			

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57	94:1774	See ANL/EA/CP-79947			
58	94:1775	See ANL/EA/CP-79948			
59	94:1960	See FEMP-2310			
61	94:1776	See ANL/EA/CP-79949			
62	94:527	See WHC-SA-2110			
63	94:2135	See ANL/EA/CP-79945			
64	94:2134	See ANL/EA/CP-79884			
65	94:13	See ANL/EA/CP-79950			
66	94:2013	See WHC-SA-1933			
68	94:2377	See PNL-SA-22677			
70	94:2373	See PNL-SA-22393			
71	94:2372	See PNL-SA-22386			
73	94:2375	See PNL-SA-22431			
74	94:2380	See PNL-SA-23141			
76	94:2608	See PNL-SA-22649			
78	94:2174	See DOE/METC/C-94/7119			
80	94:1764	See SAND-94-0488C			
83	94:528	See WHC-SA-2112			
84	94:2018	See WHC-SA-2169			
CONF-931108-		(Fall meeting of the Materials Research Society (MRS); Boston, MA (United States); 29 Nov - 3 dec 1993)			
6	94:1274	See ANL/CMT/CP-79803			
100	94:997	See UCRL-JC-116132			
15	94:2126	See ANL/CMT/CP-79780			
19	94:1277	See ANL/CMT/CP-80026			
22	94:1275	See ANL/CMT/CP-80024			
23	94:1276	See ANL/CMT/CP-80025			
27	94:1396	See PNL-SA-23098			
38	94:1273	See ANL/CMT/CP-79802			
45	94:1278	See ANL/CMT/CP-80027			
58-Pt.1	94:1280	See ANL/CMT/CP-80123			
88	94:1279	See ANL/CMT/CP-80028			
CONF-9311122-		(Superfund 14; Washington, DC (United States); 30 Nov - 2 dec 1993)			
1	94:1794	See ANL/ER/CP-80564			
CONF-9311132-		(American Society of Testing and Materials (ASTM) symposium; Williamsburg, VA (United States); 1-5 Nov 1993)			
1	94:1220	See WHC-SA-2180			
CONF-9311157-		(Risk assessment model review workshop; Washington, DC (United States); 30 Nov - 1 dec 1993)			
1	94:2136	See ANL/EA/CP-81474			
CONF-931119-		(3. international symposium on stabilization/solidification of hazardous, radioactive and mixed wastes; Williamsburg, VA (United States); 1-5 Nov 1993)			
2	94:631	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002540	MF-940
CONF-9311190-		(Department of Energy environmental remediation conference; 5. national technology information exchange (TIE) workshop; Augusta, GA (United States); Denver, CO (United States); 24-28 Oct 1993; 16-18 nov 1993)			
1	94:2174	See DOE/METC/C-94/7119			
CONF-931121-		(Annual winter meeting of the American Society of Mechanical Engineers; New Orleans, LA (United States); 28 Nov - 3 dec 1993)			
35	94:1395	See PNL-SA-23007			
CONF-931136-		(6. conference on gas, oil and environmental biotechnology; Colorado Springs, CO (United States); 29 Nov - 1 dec 1993)			
1	94:1312	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002798	MF-902
2	94:21	See ANL/ES/CP-81712			
3	94:54	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94009161	MF-902

CONF-931152--

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-931152--		(14. annual meeting of the Society of Environmental Toxicology and Chemistry (SETAC); Houston, TX (United States); 14-18 Nov 1993)			
1	94:1206	See WHC-SA-1927			
CONF-931160--		(Global '93: future nuclear systems - emerging fuel cycles and waste disposal options; American Nuclear Society (ANS) winter meeting; Seattle, WA (United States); San Francisco, CA (United States); 12-17 Sep 1993; 14-18 nov 1993)			
23	94:1199	See WHC-SA-1821			
27	94:1638	See WHC-SA-2021			
35	94:1634	See WHC-SA-1976			
36	94:1398	See PNL-SA-23271			
38	94:2119	See WHC-SA-1977			
39	94:2078	See DOE/MC/29115-94/C0274			
CONF-931164--		(Annual meeting of the American Institute of Chemical Engineers; St. Louis, MO (United States); 7-12 Nov 1993)			
1	94:880	See LA-UR-93-3717			
CONF-931201--		(4. international conference on chemistry and migration behavior of actinides and fission products in the geosphere; Charleston, SC (United States); 12-17 Dec 1993)			
7	94:411	See SAND-93-7112C			
9	94:409	See SAND-93-3846C			
10	94:412	See SAND-93-7113C			
CONF-931237--		(LASERS '93: international conference on lasers and applications; Lake Tahoe, NV (United States); 6-10 Dec 1993)			
3	94:1218	See WHC-SA-2132			
CONF-940149--		(8. international forum on process analytical chemistry; Houston, TX (United States); 24-26 Jan 1994)			
1	94:1640	See WHC-SA-2074			
CONF-940159--		(Joint 40/50 industry outreach meeting; Seattle, WA (United States); 25-27 Jan 1994)			
1	94:55	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94006549	MF-902
CONF-940165--		(Symposium on hazardous materials, identification, handling and management; Arzamas-16 (Russian Federation); 25 Jan - 2 feb 1994)			
1	94:2419	See UCRL-JC-115724			
CONF-940178--		(2. international conference on on-site analysis and field-portable instrumentation; Houston, TX (United States); 24-26 Jan 1994)			
1	94:2158	OSTI; NTIS; GPO Dep.	E 1.99:	DE94010123	MF-906
CONF-940209--		(Pittsburgh conference on analytical chemistry and applied spectroscopy; Chicago, IL (United States); 28 Feb - 4 mar 1994)			
3	94:1214	See WHC-SA-2098			
CONF-940211--		(27. midyear topical meeting of the Health Physics Society: managing radioactive and mixed waste; Albany, NY (United States); 13-17 Feb 1994)			
1	94:2233	See LA-UR-94-186			
CONF-940212--		(Seminar on developments in radioactive waste transport; Vienna (Austria); 21-25 Feb 1994)			
3	94:632	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94012331	MF-940
CONF-940214--		(Space 94: international conference and exposition on engineering, construction, and operations in space; Albuquerque, NM (United States); 26 Feb - 3 mar 1994)			
1	94:2107	See SAND-93-1361C			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-940222-		(Corrosion 94: National Association of Corrosion Engineers (NACE) international annual conference; Baltimore, MD (United States); 28 Feb - 4 mar 1994)			
8	94:1637	See WHC-SA-1985			
15	94:1635	See WHC-SA-1982			
16	94:1636	See WHC-SA-1983			
CONF-940225-		(Waste management '94; Tucson, AZ (United States); 27 Feb - 3 mar 1994)			
5	94:1346	See LA-UR-94-52			
6	94:883	See LA-UR-94-363			
7	94:882	See LA-UR-94-361			
8	94:2234	See LA-UR-94-0337			
9	94:2614	See SAND-93-2231C			
100	94:1646	See WHC-SA-2129			
101	94:1647	See WHC-SA-2130			
102	94:1642	See WHC-SA-2102			
103	94:1645	See WHC-SA-2124			
104	94:1649	See WHC-SA-2152			
105	94:1219	See WHC-SA-2143			
106	94:1213	See WHC-SA-2094			
107	94:1400	See PNL-SA-23793			
109	94:57	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94012322	MF-902
11	94:2017	See WHC-SA-2131			
110	94:1313	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94012321	MF-902
111	94:634	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94012332	MF-940
16	94:2405	See SAND-93-4075C			
20	94:1779	See ANL/EA/CP-80825			
21	94:1780	See ANL/EA/CP-80956			
22	94:1772	See ANL/DIS/CP-80940			
23	94:1291	See ANL/EA/CP-80958			
24	94:1778	See ANL/EA/CP-80824			
27	94:2406	See SAND-94-0276C			
29	94:1781	See ANL/EA/CP-80957			
30	94:415	See SAND-94-0537C			
34	94:6	See ANL/CMT/CP-80854			
36	94:1782	See ANL/EA/CP-80969			
37	94:885	See LA-UR-94-607			
39	94:1784	See ANL/EA/CP-82021			
47	94:299	See LA-UR-94-400			
48	94:884	See LA-UR-94-493			
49	94:1783	See ANL/EA/CP-80976			
50	94:580	See ANL/EA/CP-80977			
51	94:579	See ANL/EA/CP-80972			
53	94:2407	See SAND-94-0658C			
54	94:2615	See SAND-93-3966C			
57	94:2235	See LA-UR-94-557			
59	94:973	See PNL-SA-23686			
60	94:972	See PNL-SA-23035			
64	94:570	See ANL/CMT/CP-80987			
72	94:569	See ANL/CMT/CP-80571			
73	94:571	See ANL/CMT/CP-82230			
74	94:1814	OSTI; NTIS; GPO Dep.	E 1.99:	DE94008609	MF-900
76	94:56	OSTI; NTIS; GPO Dep.	E 1.99:	DE94008606	MF-902
77	94:1672	OSTI; NTIS; GPO Dep.	E 1.99:	DE94008607	MF-903
79	94:1673	OSTI; NTIS; GPO Dep.	E 1.99:	DE94008604	MF-902
82	94:633	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94009174	MF-906
85	94:529	See WHC-SA-2113			
86	94:1644	See WHC-SA-2123			
87	94:1654	See WHC-SA-2341			
88	94:2020	See WHC-SA-2288			
90	94:1404	See SAND-94-0680C			
91	94:526	See WHC-SA-2101			
92	94:715	See DOE/MC/29107-94/C0331			
93	94:1215	See WHC-SA-2105			
94	94:583	See ANL/ET/CP-80828			
95	94:1648	See WHC-SA-2140			
96	94:398	See PNL-SA-23721			
97	94:1653	See WHC-SA-2190			
99	94:2159	OSTI; NTIS; GPO Dep.	E 1.99:	DE94010130	MF-902

CONF-940266-

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-940266-		(Institute of Mexican Petroleum (IMP) conference; Mexico City (Mexico); Feb 1994)			
1	94:2236	See LA-UR-94-572			
CONF-940276-		(Energy Facility Contractors Group (EFCOG) conference; San Francisco, CA (United States); 15 Feb 1994)			
2	94:533	See WHC-SA-2345			
CONF-9403102-		(Human health risk assessment strategy for the Oak Ridge Reservation; Knoxville, TN (United States); 8 Mar 1994)			
1	94:58	OSTI; NTIS; GPO Dep.	E 1.99:	DE94010131	MF-940
CONF-9403113-		(Environmental and molecular sciences laboratory conference; Richland, WA (United States); 17-19 Mar 1994)			
1	94:2609	See PNL-SA-23921			
CONF-940312-		(2. Probabilistic safety assessment and management conference (PSAM); San Diego, CA (United States); 20-24 Mar 1994)			
8	94:1344	See LA-UR-93-3489			
CONF-940335-		(Gas supply planning, control and deliverability under Order 636; Houston, TX (United States); 7-9 Mar 1994)			
1	94:2374	See PNL-SA-22430			
CONF-940353-		(Symposium on the application of geophysics to environmental and engineering problems; Boston, MA (United States); 27-31 Mar 1994)			
1	94:2420	See UCRL-JC-116144			
2	94:429	See UCRL-JC-115362			
3	94:2065	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94007415	MF-902
4	94:2510	See WHC-SA-2304			
CONF-940385-		(Shelter '94; Kiev (Russian Federation); 21 Mar 1994)			
1	94:416	See SAND-94-0797C			
CONF-940386-		(Cost efficient acquisition and utilization of data in the management of hazardous waste sites; Herndon, VA (United States); 23-25 Mar 1994)			
1	94:2408	See SAND-94-0857C			
3	94:2160	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94012752	MF-902
CONF-940406-		(International symposium on decontamination and decommissioning; Knoxville, TN (United States); 27-29 Apr 1994)			
1	94:2015	See WHC-SA-1979			
2	94:577	See ANL/DIS/CP-82018			
3	94:581	See ANL/EA/CP-82020			
5	94:2143	See ANL/EWM/VU-82273			
8	94:2022	See WHC-SA-2372			
CONF-9404114-		(10. Performance Management Association (PMA) annual conference; San Antonio, TX (United States); 20-22 Apr 1994)			
1	94:1777	See ANL/EA/CP-80790			
CONF-9404126-		(Mixed waste thermal treatment symposium; Denver, CO (United States); 12-14 Apr 1994)			
1	94:886	See LA-UR-94-1056			
CONF-940416-		(96. annual meeting of the American Ceramic Society; Indianapolis, IN (United States); 24-28 Apr 1994)			
4	94:584	See ANL/ET/CP-81294			
6	94:1283	See ANL/CMT/CP-81229			
7	94:1282	See ANL/CMT/CP-81047			
CONF-9404161-		(4. annual waste-management education and research consortium technology development conference; Las Cruces, NM (United States); 10-15 Apr 1994)			
1	94:1766	See SAND-94-1202C			
CONF-940417-		(4. international conference on nuclear fuel reprocessing and waste management; London (United Kingdom); 24-28 Apr 1994)			
1	94:1669	See WINCO-11935			

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CONF-940433-		(Spring meeting of the American Institute of Chemical Engineers; Atlanta, GA (United States); 17-21 Apr 1994)			
6 CONF-940436-	94:635	OSTI; NTIS; INIS; GPO Dep. (4. international meeting on nuclear thermal hydraulics, operations and safety; Taipei (Taiwan, Province of China); 3-6 Apr 1994)	E 1.99:	DE94012653	MF-902
2 CONF-940456-	94:2229	See LA-UR-93-2673 (1994 Society for Computer Simulation multiconference; San Diego, CA (United States); 11-15 Apr 1994)			
15	94:1652	See WHC-SA-2185			
16	94:530	See WHC-SA-2186			
17 CONF-940490-	94:1650	See WHC-SA-2159 (7. international symposium on the observation of the continental crust through drilling: continental processes - a decade of drilling discoveries; Santa Fe, NM (United States); 25-30 Apr 1994)			
1 CONF-940499-	94:2237	See LA-UR-94-739 (Federal environmental restoration and waste minimization conference and exhibition; New Orleans, LA (United States); 25-29 Apr 1994)			
7	94:2019	See WHC-SA-2269			
8	94:1765	See SAND-94-0982C			
9 CONF-940501-	94:1221	See WHC-SA-2300 (9. Pacific basin nuclear conference; Sydney (Australia); 1-5 May 1994)			
2 CONF-940506-	94:636	OSTI; NTIS; INIS; GPO Dep. (8. international conference on computer methods and advances in geomechanics; Morgantown, WV (United States); 22-28 May 1994)	E 1.99:	DE94007213	MF-940
1 CONF-9405109-	94:2403	See SAND-93-2670C (Department of Energy defense programs packaging workshop; Knoxville, TN (United States); 16-19 May 1994)			
3 CONF-940524-	94:1222	See WHC-SA-2361 (8. symposium on radiation measurements and applications; Ann Arbor, MI (United States); 16-19 May 1994)			
3 CONF-940528-	94:567	See ANL/CMT-ACL/CP-82554 (Incineration conference: 13th international symposium on thermal treatment technologies; Houston, TX (United States); 9-13 May 1994)			
2 CONF-940536-	94:860	See K/TCO-1080 (10. conference on geologic remote sensing: exploration, environment and engineering; San Antonio, TX (United States); 9-12 May 1994)			
1 CONF-940550-	94:557	See WSRC-MS-94-0233 (Institute of Electrical and Electronics Engineers (IEEE) international conference on robotics; San Diego, CA (United States); 8-13 May 1994)			
5	94:2110	See SAND-93-2380C			
8	94:2066	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002799	MF-906
12 CONF-940553-	94:2112	See SAND-94-1111C (International high-level radioactive waste management conference; Las Vegas, NV (United States); 22-26 May 1994)			
25	94:1314	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94009162	MF-940
29 CONF-940578-	94:1641	See WHC-SA-2100 (Pollution prevention conference; Denver, CO (United States); 3-5 May 1994)			
3 CONF-940613-	94:566	See ANL/CMT-ACL/CP-82220 (1994 pressure vessels and piping conference; Minneapolis, MN (United States); 19-23 Jun 1994)			
4	94:1639	See WHC-SA-2065			

CONF-940613-

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
5	94:1643	See WHC-SA-2118			
8	94:1217	See WHC-SA-2111			
9	94:1297	See BNL-49761			
CONF-940632-		(Annual meeting and exhibition of the Air and Waste Management Association; Cincinnati, OH (United States); 19-24 Jun 1994)			
3	94:531	See WHC-SA-2263			
8	94:1785	See ANL/EA/CP-82328			
9	94:532	See WHC-SA-2264			
CONF-940642-		(1. North American rock mechanics symposium; Austin, TX (United States); 1-3 Jun 1994)			
2	94:2401	See SAND-93-2090C			
CONF-940668-		(4. international symposium on fire safety science; Ottawa (Canada); 13-17 Jun 1994)			
1	94:2400	See SAND-93-1577C			
CRTD-					
22	94:1800	See CONF-910164-			
DOE/AL-					
0347	94:1815	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001479	MF-902
150329.0001	94:1700	OSTI; NTIS; GPO Dep.	E 1.99:	DE93005693	MF-902
150329.0002	94:1701	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93005694	MF-902
DOE/AL/62350-					
0198-Rev.1	94:99	See DOE/EIS-0198-Rev.1			
100	94:1697	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94007199	MF-902
108	94:1698	OSTI; NTIS; GPO Dep.	E 1.99:	DE94008245	MF-907
109	94:91	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008246	MF-902
10F	94:1816	OSTI; NTIS; GPO Dep.	E 1.99:	DE94004829	MF-902
110	94:92	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94011043	MF-902
111D	94:1699	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94011034	MF-902
115	94:93	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94011035	MF-902
117	94:94	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94011040	MF-902
118	94:95	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94011039	MF-902
122	94:96	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94011037	MF-902
19F-Rev.2	94:1817	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004830	MF-902
20F	94:59	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94003069	MF-902
21D	94:60	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93041030	MF-902
21D-Attach.2	94:1675	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93041031	MF-902
21D-Attach.3	94:1676	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93041032	MF-903
21D-Attach.3-App.A	94:1677	OSTI; NTIS; GPO Dep.	E 1.99:	DE93041033	MF-903
21D-Attach.3-App.B	94:1678	OSTI; NTIS; GPO Dep.	E 1.99:	DE93041034	MF-903
21D-Attach.3-App.C	94:1679	OSTI; NTIS; GPO Dep.	E 1.99:	DE93041035	MF-902
21D-Attach.4	94:1680	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93041036	MF-902
21PF	94:1681	OSTI; NTIS; GPO Dep.	E 1.99:	DE94008596	MF-903
21PF-Attach.2	94:1682	OSTI; NTIS; GPO Dep.	E 1.99:	DE94008597	MF-903
21PF-Attach.3	94:1683	OSTI; NTIS; GPO Dep.	E 1.99:	DE94008598	MF-903
21PF-Attach.3-App.A	94:1684	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008599	MF-902
21PF-Attach.3-App.B	94:1685	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008600	MF-902
21PF-Attach.3-App.C	94:1686	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008601	MF-902
21PF-Attach.4	94:1687	OSTI; NTIS; GPO Dep.	E 1.99:	DE94008603	MF-903
32D	94:61	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001509	MF-902
33D	94:1688	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040745	MF-900
35F-Rev.1	94:1689	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040747	MF-903
36-Rev.1	94:1819	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94011032	MF-902
36PF	94:1818	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001475	MF-902
38F	94:62	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001478	MF-940
40F-Attach.2	94:1690	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94011048	MF-902
40F-Attach.3-4	94:1691	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94011041	MF-902
40F-Attach.3-App.A	94:1692	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94011049	MF-902
40PF-Attach.2	94:1693	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93041027	MF-902
40PF-Attach.3-4	94:1694	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93041028	MF-902
40PF-Attach.3-App.A	94:1695	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93041029	MF-902
43D	94:63	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001510	MF-902; MF-903
44	94:1696	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94003070	MF-902
47D	94:1820	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040746	MF-903
48D	94:64	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001513	MF-903
48F-Rev.1	94:65	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94011038	MF-903
53F	94:66	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001511	MF-902
53F-Rev.1	94:67	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94006202	MF-902
54D	94:68	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001508	MF-902

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56-Rev.4	94:69	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94003071	MF-902
57D	94:70	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004831	MF-903
57D-Rev.1	94:71	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94011033	MF-903
58F	94:2161	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040748	MF-903
59	94:72	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94003072	MF-902
60F	94:1821	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004832	MF-902
61	94:73	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004833	MF-903
68F	94:74	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001512	MF-902
68F-Rev.1	94:75	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004834	MF-903
68F-Rev.2	94:76	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94006199	MF-902
69F	94:77	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94003073	MF-902
70F	94:78	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001481	MF-902
72D	94:79	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94011045	MF-906
74D	94:1822	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94003074	MF-902
76-Rev.5	94:80	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004836	MF-902
77	94:1823	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94011047	MF-902
78	94:81	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94007201	MF-902
79	94:82	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94003075	MF-902
86D	94:83	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004837	MF-902
87D	94:84	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94006200	MF-902
88	94:85	OSTI; NTIS; GPO Dep.	E 1.99:	DE94004838	MF-900
88F	94:86	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004839	MF-900; MF-907
90D	94:87	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94007200	MF-902
92	94:88	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94007198	MF-903
95D	94:89	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94011046	MF-902
97D	94:90	OSTI; NTIS; GPO Dep.	E 1.99:	DE94007203	MF-902
9F	94:1674	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001477	MF-900
DOE/CH- 9202	94:2162	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94007974	MF-600; MF-902
9212	94:97	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93009532	MF-903
DOE/DP/48075- 7	94:2541	OSTI; NTIS; GPO Dep.	E 1.99:	DE93005143	MF-900
8	94:2542	OSTI; NTIS; GPO Dep.	E 1.99:	DE93005144	MF-902
DOE/EA- 0339	94:98	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93041026	MF-902
0339-Rev.1	94:2163	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94011036	MF-902
0441	94:1824	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91015814	MF-902
0464-Rev.1	94:1702	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93041037	MF-902
0464-Rev.2	94:1703	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94006201	MF-902
0464-Rev.3	94:1704	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94007202	MF-902
0489	94:2164	OSTI; NTIS; GPO Dep.	E 1.99:	DE91014301	MF-902
0489-Rev.1	94:2165	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010382	MF-902
0491	94:637	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91015815	MF-902
0499	94:2166	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001936	MF-902; MF-940
0785	94:1825	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016873	MF-940
0809	94:1315	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001944	MF-902
DOE/EH- 94007658	94:2167	OSTI; NTIS; GPO Dep.	E 1.99:	DE94007658	MF-630
DOE/EIS- 0185D-074-Vol.1	94:638	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93003926	MF-902
0185D-074-Vol.2	94:639	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93003927	MF-902
0185D-091	94:640	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93003627	MF-902; MF-907
0185D-148-Vol.1	94:641	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93003925	MF-902
0185D-148-Vol.2	94:642	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93003924	MF-902
0185D-160	94:643	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93003923	MF-902; MF-907
0185F-387	94:644	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019015	MF-902
0198-Rev.1	94:99	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94003177	MF-902
0198-Rev.2	94:100	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94011044	MF-902
0198-Rev.3	94:101	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94011042	MF-902
DOE/EM- 0001/92	94:102	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040728	MF-902
0005P	94:103	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91006061	MF-900
0006P	94:645	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91006746	MF-900
0007T-Vol.1	94:2067	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91008026	MF-900
0007T-Vol.2	94:2068	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91008027	MF-900

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
0007T-Vol.3	94:2069	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91008028	MF-900
0011P	94:2543	OSTI; NTIS; GPO Dep.	E 1.99:	DE91012191	MF-902
0012P	94:2544	OSTI; NTIS; GPO Dep.	E 1.99:	DE91012276	MF-902
0013P	94:104	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91018290	MF-902
0056P	94:1316	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92002219	MF-902
0057P	94:646	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92002628	MF-900
0058P	94:2545	OSTI; NTIS; GPO Dep.	E 1.99:	DE92007163	MF-900
0059P	94:647	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92007162	MF-900
0060P	94:2546	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92007385	MF-900
0061P	94:2547	OSTI; NTIS; GPO Dep.	E 1.99:	DE92007386	MF-900
0062P	94:2548	OSTI; NTIS; GPO Dep.	E 1.99:	DE92007387	MF-900
0079	94:1826	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000946	MF-900
0080T	94:1317	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92019798	MF-902
0088P	94:648	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93003135	MF-900
0091P	94:649	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93006957	MF-940
0095P	94:1318	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001758	MF-902
0096	94:650	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018386	MF-940
0099	94:2549	OSTI; NTIS; GPO Dep.	E 1.99:	DE94001564	MF-900
0104	94:1319	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94000552	MF-902
0107P	94:2213	See IS-5096			
0108P	94:105	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94003840	MF-902
0109P	94:106	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002591	MF-902
0121P	94:651	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008853	MF-940
0122P	94:1320	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008854	MF-940
0123P	94:1827	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008855	MF-940
0124P	94:1321	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008856	MF-940
0125P	94:652	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008857	MF-940
0126P	94:653	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008858	MF-940
0127P	94:2070	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008859	MF-902
0128P	94:654	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008860	MF-903
0129P	94:655	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008861	MF-903
0134P	94:656	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008862	MF-903
0135P	94:657	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008863	MF-903
0136P	94:658	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008864	MF-903
0138P	94:2550	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008866	MF-940
0139P	94:659	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94007838	MF-940
0141P	94:2551	OSTI; NTIS; GPO Dep.	E 1.99:	DE94009188	MF-902
0142P	94:1828	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94012855	MF-902
0143P	94:660	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008981	MF-940
0147P	94:2552	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94012580	MF-902
0149P	94:661	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94012772	MF-940
0153P	94:2553	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94012127	MF-902
0157P	94:1829	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94013040	MF-902
0158P	94:2168	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94013041	MF-902
0159P	94:2169	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94013042	MF-902
0160P	94:2170	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94013043	MF-902
0161P	94:2171	OSTI; NTIS; GPO Dep.	E 1.99:	DE94013376	MF-900
94007053	94:1830	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94007053	MF-900
DOE/EW/40017-					
T1	94:1831	OSTI; NTIS; GPO Dep.	E 1.99:	DE92008135	MF-902
T2	94:1832	OSTI; NTIS; GPO Dep.	E 1.99:	DE92016095	MF-902
T3	94:1833	OSTI; NTIS; GPO Dep.	E 1.99:	DE93002311	MF-902
T4	94:1834	OSTI; NTIS; GPO Dep.	E 1.99:	DE93010138	MF-902
T5	94:1835	OSTI; NTIS; GPO Dep.	E 1.99:	DE93011518	MF-902
DOE/EW/50616-					
T13	94:662	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019890	MF-906
DOE/FTR-					
93010493	94:2554	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93010493	MF-903
93010639	94:2555	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93010639	MF-900
93010782	94:2556	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93010782	MF-902
93010923	94:2557	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93010923	MF-940
93011057	94:2558	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93011057	MF-903
93011412	94:2559	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93011412	MF-902
93011432	94:2560	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93011432	MF-940
93012248	94:2561	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93012248	MF-902
93012360	94:2562	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93012360	MF-902
93012976	94:2563	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93012976	MF-902
93013397	94:2564	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93013397	MF-900
93013558	94:2565	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93013558	MF-940
93013560	94:2566	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93013560	MF-906

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
93013658	94:2567	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93013658	MF-902
93014405	94:2568	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014405	MF-902
93014498	94:2569	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014498	MF-940
93014810	94:2570	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014810	MF-906
93015303	94:2571	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93015303	MF-940
93015529	94:2572	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93015529	MF-902
93017128	94:2573	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93017128	MF-940
93018125	94:2574	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93018125	MF-900
93018126	94:2575	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93018126	MF-900
93018259	94:2576	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93018259	MF-820
93018260	94:2577	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93018260	MF-940
93018609	94:2578	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93018609	MF-903
93018760	94:2579	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93018760	MF-902
93019182	94:2580	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019182	MF-940
94003540	94:2581	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE94003540	MF-940
94003794	94:2582	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE94003794	MF-902
94004456	94:2583	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE94004456	MF-940
DOE/HWP-					
102	94:1837	NTIS, PC A14/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016542	MF-902
104	94:1323	NTIS, PC A13/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001636	MF-900
106-Vol.1	94:663	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91018445	MF-902
106-Vol.2	94:664	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91018446	MF-902
108	94:665	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91012211	MF-900
116	94:666	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005255	MF-902
139	94:1838	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94010115	MF-902
147	94:1839	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94005146	MF-902
69/R1	94:1836	OSTI; NTIS; GPO Dep.	E 1.99:	DE91018447	MF-902
99	94:1322	NTIS, PC A13/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90010826	MF-902
DOE/ID-					
10054(90)	94:667	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003314	MF-902
10054(91)	94:668	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016401	MF-940
10054(92)	94:669	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002936	MF-940
10057(90)	94:670	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003268	MF-902
10057(92)	94:671	OSTI; NTIS; GPO Dep.	E 1.99:	DE94002935	MF-902
10253	94:672	NTIS, PC A13/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015473	MF-900
10253(FY92)	94:1840	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92017856	MF-902
10253-FY93	94:1841	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016684	MF-900
10253-FY94	94:1842	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94011024	MF-900
10317-Rev.1	94:1843	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93007125	MF-940
10382-App.A-F	94:107	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92019702	MF-940
10408	94:1324	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93007121	MF-940
10409	94:1325	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93007123	MF-940
10410	94:1326	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93007124	MF-940
10411	94:1327	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93007122	MF-940
10412	94:673	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93007120	MF-940
10415	94:674	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93012171	MF-940
10432	94:108	OSTI; NTIS; GPO Dep.	E 1.99:	DE93013749	MF-902
10433	94:109	OSTI; NTIS; GPO Dep.	E 1.99:	DE93013730	MF-902
10437(92)	94:110	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016687	MF-902
12123	94:1705	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012364	MF-902
DOE/ID/12584-					
103	94:1844	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93002870	MF-902
148	94:676	OSTI; NTIS; GPO Dep.	E 1.99:	DE94006804	MF-902
97	94:675	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92040889	MF-902
T2	94:677	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93002871	MF-902
DOE/ID/13042-					
7	94:111	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93012950	MF-902
16	94:112	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93012956	MF-902
17	94:113	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93012955	MF-903
18	94:114	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93012946	MF-902
22	94:115	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93012947	MF-903
23	94:116	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002418	MF-903
26	94:117	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008822	MF-902
27	94:118	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008823	MF-902
28	94:119	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008824	MF-902
29	94:120	OSTI; NTIS; GPO Dep.	E 1.99:	DE94008825	MF-902
30	94:121	OSTI; NTIS; GPO Dep.	E 1.99:	DE94008826	MF-902
T4	94:2172	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93003254	MF-902
DOE/ID/13167-					
T2	94:122	OSTI; NTIS; GPO Dep.	E 1.99:	DE93015092	MF-900

DOE/ID/13215-

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
DOE/ID/13215-					
T1	94:678	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040363	MF-903
T2	94:679	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94011114	MF-902
T2-Attach.	94:680	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94011115	MF-902
DOE/LLW-					
101	94:683	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92017836	MF-900
111-Draft	94:684	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92018815	MF-940
114	94:685	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003291	MF-902
116	94:686	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92010845	MF-940
117	94:687	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93007046	MF-902
118	94:688	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93007047	MF-902
119	94:689	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93007048	MF-902
120	94:690	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93007049	MF-902
133	94:691	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93007226	MF-940
135	94:692	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92017835	MF-900
137	94:693	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92017837	MF-900
141	94:694	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92019892	MF-902
144	94:695	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017394	MF-902
145	94:696	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92017750	MF-902
146	94:697	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92019893	MF-902
147	94:698	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012308	MF-902
151	94:699	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93005247	MF-902
152	94:1706	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93005068	MF-940
156	94:700	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93005177	MF-902
159	94:701	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93007647	MF-940
161	94:702	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93013739	MF-906
162	94:703	OSTI; NTIS; GPO Dep.	E 1.99:	DE93012170	MF-900
164	94:704	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93007229	MF-940
165	94:705	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93013744	MF-900
166	94:706	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93013696	MF-940
170	94:707	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017395	MF-902
171	94:708	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93013740	MF-905
172	94:709	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93013738	MF-940
178	94:710	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018938	MF-940
181	94:711	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002919	MF-940
184	94:712	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002937	MF-940
193	94:713	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008513	MF-940
198	94:714	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94010709	MF-940
93	94:681	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92010806	MF-900
99	94:682	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94005183	MF-940
DOE/MC/29103-					
3661	94:123	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004078	PC-902
DOE/MC/29106-					
3531	94:124	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94000056	PC-902
DOE/MC/29107-					
3701	94:716	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004098	PC-902
94/C0331	94:715	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94009548	MF-902
DOE/MC/29109-					
3356	94:717	OSTI; NTIS; GPO Dep.	E 1.99:	DE93041217	MF-902
3392	94:718	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040019	MF-902
3634	94:719	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004053	MF-902
DOE/MC/29112-					
3641	94:2071	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004062	MF-902
DOE/MC/29113-					
3405	94:2072	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040018	MF-902; MF-906
3536	94:2073	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94000062	MF-902; MF-906
3574	94:2074	OSTI; NTIS; GPO Dep.	E 1.99:	DE94005914	MF-900
3608	94:2075	OSTI; NTIS; GPO Dep.	E 1.99:	DE94005893	MF-900
3689	94:2076	OSTI; NTIS; GPO Dep.	E 1.99:	DE94008633	MF-902
DOE/MC/29115-					
93/C0190	94:2077	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93015930	MF-902
94/C0274	94:2078	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94006006	MF-900
DOE/MC/29116-					
3406	94:1845	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019992	MF-902
3575	94:1846	OSTI; NTIS; GPO Dep.	E 1.99:	DE94005896	MF-906
3606	94:720	OSTI; NTIS; GPO Dep.	E 1.99:	DE94005902	MF-906
DOE/MC/29119-					
3524	94:1847	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94000049	MF-906

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
3667	94:1848	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004083	PC-902
DOE/MC/29120-3498	94:1849	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94000059	MF-902
DOE/MC/29467-3475	94:1851	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94006446	MF-902
3559	94:1852	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94005790	MF-902; MF-940
93/C0192	94:1850	OSTI; NTIS; GPO Dep.	E 1.99:	DE93015861	MF-903
DOE/METC-94/1003	94:2173	OSTI; NTIS; GPO Dep.	E 1.99:	DE94000085	MF-900
DOE/METC/C-93/7063	94:721	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93015579	MF-902
93/7098	94:722	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93041131	MF-902
94/7119	94:2174	OSTI; NTIS; GPO Dep.	E 1.99:	DE94007312	MF-902
DOE/MWIP-1	94:125	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041364	MF-902
2	94:723	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93011397	MF-940
4	94:726	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040334	MF-902
9	94:728	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019953	MF-940; MF-902
10	94:729	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019952	MF-902
11	94:730	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94006308	MF-902
13	94:731	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94005359	MF-902
14	94:732	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94003997	MF-902; MF-940
15	94:733	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94011598	MF-901
19	94:734	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94011932	MF-901
25	94:735	OSTI; NTIS; GPO Dep.	E 1.99:	DE94012310	MF-900
3-Vol.1	94:724	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040594	MF-902
3-Vol.2	94:725	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040579	MF-902
8-Vol.1	94:727	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040903	MF-902
DOE/NBM-1100-Vol.2	94:736	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93012097	MF-902
1100-Vol.3	94:737	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93012098	MF-902
1100-Vol.4	94:738	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93012099	MF-902
1100-Vol.6	94:739	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93012101	MF-902
1101	94:740	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94005597	MF-900
DOE/NE/37969-5	94:2079	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94012485	MF-906
DOE/NV/11432-32	94:126	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008647	MF-902; MF-940
DOE/OR-01-1100-D2	94:1853	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93013201	MF-940
01-1100-D3	94:1854	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93013251	MF-902
01-1110-D2	94:1855	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93006269	MF-902
01-1111-D1	94:1856	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93006273	MF-902
01-1115-D2	94:127	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001950	MF-902
01-1115-D3	94:128	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001880	MF-902
01-1122-D3	94:1857	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017914	MF-902
01-1128-D1	94:1858	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017234	MF-902
01-1129-D1	94:741	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010327	MF-902
01-1135-D2	94:742	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016908	MF-902
01-1136	94:129	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93014394	MF-902
01-1138-D1	94:743	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010842	MF-902
01-1151-D1	94:1859	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001951	MF-902
01-1159-D1	94:744	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016762	MF-902
01-1161-V1-D1	94:1860	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002755	MF-902
01-1167-D1	94:745	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94000424	MF-902
01-1168-D1	94:746	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017755	MF-940
01-1168-D2	94:747	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001658	MF-902
01-1169-D1	94:748	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002752	MF-902
01-1173-D1	94:749	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94003336	MF-902
01-1175-V3	94:1863	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94006285	MF-902
01-1175/V1	94:1861	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94006283	MF-902
01-1175/V2	94:1862	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94006284	MF-902
01-1192-D1	94:1864	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94007244	MF-902
01-1214-D1	94:1865	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94010094	MF-902
01-1214-D2	94:1866	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94010030	MF-902
01-1254-D1	94:1867	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94009444	MF-902

DOE/OR-

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
03-1150-D1	94:750	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016909	MF-902
03-1195-D1	94:751	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94009505	MF-902
1047-D1	94:754	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92040322	MF-902
1051	94:755	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010885	MF-902
1054-D1	94:756	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041271	MF-902
1054-D2	94:757	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93013202	MF-902
1060-D1	94:1868	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041220	MF-902
1060-D3	94:1869	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018593	MF-902
1070-D2	94:1870	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001421	MF-902
1077	94:1871	OSTI; NTIS; GPO Dep.	E 1.99:	DE93003590	MF-900
1152-D1	94:1872	OSTI; NTIS; GPO Dep.	E 1.99:	DE94002584	MF-902
DOE/OR/00033-					
T514	94:130	OSTI; NTIS; GPO Dep.	E 1.99:	DE93005282	MF-902
T517	94:752	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93005279	MF-940
T558	94:753	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94000852	MF-940
DOE/OR/21548-					
074-Vol.1	94:638	See DOE/EIS-0185D-074-Vol.1			
074-Vol.2	94:639	See DOE/EIS-0185D-074-Vol.2			
091	94:640	See DOE/EIS-0185D-091			
148-Vol.1	94:641	See DOE/EIS-0185D-148-Vol.1			
148-Vol.2	94:642	See DOE/EIS-0185D-148-Vol.2			
160	94:643	See DOE/EIS-0185D-160			
243	94:1873	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94006381	MF-902
387	94:644	See DOE/EIS-0185F-387			
DOE/OR/21949-					
283	94:1874	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91017592	MF-900
284	94:1875	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91018921	MF-902
285	94:1876	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91018923	MF-902
286	94:1877	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91018922	MF-902
287	94:1878	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91018920	MF-902
288	94:1879	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91017593	MF-900
289	94:1880	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91017591	MF-900
340	94:1881	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001266	MF-902
341	94:1882	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001267	MF-902
342	94:1883	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001268	MF-902
343	94:1884	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001262	MF-902
344	94:1885	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001263	MF-902
345	94:1886	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001264	MF-902
346	94:1887	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001265	MF-902
364	94:1888	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017302	MF-902
365	94:1889	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017303	MF-902
366	94:1890	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017304	MF-902
367	94:1891	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018599	MF-902
368	94:1892	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018600	MF-902
369	94:1893	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018338	MF-902
374	94:1894	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94012720	MF-902
378	94:1895	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94012719	MF-902
379	94:1896	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94012721	MF-902
DOE/OR/22000-					
1	94:131	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94013173	MF-940
DOE/OR/22160-					
T2	94:132	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94003658	MF-902
T5	94:133	OSTI; NTIS; GPO Dep.	E 1.99:	DE94007161	MF-902
DOE/RL-					
89-08-02	94:134	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016377	MF-902
89-12-Rev.1	94:135	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94005512	MF-902
89-18-Rev.1	94:2175	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92008365	MF-902
89-28-Rev.1	94:1897	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94006345	MF-902
90-0025-Rev.1	94:1902	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94003465	MF-940
90-0041	94:758	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91007156	MF-902
90-03-Rev.2	94:1898	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94007150	MF-902
90-04-Rev.1	94:1899	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93002176	MF-902
90-08	94:1900	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92018160	MF-940
90-20	94:1901	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93002197	MF-902
90-45	94:759	OSTI; NTIS; GPO Dep.	E 1.99:	DE91007925	MF-902
91-14	94:1904	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91016782	MF-940
91-25	94:1905	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92000891	MF-902
91-40	94:2176	OSTI; NTIS; GPO Dep.	E 1.99:	DE93041114	MF-900
91-59	94:1906	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94005982	MF-940
91/09	94:1903	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012593	MF-902

<i>Report Number</i>	<i>Abstract Number</i>	<i>Source of Availability</i>	<i>GPO Dep.</i>	<i>Order Number</i>	<i>Distribution Category</i>
92-12	94:136	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93013032	MF-902
92-18	94:1907	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93013051	MF-902
92-20-Draft	94:1908	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93011253	MF-940
92-29	94:1909	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001179	MF-900
92-43	94:1910	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94003904	MF-902
92-51	94:1911	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93012617	MF-902
92-71	94:1912	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93012620	MF-902
92-72-Rev.1	94:1913	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040412	MF-903
93-04	94:1914	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004483	MF-902
93-06	94:2177	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94010339	MF-902
93-08	94:1915	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019979	MF-900
93-101	94:1925	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94006346	MF-940; MF-902
93-104	94:1926	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94007983	MF-902
93-11	94:760	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016353	MF-902
93-15	94:761	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016356	MF-940
93-16	94:762	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016355	MF-940
93-18	94:137	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016357	MF-940
93-19	94:1916	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001172	MF-900
93-21-Vol.1	94:1917	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008645	MF-902
93-21-Vol.2	94:1918	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008646	MF-903
93-23	94:138	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94007158	MF-903
93-35-Rev.1	94:1919	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94006332	MF-940
93-36	94:139	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018737	MF-920
93-38	94:1920	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94007992	MF-900
93-38-Exec.Summ.	94:1921	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004713	MF-900
93-39	94:1328	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019977	MF-902
93-56-3	94:140	OSTI; NTIS; GPO Dep.	E 1.99:	DE94007424	MF-902
93-56-4	94:141	OSTI; NTIS; GPO Dep.	E 1.99:	DE94012934	MF-902
93-57	94:1922	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94011332	MF-900
93-59	94:2584	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019983	MF-900
93-63	94:2585	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019579	MF-902
93-68	94:1923	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94005486	MF-902
93-76	94:763	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94007991	MF-902
93-88	94:142	OSTI; NTIS; GPO Dep.	E 1.99:	DE94009665	MF-902
93-90	94:1924	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004896	MF-900
93-94	94:143	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94006997	MF-903
94-10-Vol.1-Pt.1	94:764	OSTI; NTIS; GPO Dep.	E 1.99:	DE94012311	MF-902
94-10-Vol.1-Pt.2	94:765	OSTI; NTIS; GPO Dep.	E 1.99:	DE94012312	MF-902
94-10-Vol.2	94:766	OSTI; NTIS; GPO Dep.	E 1.99:	DE94012313	MF-902
94-10-Vol.3-Pt.1	94:767	OSTI; NTIS; GPO Dep.	E 1.99:	DE94012314	MF-902
94-10-Vol.3-Pt.2	94:768	OSTI; NTIS; GPO Dep.	E 1.99:	DE94012315	MF-902
94-10-Vol.4	94:769	OSTI; NTIS; GPO Dep.	E 1.99:	DE94012316	MF-902
94-10-Vol.5	94:770	OSTI; NTIS; GPO Dep.	E 1.99:	DE94012317	MF-902
94-15	94:771	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94010338	MF-902; MF-940
94-32	94:144	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94010337	MF-902
94-37	94:1927	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94011443	MF-902
DOE/RL/11946-					
1-Vol.2	94:594	See CAPE-3030			
1-Vol.3	94:772	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92015017	MF-900
1-Vol.4	94:773	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92015018	MF-900
1-Vol.5	94:774	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92015019	MF-900
1-Vol.6	94:775	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92015020	MF-900
1-Vol.7	94:776	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92015021	MF-900
2-Vol.1	94:777	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92019841	MF-900
2-Vol.2	94:778	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92019842	MF-900
2-Vol.3	94:779	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92019843	MF-900
2-Vol.4	94:595	See CAPE-3035			
2-Vol.5	94:780	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92019844	MF-900
T1-Vol.1	94:781	OSTI; NTIS; GPO Dep.	E 1.99:	DE94012831	MF-900
T1-Vol.2	94:782	OSTI; NTIS; GPO Dep.	E 1.99:	DE94012832	MF-500
T1-Vol.3A	94:783	OSTI; NTIS; GPO Dep.	E 1.99:	DE94012833	MF-900
T1-Vol.3B	94:784	OSTI; NTIS; GPO Dep.	E 1.99:	DE94012834	MF-900
DOE/RL/12175-					
T1	94:1928	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003440	MF-902
DOE/RL/12253-					
T1	94:1329	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003490	MF-900
T3	94:1330	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003489	MF-900

DOE/RW-

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
DOE/RW-					
0006-Rev.7	94:2178	INIS; OSTI (Free of Charge)		TI92003986	MF-810
0006-Rev.8	94:2179	INIS; OSTI (Free of Charge)		TI93005041	MF-810
DOE/S-					
0089P	94:145	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91018149	MF-902
DOE/UMTRA-					
050126-0000	94:146	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93009470	MF-903
050127-0000	94:147	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010395	MF-902
050128-0000	94:148	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010392	MF-902
050129-0000	94:149	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010393	MF-902
050130-0000	94:150	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93008959	MF-903
050503-0000	94:1707	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010352	MF-902
050503-0000-Attach.4	94:1708	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010386	MF-902
050503-Attach.2	94:1709	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010384	MF-902
050503-Attach.3	94:1710	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010385	MF-902
050503-Attach.5	94:1711	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010387	MF-902
050503-Attach.6	94:1712	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010388	MF-902
050506-0000-Vol.1	94:1713	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010203	MF-902
050506-0000-Vol.2	94:1714	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010763	MF-902
050506-Vol.3-App.F	94:1715	OSTI; NTIS; GPO Dep.	E 1.99:	DE93012928	MF-902
050506-Vol.4	94:1716	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93012929	MF-902
050506-Vol.5	94:1717	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93012927	MF-902
050508-0000	94:1718	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010473	MF-903
050508-0000-Attach.2	94:1719	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010474	MF-903
050508-0000-Attach.3	94:1720	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010475	MF-903
050508-0000-Attach.3-App.A	94:1721	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010476	MF-903
050508-0000-Attach.3-App.B	94:1722	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010484	MF-903
050508-0000-Attach.3-App.C	94:1723	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010485	MF-903
050508-0000-Attach.4	94:1724	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010471	MF-903
050508-0000-Attach.5	94:1725	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010472	MF-903
050510-0000-Rev.1-Vol.1	94:1726	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93009101	MF-902
050510-0000-Rev.1-Vol.2	94:1727	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93008953	MF-902
050510-0000-Rev.1-Vol.3	94:1728	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93009025	MF-902
050510-CARD	94:1729	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93009100	MF-902
050510-GRNO	94:1730	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93009102	MF-902; MF-903
050510-GRNO-Vol.1	94:1731	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93008967	MF-902; MF-903
050510-GRNO-Vol.2A	94:1732	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93008968	MF-902; MF-903
050510-GRNO-Vol.3	94:1733	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93009099	MF-902; MF-903
050512-0000	94:1734	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93009143	MF-902
050512-0000-App.B-Attach.3	94:1735	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93009146	MF-902
050512-0000-Attach.2	94:1736	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93009145	MF-903
050512-0000-Attach.4	94:1737	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93009147	MF-902
050512-App.B-Attach.1	94:1738	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93009144	MF-902
0505125-0000	94:1949	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93009141	MF-903
050515-0000-Vol.1	94:1739	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010465	MF-902
050515-0000-Vol.2-App.F	94:1740	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010466	MF-902
050516-0000-Vol.1	94:1741	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93009137	MF-902
050516-0000-Vol.2	94:1742	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93009138	MF-902
050516-0000-Vol.3	94:1743	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93009139	MF-902
050518-0000-App.A-C	94:1744	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93009593	MF-902
050518-0000-App.E	94:1745	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93009595	MF-902
050520-0000	94:1746	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010886	MF-903
050522-0000-Vol.1	94:1747	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010888	MF-903
050522-0000-Vol.2	94:1748	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010889	MF-903
150128-0000	94:1930	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93008958	MF-902
150129-0000	94:1931	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93008951	MF-902
150306-MITI	94:1932	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93008956	MF-902

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
150308-GAME	94:1933	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010390	MF-902
150308-MITI	94:1934	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010391	MF-902
150312-0000	94:1935	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93008952	MF-902
150320-EADR	94:1936	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010324	MF-902
150329-0003	94:151	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93005695	MF-902
3050-93-1235-Vol.1	94:1929	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94007205	MF-902
3050-93-1235-Vol.2	94:2180	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94007206	MF-902
350125-0000-Rev.1	94:1937	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93005955	MF-902
350214-0000	94:152	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93005953	MF-902
400134-0000	94:1938	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010588	MF-902
400135-0000	94:1939	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93011699	MF-902
400327-0000	94:153	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010759	MF-902
400653-0000	94:154	OSTI; NTIS; INIS; GPO; GPO Dep.	E 1.99:	DE93010469	MF-903
400655-0000	94:1940	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93009466	MF-901; MF-902
400661-0000	94:1941	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93008955	MF-902
400662-0000	94:1942	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93009467	MF-902
400663-0000	94:1943	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93009469	MF-902
400665-0000	94:1944	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93008964	MF-902
400666-0000	94:155	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010094	MF-903
400668-0000	94:1945	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93008960	MF-902
400669-0000	94:156	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93008966	MF-902
400670-0000	94:157	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93009140	MF-902
400671-0000	94:158	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93005948	MF-902
400673-0000	94:159	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010322	MF-902
400675-0000	94:160	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010097	MF-902
400677-0000	94:1946	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010096	MF-902
400679-0000	94:161	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93008963	MF-902
400680-0000	94:162	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010591	MF-903
400681-0000	94:163	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93008500	MF-902
400689-0000	94:164	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93008965	MF-902
400690-0000	94:1947	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93008962	MF-902
400730-0000	94:1948	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93009468	MF-902
EGG-					
2656	94:785	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92016826	MF-902
2678(92)	94:165	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002897	MF-902
2679(92)	94:1950	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002898	MF-902; MF-940
2683	94:1951	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93012142	MF-940
2710	94:2080	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002604	MF-940
EGG-CIET-					
11061	94:786	OSTI; NTIS; GPO Dep.	E 1.99:	DE94008520	MF-905
EGG-EEL-					
10498	94:166	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016668	MF-903
10794	94:167	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018934	MF-903
EGG-EELS-					
10666	94:168	OSTI; INIS; NTIS (documentation only); ESTSC (complete software package), P.O. Box 1020, Oak Ridge, TN 37831-1020; GPO Dep.	E 1.99:	DE93012331	MF-905
EGG-ENV-					
10975	94:169	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94010796	MF-902
EGG-ER-					
10792	94:2181	OSTI; NTIS; GPO Dep.	E 1.99:	DE94002882	MF-900
EGG-ERD-					
10422	94:1952	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002834	MF-902
10453	94:1953	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002883	MF-902
EGG-ESQ-					
10614	94:170	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010756	MF-902
EGG-GEO-					
10068	94:173	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012320	MF-902
10158	94:174	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012532	MF-902
10274	94:175	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92018038	MF-902
10329	94:176	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92019760	MF-902
10330	94:177	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92019768	MF-902
10368	94:178	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92019691	MF-902
10797	94:179	OSTI; NTIS (documentation only); ESTSC (complete software package), P.O. Box 1020, Oak Ridge, TN 37831-1020; INIS; GPO Dep.	E 1.99:	DE93019026	MF-902

EGG-GEO-

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
10798	94:180	OSTI; NTIS (documentation only); ESTSC (complete software package), P.O. Box 1020, Oak Ridge, TN 37831-1020; INIS; GPO Dep.	E 1.99:	DE94002877	MF-905
9987	94:171	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011699	MF-903
9990	94:172	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012237	MF-903
EGG-LLW- 11140	94:787	OSTI; NTIS; GPO Dep.	E 1.99:	DE94010778	MF-940
EGG-M- 89238	94:181	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91018694	MF-902; MF-940
91219	94:182	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003334	MF-902
91394	94:788	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92017842	MF-902
91416	94:789	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92017857	MF-902
91419	94:1749	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92017889	MF-940
91423	94:790	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92017899	MF-902
91476	94:791	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003301	MF-940
91481	94:792	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92017840	MF-940
91495	94:793	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003319	MF-902
92051	94:794	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92017843	MF-902
92097	94:795	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92017920	MF-940
92121	94:796	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92019762	MF-902
92186	94:1750	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92017888	MF-940
92226	94:797	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92018016	MF-902
92301	94:798	OSTI; NTIS; GPO Dep.	E 1.99:	DE92018028	MF-906
92308	94:799	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92018014	MF-906
92342	94:800	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92018012	MF-940
92580	94:2081	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010803	MF-940
92586	94:801	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93013681	MF-906
92597	94:802	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016556	MF-940; MF-906
92598	94:803	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016637	MF-940
92605	94:804	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93005192	MF-940
92644	94:805	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93005190	MF-940
92702	94:806	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93013668	MF-940
92714	94:807	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018941	MF-902
93135	94:808	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93013677	MF-902
93176	94:809	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93013660	MF-901; MF-902
EGG-ME- 10522	94:810	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93007145	MF-902
EGG-MS- 10613	94:812	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016480	MF-906; MF-902
10617	94:813	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93013742	MF-940
10642	94:814	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002809	MF-901
10646	94:815	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016484	MF-900
10657	94:816	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016595	MF-940
9879	94:811	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92010488	MF-900
EGG-NRP- 10991	94:817	OSTI; NTIS; GPO Dep.	E 1.99:	DE94010797	MF-902
EGG-PHY- 10446	94:818	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93005268	MF-902
EGG-WM- 10109	94:820	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012369	MF-900
10146	94:821	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92017992	MF-940
10477	94:1331	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002878	MF-940
10496	94:822	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016369	MF-940; MF-902
10533	94:823	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93012189	MF-940
10630	94:824	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93012166	MF-902
10728	94:825	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002899	MF-940
10823	94:826	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002810	MF-902
10823-Rev.1	94:827	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008521	MF-940
10974	94:1751	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008524	MF-902
11066	94:183	OSTI; NTIS; GPO Dep.	E 1.99:	DE94010795	MF-902
11179	94:828	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94010765	MF-902
11205	94:829	OSTI; NTIS; GPO Dep.	E 1.99:	DE94010764	MF-940
9857	94:819	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012374	MF-940
EGG-WMO- 10244-App.A	94:830	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92019852	MF-902

<i>Report Number</i>	<i>Abstract Number</i>	<i>Source of Availability</i>	<i>GPO Dep.</i>	<i>Order Number</i>	<i>Distribution Category</i>
10244-App.B-Pt.1	94:831	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92019853	MF-902
10244-App.B-Pt.2	94:832	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92019854	MF-902
10244-Pt.1	94:833	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93007637	MF-902; MF-907
10244-Pt.2	94:834	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93007636	MF-902; MF-907
10244-Vol.1-Vol.2	94:835	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92019612	MF-902
10244-Vol.3	94:836	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92019851	MF-902
EGG-WTD-					
10033	94:221	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012368	MF-900
10035	94:222	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012522	MF-906; MF-902
10036	94:843	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012512	MF-902
10037	94:844	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92017990	MF-940
10056	94:845	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012510	MF-902
10058	94:846	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92018049	MF-902
10092	94:223	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92018036	MF-902
10129	94:224	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012373	MF-906
10172	94:225	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92018050	MF-902
10180	94:2187	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013101	MF-902; MF-906
10194	94:226	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92017998	MF-902
10204	94:227	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001938	MF-902; MF-940
10254	94:847	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001932	MF-902; MF-940
10255	94:228	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92017996	MF-902
10325	94:229	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92019687	MF-902
10354	94:230	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001939	MF-902
10360	94:231	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92019690	MF-902
10386	94:232	OSTI; NTIS; GPO Dep.	E 1.99:	DE93005260	MF-902
10397	94:233	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93005202	MF-940
10429	94:234	OSTI; NTIS; GPO Dep.	E 1.99:	DE93005261	MF-902
10443	94:848	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016371	MF-902
10450	94:235	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93005233	MF-940
10507	94:2188	OSTI; NTIS; GPO Dep.	E 1.99:	DE93012185	MF-906
10539	94:236	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93012167	MF-902; MF-907
10566	94:2189	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93007641	MF-902; MF-906
10610	94:237	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93012188	MF-940
10612	94:238	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93012182	MF-902
10635	94:239	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93012183	MF-906
10660	94:240	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002841	MF-902
10663	94:2190	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002850	MF-906
10677	94:2191	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93012163	MF-902
10703	94:2084	OSTI; NTIS; GPO Dep.	E 1.99:	DE94002876	MF-906
10716	94:241	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018990	MF-900
10717	94:242	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016636	MF-902
10719	94:243	OSTI; NTIS; GPO Dep.	E 1.99:	DE94008516	MF-940
10744	94:244	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016374	MF-906
10766	94:245	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002861	MF-940
10771	94:246	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002842	MF-906
10784-Vol.1	94:247	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008589	MF-940
10784-Vol.2	94:248	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008590	MF-940
10784-Vol.3	94:249	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008591	MF-940
10812	94:250	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002838	MF-940; MF-906
10813	94:251	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002881	MF-940
10875	94:2192	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002846	MF-940
10878	94:252	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002845	MF-940
10895	94:253	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002847	MF-902
10931	94:254	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94010777	MF-940
10935	94:849	OSTI; NTIS; GPO Dep.	E 1.99:	DE94008512	MF-900
10988	94:255	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94010776	MF-906
9194	94:837	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003267	MF-902
9214	94:838	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013100	MF-905
9291	94:184	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91014090	MF-902
9291-Rev.1	94:185	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91014168	MF-940

EGG-WTD-

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
9336	94:186	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91014167	MF-940
9383-Rev.1	94:187	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91014093	MF-900
9408	94:1752	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91014153	MF-902
9412	94:188	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91014160	MF-902
9422-Rev.1	94:189	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92017999	MF-902
9423	94:190	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91014169	MF-906
9432-Vol.1-Rev.1	94:191	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012568	MF-903
9432-Vol.2	94:192	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012569	MF-903
9432-Vol.3	94:193	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012601	MF-903
9438	94:194	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91014094	MF-940
9520	94:839	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012515	MF-902
9594-Vol.1	94:195	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003326	MF-902
9594-Vol.2	94:196	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003327	MF-902
9594-Vol.3	94:197	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012533	MF-902
9594-Vol.4	94:198	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010848	MF-902
9594-Vol.5	94:199	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012534	MF-902
9594-Vol.7	94:200	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012536	MF-902
9594-Vol.8	94:201	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012537	MF-902
9671	94:202	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91018787	MF-902
9672	94:203	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003263	MF-902
9684	94:840	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003307	MF-904
9723	94:841	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003303	MF-906
9735	94:2182	OSTI; NTIS; GPO Dep.	E 1.99:	DE91018829	MF-602
9736	94:2183	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91018830	MF-602
9749	94:2184	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91018785	MF-902
9752	94:204	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012224	MF-902
9765	94:2082	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91018786	MF-902; MF-906
9776	94:205	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91018715	MF-940
9776-Rev.1	94:206	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003336	MF-902
9780	94:207	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91018833	MF-906
9799	94:208	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003269	MF-902
9807	94:209	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003384	MF-902
9845	94:2185	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012215	MF-906
9868	94:210	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012310	MF-902
9870-Rev.1	94:211	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012223	MF-902
9872	94:212	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012526	MF-902
9876	94:213	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92017864	MF-902
9901	94:214	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012371	MF-902
9911	94:2586	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012365	MF-940
9916	94:215	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003255	MF-940; MF-906
9923	94:2083	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012523	MF-902
9925	94:216	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012372	MF-940
9928	94:2587	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92018001	MF-902
9935	94:842	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003302	MF-940
9980	94:2186	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012216	MF-902
9985-Vol.1	94:217	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012513	MF-902
9985-Vol.2	94:218	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012514	MF-902
9985-Vol.3	94:219	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92018039	MF-940
9989	94:2588	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92018000	MF-902
9993	94:220	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012359	MF-902
ES/ER-					
10/V2-D2	94:560	See Y/ER-20/V2			
16-D1	94:564	See Y/ER/Sub-90/VK1684-D1			
17-D1	94:850	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92008499	MF-940
17-D1/R1	94:742	See DOE/OR-01-1135-D2			
22/V1/D1	94:336	See ORNL/ER/Sub-87/99053/5/V1			
22/V2/D1	94:337	See ORNL/ER/Sub-87/99053/5/V2			
22/V3/D1	94:338	See ORNL/ER/Sub-87/99053/5/V3			
22/V5/D1	94:340	See ORNL/ER/Sub-87/99053/5/V5			
22/V6/D1	94:341	See ORNL/ER/Sub-87/99053/5/V6			
23D1	94:2535	See Y/ER/Sub-90/97777/2			
36-D2	94:561	See Y/ER-21			
43-D1	94:1868	See DOE/OR-1060-D1			
ES/ER/TM-					
2	94:257	OSTI; NTIS; GPO Dep.	E 1.99:	DE91015059	MF-902
7	94:1753	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003714	MF-902
1/R2	94:256	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017754	MF-902
101	94:854	OSTI; NTIS; GPO Dep.	E 1.99:	DE94007919	MF-902

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
102	94:269	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94006323	MF-902
18	94:259	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92001785	MF-902
20	94:1954	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92007776	MF-902
25	94:1955	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005308	MF-900
26/R1	94:2193	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000788	MF-902
33	94:2194	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92019010	MF-902
38	94:260	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001933	MF-902; MF-907
4/R2	94:258	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040849	MF-902
41	94:851	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000554	MF-902
43	94:129	See DOE/OR-01-1136			
48/Pt.1	94:1956	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93007801	MF-902
48/Pt.2	94:1957	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93007802	MF-902
52	94:261	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93005173	MF-902
54	94:852	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93012076	MF-902
55	94:853	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93011693	MF-902
59	94:262	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010884	MF-902
60	94:263	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010559	MF-902
61	94:264	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010833	MF-902
62	94:2195	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93011828	MF-902
75	94:265	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94006375	MF-902
78	94:2196	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94009495	MF-902
84/V1	94:1861	See DOE/OR-01-1175/V1			
84/V2	94:1862	See DOE/OR-01-1175/V2			
84/V3	94:1863	See DOE/OR-01-1175-V3			
85	94:2197	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94009875	MF-902
87/Pt.1	94:1958	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94006305	MF-940
87/Pt.2	94:1959	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94006306	MF-940
89	94:266	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001033	MF-902
90	94:267	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001032	MF-902
91	94:2198	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001034	MF-902
92	94:268	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001035	MF-902
95	94:2199	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94006324	MF-902
96	94:2200	OSTI; NTIS; GPO Dep.	E 1.99:	DE94006320	MF-902
97	94:2201	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94006503	MF-902
ES/ESH-					
36	94:2202	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001937	MF-902
37	94:2203	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001936	MF-902
ESD-					
4006	94:319	See ORNL/ER-125			
4039	94:324	See ORNL/ER-150			
4138	94:2331	See ORNL/TM-12401			
ESTSC-					
000597IBMPC00	94:2204	ESTSC			
000597IBMPC01	94:2205	ESTSC			
000597IBMPC02	94:2206	ESTSC			
FEMP-					
2248	94:270	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92014913	MF-902
2266	94:271	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92014256	MF-940
2267	94:2085	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016470	MF-940; MF-906
2288	94:855	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002547	MF-940
2301	94:2207	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94003189	MF-902
2305	94:272	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002548	MF-902
2310	94:1960	OSTI; NTIS; GPO Dep.	E 1.99:	DE94003187	MF-900
2312	94:273	OSTI; NTIS; GPO Dep.	E 1.99:	DE94002552	MF-903
2316	94:2086	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94006523	MF-940
2334	94:2208	OSTI; NTIS; GPO Dep.	E 1.99:	DE94009569	MF-903
93010810	94:274	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010810	MF-902; MF-903
FEMP/SUB-					
064	94:275	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002557	MF-902
068	94:276	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94005364	MF-903
074	94:2087	OSTI; NTIS; GPO Dep.	E 1.99:	DE94007082	MF-906
GJPO-					
105	94:675	See DOE/ID/12584-97			
GJPO-GP-					
7	94:676	See DOE/ID/12584-148			
GRI-					
91/0046	94:2209	OSTI; NTIS; GPO Dep.	E 1.99:	DE92006556	MF-902

HWVP-

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
HWVP-					
89-001-Rev.1	94:1332	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018729	MF-940
89-007-Rev.3	94:1333	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018409	MF-940
ITRL-C-					
06787	94:132	See DOE/OR/22160-T2			
INEL/MISC-					
91107	94:856	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012222	MF-902
92065	94:857	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001935	MF-902
92068	94:699	See DOE/LLW-151			
92070	94:1706	See DOE/LLW-152			
92084	94:700	See DOE/LLW-156			
92154	94:703	See DOE/LLW-162			
92174	94:701	See DOE/LLW-159			
93014	94:674	See DOE/ID-10415			
93065	94:108	See DOE/ID-10432			
93066	94:109	See DOE/ID-10433			
93087	94:712	See DOE/LLW-184			
IS-					
5082	94:2210	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040933	PC-902
5085	94:2211	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94005568	MF-940
5093	94:2212	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94005569	MF-902
5096	94:2213	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93011563	MF-902
5099	94:2589	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94005571	MF-900
5104	94:2590	OSTI; NTIS; GPO Dep.	E 1.99:	DE94007459	MF-900
IS-M-					
705	94:858	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013562	MF-904
708	94:2088	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92014390	MF-902
709	94:277	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92014113	MF-902
730	94:278	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93002545	MF-910
774	94:279	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001805	MF-902
K-					
2073-Vol.1	94:280	OSTI; NTIS; GPO Dep.	E 1.99:	DE93009485	MF-900
2073-Vol.2	94:281	OSTI; NTIS; GPO Dep.	E 1.99:	DE93009486	MF-900
2073-Vol.3A	94:282	OSTI; NTIS; GPO Dep.	E 1.99:	DE93009487	MF-900
2073-Vol.3B	94:283	OSTI; NTIS; GPO Dep.	E 1.99:	DE93009488	MF-900
K/EM-					
24/R1	94:2273	See ORNL/M-2563			
K/ER-					
40	94:284	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92006589	MF-900
47	94:285	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003315	MF-902
56	94:2214	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93008690	MF-903
K/HWP-					
1	94:859	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91011429	MF-902
K/QT-					
407	94:286	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92008519	MF-901
K/TCD-					
1054	94:287	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010258	MF-901
1076	94:1961	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004841	MF-906
1080	94:860	OSTI; NTIS; GPO Dep.	E 1.99:	DE94011050	MF-901
1089	94:1962	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004931	MF-902
1090	94:1963	OSTI; NTIS; GPO Dep.	E 1.99:	DE94005426	MF-901
KY/ER-					
8	94:1964	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92018415	MF-902
11	94:1965	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94000599	MF-902
15	94:288	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93012077	MF-902
LA-					
11941-MS	94:2215	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000018	MF-902
12195-MS	94:2216	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001895	PC-903
12216-MS	94:861	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004341	PC-940
12221-MS	94:862	OSTI; NTIS; GPO Dep.	E 1.99:	DE92015975	PC-940
12332-MS	94:2217	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92014273	MF-906
12356	94:1966	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93002708	MF-940
12464	94:1967	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93012258	MF-940
12528	94:1334	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93013595	PC-721
12572-ENV	94:2218	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019549	MF-902
12650-MS	94:2219	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002499	MF-940
12654	94:1335	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001570	PC-940
12667-MS	94:863	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001837	MF-940
12676-MS	94:1336	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94003872	MF-940
12701-MS	94:1337	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94005243	MF-940

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12742-MS	94:2220	OSTI; NTIS; GPO Dep.	E 1.99:	DE94007727	MF-940; MF-906
LA-SUB-					
92-9-Pt.11	94:864	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001287	MF-902; MF-940
93-118	94:2223	OSTI; NTIS; GPO Dep.	E 1.99:	DE93012082	MF-903
93-138	94:2224	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010814	MF-902
93-200	94:2225	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040586	MF-906
93-264	94:289	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040571	MF-902
93-29	94:2089	OSTI; NTIS; GPO Dep.	E 1.99:	DE93008008	MF-905
93-48	94:2221	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93008674	MF-902
93-83	94:2222	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93008910	MF-903; MF-940
93-92	94:865	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93008679	MF-902; MF-940
LA-UR-					
91-1295	94:290	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91011440	MF-907
91-1303	94:291	OSTI; NTIS; GPO Dep.	E 1.99:	DE91011439	MF-902
91-1552	94:866	OSTI; NTIS; GPO Dep.	E 1.99:	DE91013656	MF-940
91-2077	94:1338	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91014597	MF-940
91-2408	94:867	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE91016009	MF-940
91-2409	94:868	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE91016008	MF-940
91-2874	94:1968	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92000311	MF-940
91-2875	94:292	OSTI; NTIS; GPO Dep.	E 1.99:	DE92000309	MF-902
91-2976	94:869	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92000213	MF-902
91-4069	94:2226	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005054	MF-902; MF-907
92-1312	94:871	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013534	MF-940
92-1383	94:872	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013944	MF-902
92-1948	94:2228	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92017512	MF-902
92-2071	94:293	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92018983	MF-940
92-2425	94:294	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92018602	MF-902
92-2508	94:1340	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92018995	MF-940
92-283	94:2227	OSTI; NTIS; GPO Dep.	E 1.99:	DE92007582	MF-402
92-3977	94:1341	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93005456	MF-902; MF-940
92-4053	94:295	OSTI; NTIS; GPO Dep.	E 1.99:	DE93005446	MF-902
92-644	94:870	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92008481	MF-902
92-654	94:1339	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92008491	MF-940
92-662	94:2591	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92008479	MF-902
93-1204	94:874	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93012661	MF-940
93-1205	94:875	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93012660	MF-940
93-1206	94:876	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93012659	MF-902
93-1598	94:297	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93012725	MF-940
93-2171	94:877	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016606	MF-940
93-2377	94:878	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016485	MF-940
93-2516	94:298	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018372	MF-902; MF-906
93-2584	94:1343	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018548	MF-940
93-2673	94:2229	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018462	MF-902; MF-940
93-2934	94:2230	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040098	MF-902
93-2935	94:2231	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040097	MF-902
93-3089	94:879	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040140	MF-902; MF-940
93-3489	94:1344	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94000676	MF-940
93-3717	94:880	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002694	MF-940
93-3750	94:881	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002687	MF-940
93-3800	94:1345	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002724	MF-940
93-456	94:1342	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93008714	MF-940
93-656	94:296	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93008728	MF-940
93-998	94:873	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010726	MF-940
94-0130	94:2232	OSTI; NTIS; GPO Dep.	E 1.99:	DE94006246	MF-902
94-0337	94:2234	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94006147	MF-906
94-1056	94:886	OSTI; NTIS; GPO Dep.	E 1.99:	DE94009334	MF-902
94-1361	94:300	OSTI; NTIS; GPO Dep.	E 1.99:	DE94012885	MF-902
94-186	94:2233	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94006263	MF-902
94-361	94:882	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94006152	MF-940
94-363	94:883	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94006154	MF-902; MF-940

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Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
94-400	94:299	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94007526	MF-940
94-493	94:884	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94007541	MF-940
94-52	94:1346	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94006226	MF-940
94-557	94:2235	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94007578	MF-940
94-570	94:1754	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94007577	MF-902
94-572	94:2236	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94007576	MF-902
94-593	94:1755	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94007570	MF-902
94-607	94:885	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94007563	MF-940
94-739	94:2237	OSTI; NTIS; GPO Dep.	E 1.99:	DE94009295	MF-920
94-928	94:735	See DOE/MWIP-25			
LBL-					
27170(1993)	94:301	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016704	MF-402; MF-407
32418	94:2238	OSTI; NTIS; GPO Dep.	E 1.99:	DE93015266	MF-902
32529	94:2239	OSTI; NTIS; GPO Dep.	E 1.99:	DE93010408	MF-903
33252	94:302	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93007698	MF-402; MF-408
33957	94:2240	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93015270	MF-902
MISC-					
91090-Draft	94:684	See DOE/LLW-111-Draft			
91117	94:686	See DOE/LLW-116			
NDPP-OSP-					
0052	94:303	OSTI; NTIS; GPO Dep.	E 1.99:	DE91017857	MF-902
NVO-					
325-Rev.1	94:887	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93008616	MF-940; MF-902
OPTR-					
93-01	94:116	See DOE/ID/13042-23			
ORISE-					
92/E-41	94:2241	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92016386	MF-902
ORNL-					
6485	94:888	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92000389	PC-721
6638	94:2242	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000503	MF-902
6762	94:304	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001998	MF-902
ORNL/ER-					
7	94:2243	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92018071	MF-902
8	94:2244	OSTI; NTIS; GPO Dep.	E 1.99:	DE91014948	MF-902
9	94:2245	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010371	MF-902
116	94:317	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013478	MF-902; MF-906
117	94:318	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000823	MF-902
118	94:894	OSTI; NTIS; GPO Dep.	E 1.99:	DE92014958	MF-902
119	94:1975	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92019216	MF-902
12	94:889	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93014339	MF-902
121	94:1348	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93002706	MF-902
122	94:895	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92040848	MF-902
123	94:2253	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92018073	MF-902
124	94:2254	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000588	MF-902
125	94:319	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93005176	MF-902; MF-903
126	94:320	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92019509	MF-902
130	94:1976	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92019495	MF-902; MF-940
134	94:321	OSTI; NTIS; GPO Dep.	E 1.99:	DE93006723	MF-902
135	94:2255	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001787	MF-902
136	94:322	OSTI; NTIS; GPO Dep.	E 1.99:	DE92041014	MF-902
137	94:2256	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000547	MF-902
138	94:2257	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010256	MF-902
139	94:2258	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000719	MF-902
141	94:1977	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001423	MF-902
142	94:896	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93006363	MF-902
143	94:323	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002751	MF-902
146	94:2259	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93003366	MF-902
148	94:897	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019602	MF-902; MF-940
150	94:324	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93006841	MF-902
154	94:325	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000548	MF-902
155	94:326	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93006272	MF-902
156-D1	94:1856	See DOE/OR-01-1111-D1			
157-D3	94:1857	See DOE/OR-01-1122-D3			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
158-D1	94:1864	See DOE/OR-01-1192-D1			
165	94:327	OSTI; NTIS; GPO Dep.	E 1.99:	DE93015478	MF-902
166	94:328	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016912	MF-902
169	94:329	OSTI; NTIS; GPO Dep.	E 1.99:	DE94003175	MF-902
169/S1	94:330	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94005996	MF-902
17	94:1969	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92000418	MF-902
171-D1	94:745	See DOE/OR-01-1167-D1			
172	94:2260	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008061	MF-902
173	94:331	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94009445	MF-902
180	94:2261	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001153	MF-902
186	94:332	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94009443	MF-902
19	94:890	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92010937	MF-940
192	94:2262	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94010028	MF-902
193-D1	94:751	See DOE/OR-03-1195-D1			
199	94:333	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94010812	MF-902
200	94:334	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94009504	MF-902
203	94:2263	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94010029	MF-902
204	94:2264	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008062	MF-902
208	94:1978	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004745	MF-902
209	94:335	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004790	MF-902
219	94:1979	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94009501	MF-902
220	94:2265	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94009491	MF-902
223	94:2266	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94009494	MF-902
23	94:305	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012589	MF-902
232-D1	94:1867	See DOE/OR-01-1254-D1			
24	94:306	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012588	MF-902
25	94:1970	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012591	MF-902
30	94:307	OSTI; NTIS; GPO Dep.	E 1.99:	DE92008025	MF-902
35	94:2246	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92008580	MF-902
36	94:1756	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003728	MF-902
37	94:2247	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92000108	MF-902
39	94:1971	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93004613	MF-902
45	94:2248	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003734	MF-902
46	94:308	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92002379	MF-903
51	94:1972	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92007197	MF-907
52	94:891	OSTI; NTIS; GPO Dep.	E 1.99:	DE91018993	MF-940
53	94:2249	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92010266	MF-902
55	94:892	OSTI; NTIS; GPO Dep.	E 1.99:	DE92002436	MF-902
58-D2	94:1870	See DOE/OR-1070-D2			
59	94:309	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005316	MF-902
60	94:1973	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003745	MF-902
61	94:1974	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003746	MF-902
62	94:310	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92018401	MF-902
62/R1	94:311	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000549	MF-902
63	94:312	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92008762	MF-902
65	94:313	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004585	MF-902
80	94:744	See DOE/OR-01-1159-D1			
80	94:893	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92018074	MF-902
81	94:2250	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93006364	MF-902
82	94:314	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92018076	MF-902
84	94:1347	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000553	MF-902
85	94:315	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000977	MF-902
87	94:1757	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92018070	MF-902
90	94:316	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001297	MF-902
91	94:2251	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010873	MF-906
93	94:2252	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92018072	MF-902
ORNL/ER/Sub-					
87-99053/49	94:1980	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92016615	MF-902
87-99053/50	94:2267	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92019492	MF-902; MF-940
87-99053/55	94:898	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94003516	MF-902
87-99053/56	94:342	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94005480	MF-902
87-99053/62	94:2268	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94003517	MF-905
87-99053/64	94:343	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93009335	MF-902
87-99053/69	94:2269	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002537	MF-902
87-99053/70	94:2270	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94009179	MF-902
87/99053/5/V1	94:336	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92007763	MF-902
87/99053/5/V2	94:337	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92007764	MF-902
87/99053/5/V3	94:338	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92007771	MF-902
87/99053/5/V4	94:339	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92007772	MF-902

ORNL/ER/Sub-

<i>Report Number</i>	<i>Abstract Number</i>	<i>Source of Availability</i>	<i>GPO Dep.</i>	<i>Order Number</i>	<i>Distribution Category</i>
87/99053/5/V5	94:340	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92007773	MF-902
87/99053/5/V6	94:341	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92007774	MF-902
90-KA931/2	94:344	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003674	MF-902
90-LJ068/1	94:2271	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041218	MF-902
90-LJ068/1-D1	94:746	See DOE/OR-01-1168-D1			
90-LJ068/1-D2	94:747	See DOE/OR-01-1168-D2			
90-LJ068/2	94:743	See DOE/OR-01-1138-D1			
91-KA931/4	94:345	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001420	MF-902
92-SK263/2-D1	94:741	See DOE/OR-01-1129-D1			
ORNL/FTR-					
4194	94:2592	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93011104	MF-901; MF-903
4208	94:2593	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93011105	MF-902
4358	94:2594	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93013008	MF-940
4562	94:2595	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93011817	MF-902
4601	94:2596	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014637	MF-902
4611	94:2597	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014660	MF-902
4655	94:2598	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93017236	MF-940
4832	94:2599	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE94003557	MF-940
4833	94:2600	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE94003541	MF-940; MF-610
4921	94:2601	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE94008749	MF-940
ORNL/GWPO-					
006	94:346	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94005444	MF-902
ORNL/M-					
1528	94:899	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91018524	MF-902
1814	94:1981	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004675	MF-902
1851	94:1982	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005309	MF-902
1871	94:2272	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010726	MF-902
2131	94:1964	See KY/ER-8			
2265	94:754	See DOE/OR-1047-D1			
2323	94:125	See DOE/MWIP-1			
2524	94:2179	See DOE/RW-0006-Rev.8			
2527	94:1871	See DOE/OR-1077			
2542	94:288	See KY/ER-15			
2563	94:2273	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93008487	MF-902
2580	94:1855	See DOE/OR-01-1110-D2			
2728	94:723	See DOE/MWIP-2			
2751/ES	94:900	OSTI; NTIS; GPO Dep.	E 1.99:	DE93016143	MF-902
2751/I	94:1983	OSTI; NTIS; GPO Dep.	E 1.99:	DE94009871	MF-902
2751/V1/Pt.A	94:1984	OSTI; NTIS; GPO Dep.	E 1.99:	DE93016144	MF-902
2751/V1/Pt.C	94:901	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016146	MF-902
2751/V2/Pt.A	94:1985	OSTI; NTIS; GPO Dep.	E 1.99:	DE93016147	MF-902
2751/V2/Pt.C	94:902	OSTI; NTIS; GPO Dep.	E 1.99:	DE93016149	MF-902
2810	94:750	See DOE/OR-03-1150-D1			
2965	94:728	See DOE/MWIP-9			
2966	94:729	See DOE/MWIP-10			
2984	94:726	See DOE/MWIP-4			
2990/Vol.1	94:724	See DOE/MWIP-3-Vol.1			
2990/Vol.2	94:725	See DOE/MWIP-3-Vol.2			
3002/V1	94:727	See DOE/MWIP-8-Vol.1			
3070	94:2537	See Y/TS-1016			
3181	94:732	See DOE/MWIP-14			
3183	94:347	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94010119	MF-902
3221	94:346	See ORNL/GWPO-006			
3225	94:731	See DOE/MWIP-13			
3258	94:730	See DOE/MWIP-11			
ORNL/RASA-					
89/18	94:2274	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004589	MF-902
90/7	94:2275	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91017778	MF-902
91/10	94:2279	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92018955	MF-902
91/11	94:2280	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92019484	MF-902
91/12	94:2281	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041349	MF-902
91/13	94:2282	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92017804	MF-902
91/14	94:2283	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041366	MF-907
91/15	94:2284	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041351	MF-902
91/16	94:2285	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92018517	MF-902
91/17	94:2286	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041348	MF-902
91/18	94:2287	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041369	MF-907
91/19	94:2288	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041368	MF-902

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
91/20	94:2289	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92019071	MF-902
91/21	94:2290	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92019072	MF-902
91/22	94:2291	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000556	MF-902
91/23	94:2292	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000559	MF-902
91/24	94:2293	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000557	MF-902
91/25	94:2294	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000550	MF-902
91/26	94:2295	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000555	MF-902
91/27	94:2296	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000552	MF-902
91/28	94:2297	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000558	MF-902
91/29	94:2298	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000420	MF-902
91/30	94:2299	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041370	MF-907
91/7	94:2276	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92006590	MF-902
91/8	94:2277	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92008212	MF-907
91/9	94:2278	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041365	MF-907
92/1	94:2300	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92019302	MF-902
92/12	94:2309	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93003672	MF-902
92/14	94:2310	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010257	MF-902
92/2	94:2301	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92040695	MF-902
92/3	94:2302	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000551	MF-902
92/4	94:2303	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93004612	MF-902
92/5	94:2304	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93003758	MF-902
92/6	94:2305	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93003759	MF-902
92/7	94:2306	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93003760	MF-902
92/8	94:2307	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93003761	MF-902
92/9	94:2308	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93003762	MF-902
93/1	94:2311	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93012241	MF-940
93/3	94:2312	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017380	MF-902
93/4	94:2313	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008867	MF-902; MF-940
93/5	94:2314	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94006186	MF-902
93/7	94:2315	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94006421	MF-902
94/1	94:2316	OSTI; NTIS; GPO Dep.	E 1.99:	DE94009135	MF-902
ORNL/TM-					
10352	94:903	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91010444	MF-902
11358	94:2317	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94011606	MF-902
11360	94:2318	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91010445	MF-902
11536	94:904	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92006764	MF-902
11605	94:2319	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91005647	MF-902
11654	94:905	OSTI; NTIS; GPO Dep.	E 1.99:	DE91012999	MF-900
11785	94:906	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93041041	MF-902
11793	94:348	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91013001	MF-900
11795	94:907	OSTI; NTIS; GPO Dep.	E 1.99:	DE91015271	MF-902
11799	94:908	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92002393	MF-902
11817	94:2320	OSTI; NTIS; GPO Dep.	E 1.99:	DE92007783	MF-902
11824	94:909	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94000730	MF-902
11838	94:349	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93012513	MF-902
11853/R1	94:910	OSTI; NTIS; GPO Dep.	E 1.99:	DE92007402	MF-902
11864	94:911	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91018509	MF-900
11867	94:912	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94000561	MF-902
11877	94:2321	OSTI; NTIS; GPO Dep.	E 1.99:	DE91016820	MF-902
11927	94:913	OSTI; NTIS; GPO Dep.	E 1.99:	DE92014926	MF-902
11979	94:350	OSTI; NTIS; GPO Dep.	E 1.99:	DE92007787	MF-902
11980	94:351	OSTI; NTIS; GPO Dep.	E 1.99:	DE92007403	MF-902
11999	94:914	OSTI; NTIS; GPO Dep.	E 1.99:	DE92014936	MF-902
12017	94:352	OSTI; NTIS; GPO Dep.	E 1.99:	DE92007780	MF-902
12031	94:915	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92018097	MF-902
12036	94:916	OSTI; NTIS; GPO Dep.	E 1.99:	DE93002410	MF-902
12063	94:917	OSTI; NTIS; GPO Dep.	E 1.99:	DE94001117	MF-902
12074	94:2322	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93007798	MF-903
12101	94:353	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016654	MF-940
12139	94:2323	OSTI; NTIS; GPO Dep.	E 1.99:	DE93012033	MF-902
12142	94:2324	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93012428	MF-903
12152	94:918	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93004309	MF-902
12169	94:354	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93007796	MF-902
12177	94:355	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010428	MF-902
12185	94:2090	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93002874	MF-940
12191	94:2325	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93003667	MF-902
12198	94:2091	OSTI; NTIS; GPO Dep.	E 1.99:	DE93003756	MF-906
12201	94:356	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93007790	MF-902
12217	94:357	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019361	MF-902

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
12225	94:2326	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017987	MF-902
12235	94:358	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017955	MF-903
12243	94:919	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93011692	MF-902
12251	94:2092	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94003615	MF-940
12258	94:2327	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94006112	MF-902
12260	94:359	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019397	MF-902
12265	94:2328	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93013457	MF-902
12272	94:920	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017560	MF-902
12283	94:921	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017241	MF-940
12297	94:922	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93013459	MF-902
12315	94:923	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93013460	MF-902
12317	94:924	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017850	MF-903
12329	94:925	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93012726	MF-902
12337	94:2093	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93012093	MF-906
12362	94:2329	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016874	MF-902
12368	94:2330	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94000731	MF-902
12401	94:2331	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94005329	MF-902
12403	94:926	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001780	MF-901
12417	94:1349	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040592	MF-906
12437/V1	94:927	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001089	MF-902
12437/V2	94:928	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001090	MF-902
12449	94:929	OSTI; NTIS; GPO Dep.	E 1.99:	DE94002979	MF-902
12638	94:930	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94010118	MF-902
12642	94:931	OSTI; NTIS; GPO Dep.	E 1.99:	DE94007918	MF-902
12656	94:932	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94009523	MF-902
12657	94:933	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008748	MF-940
12679	94:934	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94007408	MF-902
12687	94:935	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008561	MF-902; MF-940
12715	94:2332	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94010930	MF-902
12722	94:2333	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94009862	MF-902
PATENTS-US-					
A7841108	94:360	OSTI; NTIS; GPO Dep.	E 1.99:	DE94007344	MF-902
PNL-					
3777-Rev.2	94:2334	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93012832	MF-907
6241-Rev.2	94:936	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91017242	MF-810
7008-Vol.1	94:1986	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92001760	MF-902
7008-Vol.2	94:1987	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92001759	MF-902
7008-Vol.3	94:1988	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92001761	MF-902
7692	94:2335	OSTI; NTIS; GPO Dep.	E 1.99:	DE91012371	MF-902
7810	94:1350	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92019232	MF-902
7836	94:2336	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004452	MF-902
7840-Rev.1	94:2337	OSTI (requests by U.S. Government Agencies and Their Contractors). Other requestors should be directed to Battelle Memorial Institute	E 1.99:	T193040698	ND-902
7866	94:361	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003882	MF-902
7872	94:362	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92007842	MF-903
7999	94:2338	OSTI; NTIS; GPO Dep.	E 1.99:	DE92017553	MF-402
8008	94:1989	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001554	MF-940
8011	94:1351	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92009625	MF-902
8014	94:1352	OSTI; NTIS; GPO Dep.	E 1.99:	DE92014599	MF-902
8122	94:2339	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92019704	MF-903
8144	94:2340	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93008948	MF-902
8152	94:2341	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92017951	MF-902
8167	94:937	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93006605	MF-903
8170	94:1353	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92018664	MF-902
8173	94:2342	OSTI; NTIS; GPO Dep.	E 1.99:	DE93002043	MF-903
8219	94:363	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000481	MF-902
8221-Rev.1	94:2343	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004223	MF-903
8231	94:2344	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92019799	MF-902
8281	94:2345	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000965	MF-902
8286	94:2346	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93005040	MF-902
8294	94:364	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000479	MF-902
8295	94:1354	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93012344	MF-902
8332	94:365	OSTI; NTIS; GPO Dep.	E 1.99:	DE93004483	MF-902
8333	94:366	OSTI; NTIS; GPO Dep.	E 1.99:	DE93002182	MF-902
8334	94:367	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93013934	MF-903
8358	94:368	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93004277	MF-902
8359	94:2479	See WHC-EP-0569-Rev.1			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
8391	94:1758	OSTI; NTIS; GPO Dep.	E 1.99:	DE93016710	MF-902
8403	94:938	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93007177	MF-940
8478	94:369	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93009154	MF-902
8492	94:939	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93012861	MF-940
8498	94:1759	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010604	MF-902
8528	94:1355	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93008950	MF-940
8534-Vol.1	94:940	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001868	MF-901; MF-902
8534-Vol.2	94:941	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001869	MF-901; MF-902
8534-Vol.3	94:942	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001870	MF-901; MF-902
8534-Vol.4	94:943	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001871	MF-901; MF-902
8534-Vol.5	94:944	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001872	MF-901; MF-902
8534-Vol.6	94:945	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001873	MF-901; MF-902
8537	94:1356	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016830	MF-940
8539	94:2347	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93012240	MF-903
8548	94:946	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93011691	MF-903
8557	94:1357	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93011235	MF-940
8559	94:1358	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93012400	MF-902
8589	94:1359	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010607	MF-940
8596	94:947	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93013933	MF-902
8597	94:2348	OSTI; NTIS; GPO Dep.	E 1.99:	DE93012769	MF-902
8617	94:2349	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93012771	MF-902
8618	94:948	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93013110	MF-902
8620	94:949	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001999	MF-940
8626	94:950	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016709	MF-940
8632	94:951	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93013501	MF-510
8653	94:2350	OSTI; NTIS; GPO Dep.	E 1.99:	DE93014372	MF-902
8655	94:952	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016776	MF-940
8662	94:2351	OSTI; NTIS; GPO Dep.	E 1.99:	DE93016708	MF-903
8675	94:2352	OSTI; NTIS; GPO Dep.	E 1.99:	DE93016575	MF-902
8714	94:953	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001551	MF-901; MF-906
8741	94:1760	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001086	MF-902
8745	94:954	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019981	MF-902
8789	94:2353	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94000547	MF-902
8797	94:2354	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94000349	MF-902
8800	94:2355	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94003538	MF-903
8808	94:955	OSTI; NTIS; GPO Dep.	E 1.99:	DE94000633	MF-940
8812	94:2356	OSTI; NTIS; GPO Dep.	E 1.99:	DE94000903	MF-907
8813	94:1360	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001549	MF-902
8817	94:2357	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040838	MF-902
8818	94:956	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001080	MF-940
8830	94:957	OSTI; NTIS; GPO Dep.	E 1.99:	DE94002708	MF-902
8841	94:1761	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001085	MF-902
8847	94:958	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002382	MF-940
8863	94:959	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94000904	MF-940
8868	94:2358	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94005380	MF-903
8869	94:2359	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001678	MF-903
8871	94:1361	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001555	MF-940
8873	94:2360	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94003874	MF-907
8875	94:960	OSTI; NTIS; GPO Dep.	E 1.99:	DE94002381	MF-902
8876	94:1362	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001552	MF-902
8884	94:2361	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004300	MF-902
8887	94:1363	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94009007	MF-940
8888	94:1364	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002605	MF-940
8918	94:1990	OSTI; NTIS; GPO Dep.	E 1.99:	DE94002831	MF-902
8920	94:1991	OSTI; NTIS; GPO Dep.	E 1.99:	DE94002832	MF-900
8927	94:961	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94003875	MF-901; MF-902
8935	94:1762	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94003677	MF-902
8949	94:1763	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004375	MF-903
8951	94:1920	See DOE/RL-93-38			
8960	94:1921	See DOE/RL-93-38-Exec.Summ.			
8971	94:2362	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94005497	MF-903
8991	94:2363	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94005295	MF-903

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Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
8992	94:962	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94005296	MF-940
8998	94:1365	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94006110	MF-940
9368	94:1366	OSTI; NTIS; GPO Dep.	E 1.99:	DE94009461	MF-902
9408	94:1367	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94009878	MF-902
9423	94:1368	OSTI; NTIS; GPO Dep.	E 1.99:	DE94009843	MF-902
9426	94:1369	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94011404	MF-902
9428	94:1370	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94012136	MF-940
9434	94:1371	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94012120	MF-940
9439	94:1372	OSTI; NTIS; GPO Dep.	E 1.99:	DE94010670	MF-906
9459	94:1373	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94011405	MF-940
9747	94:1374	OSTI; NTIS; GPO Dep.	E 1.99:	DE94012775	MF-902
PNL-MA-					
588-Vol.1	94:1986	See PNL-7008-Vol.1			
588-Vol.2	94:1987	See PNL-7008-Vol.2			
588-Vol.3	94:1988	See PNL-7008-Vol.3			
PNL-SA-					
17567	94:2364	OSTI; NTIS; GPO Dep.	E 1.99:	DE91014982	MF-903
18817	94:1992	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91015528	MF-902
19337-Vol.1	94:2602	OSTI; NTIS; GPO Dep.	E 1.99:	DE91010717	MF-900
19337-Vol.2	94:2603	OSTI; NTIS; GPO Dep.	E 1.99:	DE91010718	MF-900
19511	94:370	OSTI; NTIS; GPO Dep.	E 1.99:	DE92006507	MF-902
19646	94:371	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92000799	MF-902
19718	94:2604	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010865	MF-901
19796	94:963	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005452	MF-902
19899	94:2365	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92002742	MF-902
19908	94:372	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92000057	MF-940
19974	94:373	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92010489	MF-902
20018	94:2094	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92002136	MF-906
20036	94:2366	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92002739	MF-902
20048	94:1375	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92002740	MF-810
20057	94:964	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011282	MF-902
20059	94:2605	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92010493	MF-902
20212	94:965	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012342	MF-902
20486	94:374	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92015094	MF-902
20489	94:1376	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92010491	MF-902
20508	94:375	OSTI; NTIS; GPO Dep.	E 1.99:	DE92010866	MF-902
20510	94:376	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92010495	MF-902
20526	94:2606	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92015617	MF-902
20547	94:377	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92010490	MF-902
20608	94:1377	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004591	MF-902
20622	94:378	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92019125	MF-902
20623	94:379	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001380	MF-902
20710	94:1378	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001310	MF-940
20802	94:966	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93008259	MF-902
20825	94:380	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004288	MF-902
20853	94:381	OSTI; NTIS; GPO Dep.	E 1.99:	DE93008915	MF-902
20868	94:382	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001312	MF-902
20888	94:967	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93005036	MF-902
20912	94:1379	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041340	MF-902
20937	94:2367	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93004404	MF-902
20941	94:1380	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041328	MF-940
20978	94:2368	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001308	MF-940
20984	94:383	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93008261	MF-902
20991	94:2369	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92017136	MF-902
21009	94:1381	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001516	MF-902
21033	94:2370	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92019087	MF-940
21166	94:968	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93004842	MF-940
21215	94:969	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001307	MF-940
21233	94:1382	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041332	MF-940
21257	94:384	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004316	MF-902
21452	94:1383	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93015672	MF-902; MF-901
21463	94:1384	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93009475	MF-901
21471	94:2371	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93004327	MF-906
21511	94:1385	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93013164	MF-902
21537	94:385	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93009477	MF-902
21559	94:1386	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93013166	MF-940
21560	94:1387	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93013168	MF-940
21683	94:970	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93015697	MF-902
21706	94:386	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93007880	MF-902

<i>Report Number</i>	<i>Abstract Number</i>	<i>Source of Availability</i>	<i>GPO Dep.</i>	<i>Order Number</i>	<i>Distribution Category</i>
21710	94:387	OSTI; NTIS; GPO Dep.	E 1.99:	DE93007993	MF-902
21730	94:388	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93007878	MF-902
21731	94:389	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93007877	MF-902
21763	94:390	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004319	MF-901; MF-903
21775	94:1993	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016925	MF-940
21829	94:1388	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94007487	MF-940
21856	94:1389	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010167	MF-902
21857	94:2607	OSTI; NTIS; GPO Dep.	E 1.99:	DE93009811	MF-900
21891	94:391	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93009814	MF-940
21987	94:392	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010172	MF-902
22008	94:393	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004361	MF-902
22047	94:1994	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93009813	MF-900
22070	94:394	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017124	MF-940
22076	94:1390	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004358	MF-902
22251	94:395	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93013160	MF-903
22303	94:1391	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93013504	MF-940
22322	94:1392	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93013505	MF-901
22386	94:2372	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004592	MF-902
22393	94:2373	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004299	MF-903
22430	94:2374	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94011238	MF-902
22431	94:2375	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004292	MF-902
22530	94:2376	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93015673	MF-903
22574	94:971	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017148	MF-902; MF-940
22596	94:1393	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001670	MF-902
22649	94:2608	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004760	MF-902
22677	94:2377	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004291	MF-902
22721	94:1394	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004286	MF-940
22765	94:2378	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001674	MF-902
22817	94:396	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004784	MF-902
22904	94:2379	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040667	MF-900
23007	94:1395	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004786	MF-906
23035	94:972	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008056	MF-902
23098	94:1396	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004776	MF-940
23141	94:2380	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004294	MF-902
23164	94:397	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94003699	MF-902
23181	94:1397	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008733	MF-902
23271	94:1398	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004771	MF-940
23357	94:1399	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004600	MF-940
23363	94:2381	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004594	MF-906
23686	94:973	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008058	MF-902
23721	94:398	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94009882	MF-902
23793	94:1400	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94012245	MF-940
23921	94:2609	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94011439	MF-902
POEF-					
3030	94:2203	See ES/ESH-37			
POEF/ER-					
4547	94:974	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93002255	MF-902
4548	94:1995	OSTI; NTIS; GPO Dep.	E 1.99:	DE93003320	MF-902
4549	94:1996	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93004428	MF-907
QAP-X-					
92-ES-085	94:321	See ORNL/ER-134			
RAE-					
8915-1	94:865	See LA-SUB-93-92			
8915/6-12	94:864	See LA-SUB-92-9-Pt.11			
SAND-					
88-1587	94:2382	Oxford University Press, Inc., 200 Madison Avenue, New York, NY 10016			ND-940
89-2444	94:2095	NTIS; PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91004658	PC-820
90-3065C	94:1997	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91008573	MF-820; MF-940
91-1738C	94:975	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91019067	MF-940
91-1988C	94:2383	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92006765	MF-902
91-2090C	94:976	OSTI; NTIS; GPO Dep.	E 1.99:	DE91019051	MF-902
91-2742	94:399	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92008974	PC-902
91-2775C	94:2096	OSTI; NTIS; GPO Dep.	E 1.99:	DE92007044	MF-900
91-2794C	94:2097	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004398	MF-902
91-7083	94:2384	OSTI; NTIS; GPO Dep.	E 1.99:	DE93007421	MF-902
92-0052	94:2385	OSTI; NTIS; GPO Dep.	E 1.99:	DE92015392	MF-701

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
92-0247C	94:2610	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011654	MF-940
92-0364	94:2386	OSTI; NTIS; GPO Dep.	E 1.99:	DE92017348	MF-721
92-0374C	94:2098	OSTI; NTIS; GPO Dep.	E 1.99:	DE92013661	MF-906
92-0387C	94:2387	OSTI; NTIS; GPO Dep.	E 1.99:	DE92014619	MF-902
92-0409C	94:977	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013693	MF-902
92-0426C	94:2388	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92010403	MF-902
92-0556	94:1401	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93006986	MF-721
92-0685C	94:978	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92040268	MF-940
92-0817C	94:400	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000741	MF-902
92-0818C	94:401	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93002479	MF-902
92-0959C	94:2611	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013663	MF-902
92-1072C	94:2389	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92013662	MF-906
92-1139C	94:979	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92015005	MF-902
92-1161C	94:402	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92016331	MF-902
92-1256C	94:2099	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92016336	MF-900
92-1303	94:2390	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93005911	MF-721
92-1364C	94:980	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92019422	MF-902
92-1537C	94:2391	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93011595	MF-903
92-1541C	94:403	OSTI; NTIS; GPO Dep.	E 1.99:	DE92018263	MF-906
92-1570C	94:2100	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93003997	MF-906; MF-940
92-1604C	94:2101	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93006773	MF-902; MF-906
92-1690C	94:2612	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92018819	MF-940
92-1777	94:981	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93013897	MF-602
92-1952	94:2613	OSTI; NTIS; GPO Dep.	E 1.99:	DE93003226	MF-902
92-2182C	94:2392	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93009627	MF-903
92-2254C	94:2393	OSTI; NTIS; GPO Dep.	E 1.99:	DE93002292	MF-902
92-2296C	94:2394	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93011684	MF-903
92-2312C	94:404	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93009831	MF-903
92-2630C	94:2395	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93015658	MF-900
92-2727C	94:405	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93005344	MF-901; MF-902
92-2737C	94:982	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93005365	MF-940
92-2773C	94:406	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93005343	MF-902
93-0003C	94:2102	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93009796	MF-906; MF-905
93-0070	94:2396	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040721	MF-906
93-0207C	94:2103	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93008338	MF-906
93-0377C	94:2397	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017637	MF-900
93-0466C	94:983	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93012860	MF-940
93-0469C	94:984	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93011578	MF-902
93-0489C	94:2398	OSTI; NTIS; GPO Dep.	E 1.99:	DE94006580	MF-904
93-0588C	94:2104	OSTI; NTIS; GPO Dep.	E 1.99:	DE93009850	MF-906
93-0589C	94:2105	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93009837	MF-906
93-0678C	94:2106	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93011557	MF-906
93-0715C	94:2399	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016511	MF-900
93-1027C	94:985	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93012862	MF-940
93-1244C	94:407	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001829	MF-902
93-1361C	94:2107	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017497	MF-900
93-1403C	94:1402	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017490	MF-906
93-1468C	94:2108	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040753	MF-906; MF-706
93-1568C	94:2109	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019084	MF-906
93-1577C	94:2400	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002926	MF-902
93-2090C	94:2401	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94006470	MF-940; MF-902
93-2231C	94:2614	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94006196	MF-902
93-2250C	94:2402	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001823	MF-902
93-2330/1	94:986	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94007981	MF-940
93-2330/2	94:987	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008110	MF-940
93-2380C	94:2110	OSTI; NTIS; GPO Dep.	E 1.99:	DE94001419	MF-906
93-2670C	94:2403	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94003098	MF-903
93-2742C	94:2111	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94003803	MF-905
93-2765	94:408	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94011245	MF-902
93-3846C	94:409	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94005097	MF-903
93-3884	94:2404	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94010674	MF-902
93-3966C	94:2615	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94007730	MF-900
93-3987C	94:2616	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94006140	MF-940; MF-902

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
93-4075C	94:2405	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94006587	MF-940
93-7040	94:988	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94011247	MF-903; MF-940
93-7077C	94:410	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002042	MF-902; MF-903
93-7112C	94:411	OSTI; NTIS; GPO Dep.	E 1.99:	DE94005100	MF-901
93-7113C	94:412	OSTI; NTIS; GPO Dep.	E 1.99:	DE94005099	MF-901
93-8010	94:2617	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016331	MF-902
93-8558C	94:413	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93012836	MF-902; MF-906
94-0065	94:1403	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008313	PC-902
94-0214	94:414	OSTI; NTIS; GPO Dep.	E 1.99:	DE94011003	MF-906
94-0276C	94:2406	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94006601	MF-902
94-0488C	94:1764	OSTI; NTIS; GPO Dep.	E 1.99:	DE94007852	MF-902
94-0537C	94:415	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94007062	MF-902
94-0658C	94:2407	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94007741	MF-940
94-0680C	94:1404	OSTI; NTIS; GPO Dep.	E 1.99:	DE94009555	MF-940
94-0797C	94:416	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008618	MF-902; MF-940
94-0857C	94:2408	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008950	MF-940
94-0982C	94:1765	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94010799	MF-902
94-1111C	94:2112	OSTI; NTIS; GPO Dep.	E 1.99:	DE94010803	MF-900
94-1202C	94:1766	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94012919	MF-902
94-8216	94:2409	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94006334	MF-902
TR-					
92-27	94:2222	See LA-SUB-93-83			
TTC-					
1221	94:2100	See SAND-92-1570C			
1253	94:983	See SAND-93-0466C			
UCID-					
21536-Add.2	94:2410	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93008622	MF-902
UCRL-					
21174	94:989	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040493	MF-902
UCRL-CR-					
116222	94:731	See DOE/MWIP-13			
116354	94:990	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008794	MF-904
UCRL-ID-					
110534	94:2411	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93006967	MF-902
111623	94:417	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94009974	MF-902
113852	94:418	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94010000	MF-902
115373	94:2412	OSTI; NTIS; GPO Dep.	E 1.99:	DE94007758	MF-903
115626	94:2413	OSTI; NTIS; GPO Dep.	E 1.99:	DE94009036	MF-902
115789	94:2618	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94012987	MF-903
UCRL-JC-					
109668	94:2414	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010498	MF-902
109768-Rev.1	94:991	OSTI; NTIS; GPO Dep.	E 1.99:	DE93005823	MF-907
109769	94:992	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93008024	MF-907
109902	94:419	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93013133	MF-902
110055	94:420	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93009284	MF-902; MF-903
110327	94:421	OSTI; NTIS; GPO Dep.	E 1.99:	DE94000304	MF-902
110348	94:422	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017180	MF-903
110353	94:423	OSTI; NTIS; GPO Dep.	E 1.99:	DE93012477	MF-902
110356	94:424	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92018003	MF-902
110525	94:2415	OSTI; NTIS; GPO Dep.	E 1.99:	DE93009291	MF-902
110827	94:2416	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93009282	MF-902
111199	94:2113	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92040404	MF-906
111345	94:993	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93012585	MF-721
112037	94:425	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93013843	MF-903
112062	94:994	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93005828	MF-902
112832	94:995	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93011891	MF-902
112934	94:996	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017184	MF-906
112985	94:2114	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93009066	MF-906
113731	94:2417	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017973	MF-902
113790	94:2418	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002006	MF-902
113854	94:426	OSTI; NTIS; GPO Dep.	E 1.99:	DE93016990	MF-906
114126	94:427	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94000394	MF-900
115005	94:428	OSTI; NTIS; GPO Dep.	E 1.99:	DE94001772	MF-902
115362	94:429	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94006722	MF-902
115724	94:2419	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94007070	MF-940

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
116132	94:997	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94011740	MF-904; MF-940
116144	94:2420	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94006720	MF-902
UCRL-LR- 113891	94:430	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016333	PC-902
WHC-EP- 0063-2	94:998	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91009164	MF-900
0063-3	94:999	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92006492	MF-902
0063-4	94:1000	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004869	MF-940
0125-2	94:1001	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017232	MF-900
0125-3	94:1002	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91014691	MF-940
0125-5	94:1003	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016221	MF-940
0141-2	94:1004	NTIS, PC A08/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91002443	MF-902
0142-4	94:431	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001351	MF-903
0145-2	94:2421	NTIS, PC A08/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90012640	MF-902
0145-3	94:2422	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91018137	MF-940
0145-4-Rev.4	94:2423	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92014220	MF-902
0182-23	94:1405	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90013647	MF-900
0182-24	94:1406	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90013863	MF-902
0182-25	94:1407	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015477	MF-900
0182-27	94:1408	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000553	MF-900
0182-28	94:1409	OSTI; NTIS; GPO Dep.	E 1.99:	DE91009161	MF-900
0182-29	94:1410	OSTI; NTIS; GPO Dep.	E 1.99:	DE91009159	MF-900
0182-30	94:1411	OSTI; NTIS; GPO Dep.	E 1.99:	DE91009347	MF-900
0182-31	94:1412	OSTI; NTIS; GPO Dep.	E 1.99:	DE91009348	MF-900
0182-32	94:1413	OSTI; NTIS; GPO Dep.	E 1.99:	DE91009349	MF-900
0182-33	94:1414	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91011065	MF-940
0182-34	94:1415	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91011059	MF-940
0182-35	94:1416	OSTI; NTIS; GPO Dep.	E 1.99:	DE91018148	MF-902
0182-36	94:1417	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91018143	MF-940
0182-37	94:1418	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91018138	MF-940
0182-38	94:1419	OSTI; NTIS; GPO Dep.	E 1.99:	DE91018135	MF-902
0182-39	94:1420	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92002260	MF-940
0182-40	94:1421	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92002234	MF-902
0182-41	94:1422	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92008576	MF-940
0182-42	94:1423	OSTI; NTIS; GPO Dep.	E 1.99:	DE92014041	MF-902
0182-43	94:1424	OSTI; NTIS; GPO Dep.	E 1.99:	DE92014219	MF-902
0182-44	94:1425	OSTI; NTIS; GPO Dep.	E 1.99:	DE92014210	MF-902
0182-45	94:1426	OSTI; NTIS; GPO Dep.	E 1.99:	DE92014218	MF-902
0182-46	94:1427	OSTI; NTIS; GPO Dep.	E 1.99:	DE92015826	MF-902
0182-47	94:1428	OSTI; NTIS; GPO Dep.	E 1.99:	DE92015828	MF-902
0182-48	94:1429	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001754	MF-940
0182-49	94:1430	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040793	MF-940
0182-50	94:1431	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001666	MF-902
0182-51	94:1432	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001755	MF-940
0182-52	94:1433	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93004979	MF-940
0182-53	94:1434	OSTI; NTIS; GPO Dep.	E 1.99:	DE93004982	MF-940
0182-54	94:1435	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93008145	MF-940
0182-55	94:1436	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93014633	MF-902
0182-56	94:1437	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93014504	MF-902
0182-57	94:1438	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93014506	MF-940
0182-58	94:1439	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93014632	MF-902
0182-60	94:1440	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018060	MF-902
0182-61	94:1441	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018064	MF-940
0182-62	94:1442	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002397	MF-940
0182-63	94:1443	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002426	MF-940
0182-64	94:1444	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004254	MF-940
0182-66	94:1445	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94005986	MF-940
0182-68	94:1446	OSTI; NTIS; GPO Dep.	E 1.99:	DE94010345	MF-940
0182-69	94:1447	OSTI; NTIS; GPO Dep.	E 1.99:	DE94011395	MF-940
0210-Rev.3-App.D	94:1448	OSTI; NTIS; GPO Dep.	E 1.99:	DE92008571	MF-902
0210-Rev.3-App.I	94:1449	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92008630	MF-902
0212-1	94:1005	NTIS, PC A99/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015390	MF-902
0231-4	94:1998	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004541	MF-902
0250-Draft-Rev.B-App.	94:1006	NTIS, PC A99/MF A01 - OSTI		DE90014060	MF-940
0250-Draft-Rev.B-Vol.1	94:1007	NTIS, PC A22/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90013935	MF-940
0250-Draft-Rev.B-Vol.2	94:1008	NTIS, PC A20/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90013936	MF-940
0250-Draft-Rev.B-Vol.3	94:1009	NTIS, PC A19/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90013937	MF-940
0250-Draft-Rev.B-Vol.4	94:1010	NTIS, PC A17/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90013938	MF-940
0253	94:2424	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90010367	MF-902

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
0288	94:1450	NTIS, PC A15/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015373	MF-940
0299	94:2425	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001289	MF-902
0300	94:1011	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90008209	MF-902
0324	94:1012	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90008208	MF-902
0332	94:432	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015819	MF-902
0333-Draft	94:1451	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014062	MF-900
0336-Rev.1	94:1013	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91016790	MF-907
0337-Rev.1	94:1014	OSTI; NTIS; GPO Dep.	E 1.99:	DE91016783	MF-900
0337-Rev.2	94:1015	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93004070	MF-902
0338-Draft	94:1452	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014061	MF-900
0339	94:1016	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014764	MF-902
0342	94:2426	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001175	MF-902
0342-Add.10	94:2435	NTIS, PC A05/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001174	MF-902
0342-Add.11	94:2436	NTIS, PC A05/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001181	MF-902
0342-Add.12	94:2437	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001178	MF-902
0342-Add.13	94:2438	NTIS, PC A09/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001185	MF-902
0342-Add.14	94:2439	NTIS, PC A05/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001182	MF-902
0342-Add.15	94:2440	NTIS, PC A07/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001183	MF-902
0342-Add.16	94:2441	NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001184	MF-902
0342-Add.17	94:2442	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001170	MF-940
0342-Add.18	94:2443	NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91002438	MF-902
0342-Add.19	94:2444	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001165	MF-902
0342-Add.2	94:2427	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001162	MF-902
0342-Add.20	94:2445	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001163	MF-902
0342-Add.22	94:2446	NTIS, PC A05/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91002453	MF-902
0342-Add.23	94:2447	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001172	MF-902
0342-Add.24	94:2448	NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91002454	MF-902
0342-Add.25	94:2449	NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001179	MF-902
0342-Add.26	94:2450	NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001180	MF-902
0342-Add.28	94:2451	NTIS, PC A08/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001173	MF-902
0342-Add.29	94:2452	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001167	MF-902
0342-Add.3	94:2428	NTIS, PC A08/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001168	MF-902
0342-Add.30	94:2453	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001186	MF-902
0342-Add.31	94:2454	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001187	MF-902
0342-Add.32	94:2455	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001169	MF-902
0342-Add.33	94:2456	NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91002448	MF-902
0342-Add.4	94:2429	NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001166	MF-902
0342-Add.5	94:2430	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001164	MF-902
0342-Add.6	94:2431	NTIS, PC A05/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001159	MF-902
0342-Add.7	94:2432	NTIS, PC A05/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001160	MF-902
0342-Add.8	94:2433	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001161	MF-902
0342-Add.9	94:2434	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001176	MF-902
0346	94:1017	NTIS, PC A03/MF A01; OSTI; Order software packages from National Energy Software Center, Argonne National Laboratory, 9800 South Cass Avenue, Argonne, IL 60439. Order documentation without complete package from NTIS.; GPO Dep.	E 1.99:	DE90014064	MF-900
0347	94:1453	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91011061	MF-940
0347-Suppl.	94:1454	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92015829	MF-902
0347-Suppl.2	94:1455	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93008156	MF-940
0348	94:433	NTIS, PC A05/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001284	MF-902
0348-Suppl.1	94:434	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001301	MF-902
0352	94:1456	NTIS, PC A12/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015397	MF-940
0355	94:2457	NTIS, PC A09/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91002447	MF-902
0359-Rev.1	94:2458	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001290	MF-902
0363	94:1018	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000295	MF-900
0363-Rev.1	94:1019	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92000528	MF-940
0365	94:1457	OSTI; NTIS; GPO Dep.	E 1.99:	DE91009162	MF-900
0365-1	94:1458	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92002236	MF-902
0365-2	94:1459	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93004985	MF-902
0365-3	94:1460	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002355	MF-940
0366	94:2459	NTIS, PC A17/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91002509	MF-902
0368	94:435	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91007158	MF-907
0369	94:436	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91014685	MF-902
0372-Vol.1-Rev.1	94:437	OSTI; NTIS; GPO Dep.	E 1.99:	DE93007465	MF-902
0373	94:1461	OSTI; NTIS; GPO Dep.	E 1.99:	DE91006809	MF-900
0375	94:1020	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91004550	MF-940
0376	94:1021	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91004581	MF-940
0377-Rev.1	94:1462	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91001287	MF-940

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0379	94:1463	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92002912	MF-902
0381	94:438	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91007919	MF-940
0382	94:1022	NTIS; PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001190	MF-902
0390	94:1023	OSTI; NTIS; GPO Dep.	E 1.99:	DE91007914	MF-907
0390-Rev.1	94:1024	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002356	MF-902
0391	94:1025	OSTI; NTIS; GPO Dep.	E 1.99:	DE91004586	MF-900
0392	94:1464	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91018146	MF-940
0392-Rev.1	94:1465	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93008164	MF-900
0394-1	94:2460	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91007160	MF-903
0394-2	94:2461	OSTI; NTIS; GPO Dep.	E 1.99:	DE91016737	MF-903
0394-3	94:2462	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92006498	MF-903
0394-4	94:2463	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92019878	MF-902
0394-5	94:2464	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016379	MF-902
0394-6	94:2465	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002484	MF-903
0394-7	94:2466	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94007149	MF-903
0398	94:2467	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91010034	MF-902
0399-Rev.2	94:1466	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92040413	MF-600
0400	94:2468	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92002048	MF-902
0401	94:1026	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003628	MF-940
0402	94:2469	OSTI; NTIS; GPO Dep.	E 1.99:	DE91010111	MF-902
0402-Rev.1	94:2470	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93002053	MF-902
0403	94:1467	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91016732	MF-940
0403A	94:1468	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92019877	MF-902
0404-Rev.1	94:1469	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92002046	MF-940
0405-Draft.A-Vol.1	94:1470	OSTI; NTIS; GPO Dep.	E 1.99:	DE92002919	MF-902
0405-Draft.A-Vol.2	94:1471	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92002920	MF-940
0405-Draft.A-Vol.3	94:1472	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003140	MF-902
0405-Draft.A-Vol.4-Pt.1	94:1473	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003552	MF-902
0405-Draft.A-Vol.4-Pt.2	94:1474	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92002972	MF-902
0405-DraftA-Vol.5	94:1475	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003071	MF-902
0405-DraftA-Vol.6	94:1476	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003141	MF-902
0408	94:2471	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91017742	MF-940
0412	94:439	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92002914	MF-902
0415-Rev.1	94:1477	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94003873	MF-900
0416	94:1478	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003025	MF-902
0417	94:1027	OSTI; NTIS; GPO Dep.	E 1.99:	DE92008208	MF-902
0418	94:440	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92002106	MF-905
0420	94:1028	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92014212	MF-902
0421	94:1029	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92002976	MF-902
0423	94:441	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92002105	MF-905
0424-Rev.	94:1479	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91018134	MF-902
0426	94:1480	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91016627	MF-902
0426-Rev.2	94:1481	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92008364	MF-940
0426-Rev.3	94:1482	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93008148	MF-940
0427-Pt.1	94:1030	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003283	MF-940
0427-Pt.2	94:1031	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003284	MF-940
0428	94:1483	OSTI; NTIS; GPO Dep.	E 1.99:	DE91016394	MF-940
0430	94:442	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91016625	MF-902
0430-Rev.1	94:443	OSTI; NTIS; GPO Dep.	E 1.99:	DE93006525	MF-900
0431	94:1484	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92007723	MF-902
0433	94:444	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001692	MF-940
0436	94:1485	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91016389	MF-940
0436-Rev.1	94:1486	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94011394	MF-940
0437	94:1032	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91016393	MF-940
0445	94:2472	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92000233	MF-902
0448	94:2473	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012203	MF-902
0451	94:1487	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92002257	MF-940
0458	94:445	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92019885	MF-902
0459	94:446	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92019882	MF-902
0461	94:1488	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93014487	MF-902
0461-Rev.1	94:1489	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040315	MF-940
0462	94:1033	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93006250	MF-940
0463	94:1034	OSTI; NTIS; GPO Dep.	E 1.99:	DE92002258	MF-900
0464	94:1035	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92006494	MF-900
0466	94:1036	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92008574	MF-902
0466-1-Rev.1	94:1037	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93014623	MF-902
0467	94:1038	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92008550	MF-902
0468	94:1039	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92008552	MF-940
0468-1	94:1040	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93005890	MF-902
0468-2	94:1041	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004845	MF-902

<i>Report Number</i>	<i>Abstract Number</i>	<i>Source of Availability</i>	<i>GPO Dep.</i>	<i>Order Number</i>	<i>Distribution Category</i>
0469	94:1042	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92008575	MF-940
0469-1	94:1043	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93005877	MF-902
0470	94:1044	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92008594	MF-902
0470-1	94:1045	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94005987	MF-940
0471	94:1046	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92008595	MF-940
0471-1	94:1047	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93011298	MF-940
0472	94:1048	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92008547	MF-902
0472-1	94:1049	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93005878	MF-902
0473	94:1490	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93008244	MF-940
0474-3	94:1050	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012197	MF-907
0474-4	94:1051	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92019699	MF-907
0474-5	94:1052	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040797	MF-902
0474-6	94:1053	OSTI; NTIS; GPO Dep.	E 1.99:	DE93008162	MF-940
0474-7	94:1054	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93014631	MF-900
0474-08	94:1055	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040340	MF-940
0474-9	94:1056	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004824	MF-940
0474-11	94:1057	OSTI; NTIS; GPO Dep.	E 1.99:	DE94010341	MF-940
0474-12	94:1058	OSTI; NTIS; GPO Dep.	E 1.99:	DE94011390	MF-900
0475	94:1059	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92014211	MF-902
0475-1	94:1060	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93005876	MF-940
0475-Rev.0	94:1491	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91004544	MF-902
0476	94:1061	OSTI; NTIS; GPO Dep.	E 1.99:	DE92008570	MF-902
0476-Rev.1	94:1062	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94005977	MF-940
0477	94:1063	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92008625	MF-902
0478	94:1999	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92000890	MF-902
0479	94:1064	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92008629	MF-902
0480	94:1065	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92008548	MF-902
0480-1	94:1066	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016351	MF-940
0481	94:1067	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92008569	MF-902
0489	94:447	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004542	MF-902
0489-1	94:448	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93003984	MF-902
0489-2	94:449	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016354	MF-902
0496	94:1068	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92002110	MF-902
0497	94:1069	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92008568	MF-902
0500	94:2474	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92006495	MF-903
0501	94:1492	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92008572	MF-907
0501-Rev.1-Draft	94:1493	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93011937	MF-902
0504-Vol.1	94:1494	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003013	MF-940
0504-Vol.2	94:1495	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003070	MF-940
0505	94:1496	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012205	MF-902
0508-Vol.1	94:1497	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003022	MF-902
0509	94:1070	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92008628	MF-902
0514	94:1071	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92018162	MF-902
0516	94:1498	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001676	MF-902
0517	94:1499	OSTI; NTIS; GPO Dep.	E 1.99:	DE92008366	MF-900
0521	94:1500	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92006522	MF-900
0522	94:1072	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018736	MF-940
0523	94:2475	OSTI; NTIS; GPO Dep.	E 1.99:	DE92006437	MF-902
0524	94:1501	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92040479	MF-902
0526	94:2476	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92015906	MF-908
0531-Rev.1	94:1502	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001753	MF-902
0532	94:1503	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93014489	MF-900
0532-Rev.1	94:1504	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94005980	MF-940
0533	94:1073	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011288	MF-902
0533-Draft	94:1074	OSTI; NTIS; GPO Dep.	E 1.99:	DE92011456	MF-902
0535	94:2000	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92008592	MF-940
0535-1	94:2001	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93005000	MF-900
0537	94:1075	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92008383	MF-902
0539	94:1505	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012161	MF-940
0539-Rev.1	94:1506	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92019781	MF-902
0548	94:450	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001464	MF-902
0550	94:1507	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001672	MF-902
0554	94:2477	OSTI; NTIS; GPO Dep.	E 1.99:	DE93003638	MF-902
0560	94:1508	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93005014	MF-902
0562	94:1509	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001661	MF-902
0563	94:1510	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001667	MF-940
0566	94:1511	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93009362	MF-902
0566-DRAFT	94:1512	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92015548	MF-940
0567	94:1076	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92040414	MF-902
0567-1	94:1077	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019494	MF-940

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0569	94:2478	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93008906	MF-902
0569-Rev.1	94:2479	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93014836	MF-902
0570	94:1078	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001752	MF-902
0572	94:1513	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93002050	MF-940
0573	94:1079	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001668	MF-902
0573-1	94:1080	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94003328	MF-902
0574	94:1081	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040493	MF-902
0576	94:1514	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93014503	MF-940
0577	94:1082	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93009428	MF-902
0578	94:1515	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93008838	MF-907
0581	94:1083	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93004488	MF-902
0584	94:1516	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93004996	MF-902
0586	94:1517	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93008161	MF-940
0587	94:451	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93005843	MF-902
0588	94:2619	OSTI; NTIS; GPO Dep.	E 1.99:	DE93004490	MF-905
0589	94:1518	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93004986	MF-902
0591	94:1519	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016228	MF-902
0595	94:452	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017594	MF-902
0596	94:2480	OSTI; NTIS; GPO Dep.	E 1.99:	DE93008174	MF-902
0597	94:453	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040391	MF-940
0599	94:1084	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040338	MF-940
0601	94:2481	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93003385	MF-902
0603	94:1085	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93009474	MF-901; MF-902
0606	94:1520	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93008160	MF-900
0609	94:454	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93008840	MF-903
0610	94:455	OSTI; NTIS; GPO Dep.	E 1.99:	DE93008176	MF-900
0616	94:1521	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93011904	MF-902; MF-940
0617-Draft	94:1522	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93011903	MF-902; MF-940
0619-Vol.1	94:2002	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94009389	MF-940
0619-Vol.2	94:2003	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93013004	MF-940
0619-Vol.3	94:2004	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001230	MF-940
0619-Vol.4	94:2005	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94009390	MF-940
0620	94:456	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94000737	MF-902
0621	94:1086	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93014186	MF-940
0623	94:1087	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93011297	MF-940
0625	94:1523	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040322	MF-902
0626	94:1088	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019492	MF-940
0627	94:1524	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93011938	MF-902
0628	94:1525	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93014486	MF-940
0629	94:1089	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018061	MF-940
0630	94:1767	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93011281	MF-940
0631	94:1090	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93014616	MF-940; MF-902
0635	94:1091	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93014628	MF-940
0636	94:1092	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94011450	MF-902
0638	94:1526	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94005983	MF-940
0640	94:1527	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018062	MF-940
0640-Rev.1	94:1528	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002358	MF-940
0642	94:1093	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94009786	MF-902
0643	94:1094	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016222	MF-940
0643-Rev.1	94:1095	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002354	MF-940
0644	94:2482	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018501	MF-902
0646	94:1096	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016829	MF-940
0648	94:1529	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93014619	MF-940
0650	94:1097	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94003095	MF-902
0651	94:2483	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019122	MF-902
0655-Draft	94:1098	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93014140	MF-940
0658	94:1530	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93014634	MF-902
0659	94:1099	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016826	MF-940
0660	94:1100	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019130	MF-940
0661	94:457	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018059	MF-906
0662	94:458	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040339	MF-900
0664	94:459	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040392	MF-940
0666	94:460	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040404	MF-902; MF-940
0668	94:1531	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002425	MF-940
0669	94:1532	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94005975	MF-940

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0671	94:1533	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040335	MF-902
0672	94:1101	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94003467	MF-940
0673	94:461	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008656	MF-902; MF-940
0674	94:462	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002481	MF-902
0675	94:463	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001226	MF-902
0678	94:464	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004895	MF-902
0679	94:465	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001228	MF-902
0680	94:466	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94005513	MF-940
0681	94:1534	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002357	MF-940
0682	94:1102	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001156	MF-907
0683	94:1103	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94003493	MF-940
0684	94:467	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001238	MF-902
0686	94:1104	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94003488	MF-940
0688	94:468	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001225	MF-902
0690	94:469	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94005515	MF-902
0691	94:1535	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94006330	MF-940
0693	94:2006	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94005981	MF-902
0695	94:1536	OSTI; NTIS; GPO Dep.	E 1.99:	DE94005985	MF-906
0697	94:1105	OSTI; NTIS; GPO Dep.	E 1.99:	DE94005422	MF-900
0698	94:470	OSTI; NTIS; GPO Dep.	E 1.99:	DE94007425	MF-902
0701	94:1537	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94005514	MF-940
0709	94:1538	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94005978	MF-940
0713	94:1539	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94005974	MF-940
0717	94:1540	OSTI; NTIS; GPO Dep.	E 1.99:	DE94012402	MF-900
0719	94:1106	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94009754	MF-940
0721	94:1541	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94010340	MF-940
0723	94:1542	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94012393	MF-940
0726	94:2007	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008658	MF-940
0728	94:1543	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94005976	MF-940
0733	94:1544	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94009753	MF-902
0734	94:1545	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94009442	MF-940
0734-Rev.1	94:1546	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94011393	MF-940
0737	94:1107	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94012399	MF-900
0747	94:1108	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94012400	MF-940
0749	94:471	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94010889	MF-907
0750-Vol.1	94:1547	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94012249	MF-902
0750-Vol.2	94:1548	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94012250	MF-902
0750-Vol.3	94:1549	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94012301	MF-902
0750-Vol.4	94:1550	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94012302	MF-902
0750-Vol.5	94:1551	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94012303	MF-902
0750-Vol.6	94:1552	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94012304	MF-902
0750-Vol.7	94:1553	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94012305	MF-902
0757	94:1109	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94010887	MF-940
0774	94:1554	OSTI; NTIS; GPO Dep.	E 1.99:	DE94009387	MF-900
WHC-MR-					
0213	94:1555	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91018255	MF-900
0227	94:472	OSTI; NTIS; GPO Dep.	E 1.99:	DE91013239	MF-902
0229	94:473	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91007159	MF-903
0248	94:1556	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91018154	MF-902
0250	94:1557	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91016736	MF-940
0259	94:1110	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91016781	MF-902
0264	94:1558	OSTI; NTIS; GPO Dep.	E 1.99:	DE92002047	MF-940
0270	94:474	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002477	MF-902
0284	94:2484	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93006906	MF-902
0289	94:1111	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003021	MF-902
0289-Rev.1	94:1112	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004569	MF-900
0289-Rev.2	94:1113	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93005898	MF-902
0289-Rev.3	94:1114	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94009388	MF-907
0293	94:475	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92007917	MF-900
0293-Rev.1	94:476	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011191	MF-900
0293-Rev.2	94:477	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94010377	MF-900
0300	94:1559	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92015898	MF-902
0300-Suppl.1	94:1560	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92015899	MF-902
0302	94:1561	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93005012	MF-902
0302-Suppl.1	94:1562	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93004989	MF-902
0375	94:1115	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92014413	MF-901; MF-902
0382	94:478	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93006532	MF-940
0386	94:1563	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93006533	MF-940

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
0387-1	94:1564	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040482	MF-900
0387-2	94:1565	OSTI; NTIS; GPO Dep.	E 1.99:	DE93009427	MF-900
0388	94:1116	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93006526	MF-902
0391	94:479	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93012612	MF-902
0392	94:480	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93002240	MF-902
0398	94:1117	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93004983	MF-902
0402	94:1566	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93008243	MF-940
0406	94:1567	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018731	MF-940; MF-902
0413	94:1568	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018065	MF-902
0416	94:1118	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017799	MF-940
0420	94:2485	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040395	MF-902
0423	94:1119	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019974	MF-940
0426	94:2486	OSTI; NTIS; GPO Dep.	E 1.99:	DE94005511	MF-902
0429	94:1569	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004827	MF-902
0433	94:1570	OSTI; NTIS; GPO Dep.	E 1.99:	DE94002413	MF-940
0435	94:1120	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94005973	MF-900
0437	94:1121	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004825	MF-900; MF-901
0438	94:1571	OSTI; NTIS; GPO Dep.	E 1.99:	DE94009438	MF-940
0440	94:1122	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94005425	MF-940
0441	94:2487	OSTI; NTIS; GPO Dep.	E 1.99:	DE94006326	MF-902
0442	94:2488	OSTI; NTIS; GPO Dep.	E 1.99:	DE94006325	MF-902
0451	94:1123	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94005487	MF-940
0456	94:1124	OSTI; NTIS; GPO Dep.	E 1.99:	DE94010355	MF-902
WHC-SA-					
0646	94:1572	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014063	MF-900
0648	94:1125	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92008378	MF-902
0818	94:1126	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015376	MF-940
0825	94:1127	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90014341	MF-721
0826	94:1128	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90011520	MF-902
0872	94:1129	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017233	MF-900
0873	94:1130	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001663	MF-902
0880	94:1573	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017235	MF-900
0934	94:2115	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001282	MF-902
0935	94:1131	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE91001283	MF-902
0937	94:1574	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90017234	MF-900
0939	94:1132	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91004557	MF-900
0963	94:1133	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91011056	MF-940
0975	94:1134	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91011062	MF-940
0980	94:481	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92002112	MF-902
0990	94:482	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91014681	MF-940
0993	94:483	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE91000551	MF-900
0999	94:1575	OSTI; NTIS; GPO Dep.	E 1.99:	DE91016946	MF-900
1000	94:1135	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91009215	MF-902
1001	94:1136	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91007974	MF-940
1005	94:1137	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91007174	MF-902
1006	94:484	OSTI; NTIS; GPO Dep.	E 1.99:	DE91010112	MF-907
1008	94:1138	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91010109	MF-902
1010	94:485	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91010108	MF-904
1017	94:1576	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91012198	MF-940
1019	94:1139	OSTI; NTIS; GPO Dep.	E 1.99:	DE91018165	MF-902
1020	94:1140	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91010834	MF-940
1035	94:486	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91010836	MF-940
1039	94:487	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92002917	MF-902
1042	94:2116	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91004575	MF-900
1044	94:1141	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91014645	MF-902
1071	94:1577	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91018147	MF-940
1092	94:1142	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91010107	MF-907
1124	94:2489	OSTI; NTIS; GPO Dep.	E 1.99:	DE91014682	MF-902
1130	94:2490	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91016733	MF-940
1132	94:1578	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91016734	MF-940
1133	94:1579	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91016628	MF-902
1144	94:1580	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92002107	MF-902
1155	94:2491	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91016629	MF-902
1158	94:1768	OSTI; NTIS; GPO Dep.	E 1.99:	DE91010106	MF-902
1166	94:1143	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92002232	MF-940
1167	94:1144	OSTI; NTIS; GPO Dep.	E 1.99:	DE91013240	MF-907
1182	94:488	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92002049	MF-902
1189	94:1581	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92002343	MF-940

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
1190	94:2008	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92002252	MF-940
1191	94:2009	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93004981	MF-902
1196	94:1582	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92002714	MF-902
1202	94:489	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92008380	MF-902
1203	94:490	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92006521	MF-902
1204	94:491	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92008389	MF-902
1205	94:492	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93002241	MF-902
1206	94:493	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92018155	MF-902
1207	94:494	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92008379	MF-902
1209	94:495	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91018139	MF-940
1215	94:1583	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92002114	MF-907; MF-902
1216	94:1584	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92008359	MF-940
1218	94:1585	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92002050	MF-902
1219	94:1586	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92006503	MF-902
1221	94:1587	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92008358	MF-940
1222	94:1588	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92008374	MF-902
1224	94:496	OSTI; NTIS; GPO Dep.	E 1.99:	DE92008368	MF-902
1225	94:2492	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92006497	MF-902
1228	94:497	OSTI; NTIS; GPO Dep.	E 1.99:	DE92002108	MF-902
1240	94:1145	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91016731	MF-940
1269	94:2117	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92008360	MF-906
1288	94:1589	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92008631	MF-902
1297	94:2493	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92001720	MF-902
1300	94:498	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004570	MF-902
1304	94:1590	OSTI; NTIS; GPO Dep.	E 1.99:	DE92002111	MF-902
1306	94:1591	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003019	MF-902
1318	94:1146	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92008084	MF-940
1322	94:1147	OSTI; NTIS; GPO Dep.	E 1.99:	DE92014963	MF-902
1328	94:1592	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92008627	MF-902
1343	94:1593	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92011334	MF-902
1345	94:499	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92008369	MF-902
1350	94:1148	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92008377	MF-902
1355	94:2494	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92008384	MF-902
1364	94:1594	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012199	MF-902
1365	94:1149	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92010708	MF-902
1368	94:500	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92002913	MF-902
1369	94:1595	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92008375	MF-902
1384	94:2495	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92007721	MF-900
1396	94:1150	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012656	MF-940
1405	94:1596	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92015901	MF-902
1406	94:1597	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92015900	MF-902
1411	94:1598	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92008545	MF-902
1411-Rev.2	94:1599	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93004998	MF-902
1416	94:1151	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93004495	MF-902
1418	94:1152	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92019777	MF-907
1423	94:1153	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93014190	MF-940
1426	94:1154	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92008382	MF-902
1427	94:1155	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92008081	MF-940
1431	94:1156	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92014960	MF-900
1434	94:1157	OSTI; NTIS; GPO Dep.	E 1.99:	DE92007724	MF-902
1450	94:1158	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93004487	MF-902
1450-Rev.1	94:501	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002183	MF-940
1451	94:2496	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92015896	MF-902
1456	94:2497	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012301	MF-902
1460	94:2498	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92008386	MF-902
1463	94:1159	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92014217	MF-902
1465	94:1160	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92006870	MF-902
1471	94:1600	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92012201	MF-900
1482	94:1601	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040316	MF-901; MF-902
1489	94:502	OSTI; NTIS; GPO Dep.	E 1.99:	DE92015910	MF-902
1492	94:1602	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92015833	MF-902
1492-Rev.1	94:1603	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93004980	MF-940
1501	94:1604	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93004988	MF-902
1504	94:1161	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92019884	MF-902
1505	94:1162	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92014214	MF-902
1511	94:503	OSTI; NTIS; GPO Dep.	E 1.99:	DE92012198	MF-902
1513	94:1605	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92015555	MF-902
1516	94:504	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92015834	MF-902

<i>Report Number</i>	<i>Abstract Number</i>	<i>Source of Availability</i>	<i>GPO Dep.</i>	<i>Order Number</i>	<i>Distribution Category</i>
1520	94:1163	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92015818	MF-901
1525	94:1164	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92015835	MF-902
1529	94:505	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94005485	MF-940
1540	94:1606	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92040798	MF-902
1541	94:1165	OSTI; NTIS; GPO Dep.	E 1.99:	DE92014961	MF-900
1544	94:1166	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93011357	MF-940
1545	94:1607	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92015832	MF-902
1549	94:1608	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92015895	MF-940
1551	94:1167	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93009430	MF-902
1555	94:1168	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93004494	MF-902
1565	94:1169	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93004995	MF-902
1574	94:1170	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001478	MF-900; MF-940
1576	94:1609	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004491	MF-940
1581	94:506	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93008147	MF-907
1585	94:1171	OSTI; NTIS; GPO Dep.	E 1.99:	DE92040571	MF-902
1591	94:1610	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93002805	MF-940
1600	94:1611	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92040416	MF-940
1608	94:1172	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93009425	MF-902
1609	94:1173	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93009431	MF-902
1613	94:507	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001477	MF-902; MF-940
1623	94:508	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93014916	MF-940
1630	94:1174	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93014505	MF-902
1637	94:1612	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93014589	MF-940
1661	94:1613	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93014626	MF-940
1662	94:1175	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93009429	MF-902
1665	94:2499	OSTI; NTIS; GPO Dep.	E 1.99:	DE92015909	MF-902
1667	94:1176	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93004508	MF-902
1668	94:1614	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93009419	MF-902
1669	94:1615	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93004997	MF-902
1671	94:1616	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93014627	MF-940
1673	94:1617	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93009421	MF-902
1679	94:1618	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93004496	MF-902
1680	94:1177	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93008163	MF-940
1687	94:1619	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93009423	MF-902; MF-906
1694	94:1620	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93014625	MF-901; MF-902
1697	94:1621	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93014488	MF-902
1698	94:1178	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93011282	MF-940
1701	94:1622	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93014491	MF-902
1708	94:1179	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93014485	MF-940
1713	94:1180	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93004510	MF-902
1722	94:1181	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93006907	MF-902
1723	94:1623	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93011354	MF-905; MF-940
1729	94:1182	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016478	MF-902
1731	94:1183	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93011252	MF-940
1733	94:1184	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93011280	MF-940
1734	94:1185	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93011940	MF-902
1735	94:2118	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93011277	MF-940
1738	94:1186	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93011278	MF-940
1741	94:1187	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93005889	MF-902
1748	94:1624	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93014189	MF-902
1753	94:2620	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019124	MF-940
1756	94:1188	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93004518	MF-902
1763	94:2500	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93006904	MF-902
1764	94:2501	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002483	MF-903
1770	94:1625	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93011276	MF-940
1772	94:1189	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93011275	MF-940
1773	94:1190	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016475	MF-940
1788	94:1191	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93012611	MF-940
1789	94:1192	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93013002	MF-940
1792	94:2502	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001698	MF-902
1795	94:1193	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93012616	MF-940
1796	94:1194	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93006905	MF-902
1799	94:509	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040408	MF-902
1805	94:510	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040336	MF-902
1807	94:1195	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018734	MF-940

<i>Report Number</i>	<i>Abstract Number</i>	<i>Source of Availability</i>	<i>GPO Dep.</i>	<i>Order Number</i>	<i>Distribution Category</i>
1808	94:1196	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018735	MF-940
1810	94:1197	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93011274	MF-940
1811	94:2010	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040313	MF-940
1812	94:2011	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016223	MF-900
1816	94:1198	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019129	MF-940
1821	94:1199	OSTI; INIS; NTIS; GPO Dep.	E 1.99:	DE93040382	MF-940
1825	94:1626	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93009426	MF-902
1830	94:1200	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93008179	MF-940
1831	94:2012	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016348	MF-940; MF-902
1833	94:1201	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93008175	MF-940
1835	94:1627	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93014624	MF-902
1837	94:1628	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93014490	MF-940
1846	94:511	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016476	MF-940
1866	94:1202	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93013005	MF-940
1867	94:1203	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93011352	MF-940
1878	94:1629	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040407	MF-902
1880	94:512	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040406	MF-902
1881	94:1630	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040405	MF-940
1883	94:1204	OSTI; NTIS; GPO Dep.	E 1.99:	DE93012619	MF-902
1896	94:513	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93012615	MF-902
1899	94:1631	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019318	MF-906
1902	94:1205	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017596	MF-900
1907	94:2503	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004484	MF-903
1908	94:2504	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94003094	MF-902; MF-903
1911	94:1632	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019317	MF-940
1917	94:514	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008659	MF-940
1920	94:1633	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93014164	MF-902
1921	94:515	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93013050	MF-902
1927	94:1206	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004823	MF-902
1928	94:1207	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016347	MF-940; MF-902
1929	94:516	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001694	MF-902
1933	94:2013	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94003471	MF-907
1935	94:1208	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001194	MF-902
1939	94:517	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001227	MF-902
1941	94:2014	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002409	MF-940
1943	94:518	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002353	MF-940; MF-902
1946	94:519	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94003093	MF-902
1963	94:520	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016224	MF-902
1964	94:2505	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016225	MF-906
1976	94:1634	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004490	MF-902
1977	94:2119	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94005419	MF-906
1979	94:2015	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94003849	MF-940
1982	94:1635	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94011388	MF-940; MF-902
1983	94:1636	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94011389	MF-940; MF-902
1985	94:1637	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004822	MF-940
1997	94:2016	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040370	MF-902
2018	94:521	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040409	MF-906
2021	94:1638	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001681	MF-940
2025	94:1209	OSTI; NTIS; GPO Dep.	E 1.99:	DE94001173	MF-906
2026	94:1210	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001180	MF-902
2033	94:1211	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002411	MF-940
2055	94:2506	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001691	MF-902; MF-940
2056	94:522	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001690	MF-902
2057	94:523	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001696	MF-902
2058	94:2507	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001689	MF-902
2059	94:524	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001688	MF-902
2061	94:2508	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001687	MF-902
2064	94:525	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001693	MF-902
2065	94:1639	OSTI; NTIS; GPO Dep.	E 1.99:	DE94009609	MF-940
2074	94:1640	OSTI; NTIS; GPO Dep.	E 1.99:	DE94005489	MF-901
2078	94:1212	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94000736	MF-902
2094	94:1213	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94011444	MF-940
2098	94:1214	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94009757	MF-901

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2100	94:1641	OSTI; NTIS; GPO Dep.	E 1.99:	DE94009386	MF-940
2101	94:526	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94009608	MF-940
2102	94:1642	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94010348	MF-907; MF-940; MF-902
2105	94:1215	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94009756	MF-902
2108	94:1216	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002319	MF-902
2110	94:527	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94003096	MF-903
2111	94:1217	OSTI; NTIS; GPO Dep.	E 1.99:	DE94010373	MF-906
2112	94:528	OSTI; NTIS; GPO Dep.	E 1.99:	DE94010374	MF-900
2113	94:529	OSTI; NTIS; GPO Dep.	E 1.99:	DE94009436	MF-902
2118	94:1643	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94009663	MF-906; MF-940
2123	94:1644	OSTI; NTIS; GPO Dep.	E 1.99:	DE94009437	MF-940
2124	94:1645	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94010343	MF-940
2129	94:1646	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94010347	MF-940
2130	94:1647	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94010349	MF-902; MF-940
2131	94:2017	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94005967	MF-940
2132	94:1218	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94005420	MF-906; MF-940
2140	94:1648	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94009762	MF-940
2143	94:1219	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94011445	MF-940
2152	94:1649	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94010342	MF-940
2159	94:1650	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94009765	MF-940; MF-902
2169	94:2018	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94011338	MF-940
2172	94:1651	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004480	MF-902
2175	94:2509	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001699	MF-903
2180	94:1220	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94003492	MF-940
2185	94:1652	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94009764	MF-902
2186	94:530	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94009766	MF-902; MF-940
2190	94:1653	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94009787	MF-940
2263	94:531	OSTI; NTIS; GPO Dep.	E 1.99:	DE94006327	MF-902
2264	94:532	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94009662	MF-902; MF-940
2269	94:2019	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94010346	MF-902; MF-940
2288	94:2020	OSTI; NTIS; GPO Dep.	E 1.99:	DE94009433	MF-900
2300	94:1221	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94011448	MF-940
2304	94:2510	OSTI; NTIS; GPO Dep.	E 1.99:	DE94008077	MF-903
2336	94:2021	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94010376	MF-906
2341	94:1654	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94009439	MF-940
2345	94:533	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94011396	MF-900
2361	94:1222	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94009760	MF-940
2372	94:2022	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94010350	MF-902; MF-940
2439	94:534	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94013083	MF-902
WHC-SD-C018H-ER-004	94:2511	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93041342	MF-902
WHC-SD-C018H-PLN-004	94:2512	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002495	MF-902
WHC-SD-EN-AP-122	94:2023	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94007147	MF-902
134	94:2513	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040403	MF-902
141	94:2514	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040393	MF-902
145	94:2515	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93041106	MF-902
151	94:2516	OSTI; NTIS; GPO Dep.	E 1.99:	DE94006991	MF-902
154	94:2517	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94007146	MF-940
157	94:2518	OSTI; NTIS; GPO Dep.	E 1.99:	DE94010356	MF-902
WHC-SD-EN-EV-026	94:535	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94007156	MF-903
027	94:2519	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94006328	MF-903
WHC-SD-EN-RA-014	94:1223	OSTI; NTIS; GPO Dep.	E 1.99:	DE94005461	MF-902

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WHC-SD-EN-SD-- 001	94:536	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002494	MF-510; MF-702; MF-705; MF-721
WHC-SD-EN-SPP-- 003	94:537	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004410	MF-903
WHC-SD-EN-TI-- 110	94:538	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018745	MF-940
162	94:2520	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002480	MF-903
164	94:2521	OSTI; NTIS; GPO Dep.	E 1.99:	DE93041109	MF-903
173	94:539	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94010369	MF-903
174	94:2522	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040394	MF-902
181	94:540	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93041107	MF-902
188	94:541	OSTI; NTIS; GPO Dep.	E 1.99:	DE94002485	MF-902
195	94:2523	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001685	MF-903
197	94:542	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94006329	MF-902
198	94:543	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94000738	MF-902
212	94:2524	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94006994	MF-902
214	94:544	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94010371	MF-902
216	94:545	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94006993	MF-902
218	94:2525	OSTI; NTIS; GPO Dep.	E 1.99:	DE94009664	MF-902
219	94:546	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94007148	MF-903
WHC-SD-EN-TP-- 020	94:2526	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93011376	MF-902
028	94:2527	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017680	MF-902
030	94:2528	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018518	MF-940
031	94:2529	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94010378	MF-902
033	94:2530	OSTI; NTIS; GPO Dep.	E 1.99:	DE94001684	MF-903
036	94:547	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94013012	MF-902
038	94:2531	OSTI; NTIS; GPO Dep.	E 1.99:	DE94008076	MF-903
039	94:2532	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94006995	MF-903
WHC-SD-ER-DTR-- 001	94:548	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008611	MF-903
WHC-SD-W026-TRP-- 006	94:1224	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94001007	MF-902
WHC-SD-W100-TP-- 002	94:1225	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94009385	MF-902
WHC-SD-WM-ER-- 288	94:1655	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94005424	MF-906
WHC-SD-WM-ES-- 218-Rev.1	94:1656	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016767	MF-940
219	94:1657	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93005134	MF-902
WHC-SD-WM-FRD-- 011	94:1658	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004257	MF-940
WHC-SD-WM-PRS-- 012	94:1659	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94003528	MF-940
WHC-SD-WM-RD-- 044	94:1226	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94011330	MF-940
WHC-SD-WM-SARR-- 001	94:1660	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94011592	MF-902
WHC-SD-WM-TRP-- 150	94:1661	OSTI; NTIS; GPO Dep.	E 1.99:	DE94005488	MF-904
WHC-SP-- 0098-5	94:549	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94005510	MF-902
0126-2	94:1227	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91013241	MF-900
0434-14	94:1228	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001465	MF-902
0615-Rev.3-Vol.1	94:2024	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93011299	MF-940
0704	94:550	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93006901	MF-903
0822	94:1229	OSTI; NTIS; GPO Dep.	E 1.99:	DE93007031	MF-610
0835	94:1230	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92040796	MF-902
0850	94:1662	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001677	MF-902
0850-Rev.1	94:1663	OSTI; NTIS; GPO Dep.	E 1.99:	DE93008159	MF-900
0851	94:1231	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93001669	MF-902
0852	94:1232	OSTI; NTIS; GPO Dep.	E 1.99:	DE93001673	MF-500
0918	94:1233	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040337	MF-906
0920	94:1234	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93011254	MF-900
1072	94:1235	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94011414	MF-940
1689	94:1664	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93011285	MF-940

WINCO-

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
WINCO-					
1127	94:1236	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94000722	MF-940
1129	94:1237	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94000721	MF-940
1130	94:1238	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94000720	MF-940
1131	94:1239	OSTI; NTIS; GPO Dep.	E 1.99:	DE94000719	MF-900
1132	94:2025	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94000718	MF-940
1133	94:1240	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94000717	MF-940
1136	94:1241	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94000713	MF-940
1139	94:1242	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94000714	MF-940
1146	94:1243	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008911	MF-940
1150	94:1244	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008807	MF-940
1153	94:1245	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008811	MF-940
1155	94:2120	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008914	MF-940
1163	94:2026	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008810	MF-901; MF-940
1164	94:1246	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008809	MF-940
1165	94:1247	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008808	MF-904; MF-940
1171	94:1248	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008803	MF-901; MF-940
1172	94:1249	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008916	MF-940
1173	94:1250	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008802	MF-901; MF-940
1176	94:1251	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008801	MF-940
1177	94:1252	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008800	MF-901
1178	94:1253	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008799	MF-940
1180	94:1254	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008918	MF-940
1182	94:551	OSTI; NTIS; GPO Dep.	E 1.99:	DE94008920	MF-900
1183	94:1665	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008921	MF-902
1184	94:1666	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008922	MF-902
1187	94:1255	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008798	MF-940
1191	94:1256	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008925	MF-900
1192	94:1667	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94008926	MF-940
11926	94:1668	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93015567	MF-902
11933	94:1257	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94000936	MF-940
11935	94:1669	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94000933	MF-940
11939	94:1258	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94000927	MF-902
11980	94:552	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94000932	MF-903
WM-PD-					
91-003-Vol.1	94:1259	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93007638	MF-902
WSRC-MS-					
91-290-Draft	94:553	OSTI; NTIS; GPO Dep.	E 1.99:	DE92009587	MF-902
92-155	94:2121	OSTI; NTIS; GPO Dep.	E 1.99:	DE92015336	MF-900
93-018	94:302	See LBL-33252			
93-362	94:554	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94009055	MF-903
93-362-Rev.1	94:555	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94004033	MF-902
93-511	94:556	OSTI; NTIS; GPO Dep.	E 1.99:	DE94001184	MF-903
94-0233	94:557	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94011166	MF-902; MF-906
WSRC-RP-					
93-610	94:1260	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93041132	MF-940
WSRC-TR-					
93-459	94:2533	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94003819	MF-902
93-565	94:558	OSTI; NTIS; GPO Dep.	E 1.99:	DE94006668	MF-902
Y/ER-					
3	94:2534	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92019627	MF-902
10	94:2027	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92019629	MF-902
105/V1-D1	94:1860	See DOE/OR-01-1161-V1-D1			
112-D1	94:749	See DOE/OR-01-1173-D1			
149-D1	94:1865	See DOE/OR-01-1214-D1			
149-D2	94:1866	See DOE/OR-01-1214-D2			
16	94:559	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92019636	MF-902
17	94:2028	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92019630	MF-902
19	94:2029	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003900	MF-902
20/V2	94:560	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92006666	MF-902
21	94:561	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92006667	MF-902
29	94:562	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92041274	MF-902
42-D1	94:756	See DOE/OR-1054-D1			
42-D2	94:757	See DOE/OR-1054-D2			
50	94:563	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93004698	MF-902

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51-D1	94:1858	See DOE/OR-01-1128-D1			
53-D2	94:1853	See DOE/OR-01-1100-D2			
53-D3	94:1854	See DOE/OR-01-1100-D3			
56-D2	94:127	See DOE/OR-01-1115-D2			
56-D3	94:128	See DOE/OR-01-1115-D3			
69	94:2030	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93011831	MF-902
70-D1	94:1872	See DOE/OR-1152-D1			
80-D1	94:1859	See DOE/OR-01-1151-D1			
93-D1	94:748	See DOE/OR-01-1169-D1			
Y/ER/SUB-					
91-99069/1/R3	94:1869	See DOE/OR-1060-D3			
Y/ER/Sub-					
90/97777/2	94:2535	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005401	MF-902
90/VK168/4-D1	94:564	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92008046	MF-902
91-99069/1	94:1868	See DOE/OR-1060-D1			
91-ALV96/1	94:565	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005402	MF-902
91-ALV96/2-Draft	94:2536	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005403	MF-902
91-ALV96/3-Draft	94:2031	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004747	MF-902
Y/TS-					
1016	94:2537	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE94002538	MF-902
Y/WM-					
162	94:2032	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017226	MF-902

Order Number Correlation

The correlation list is provided for those organizations that file documents by report number but may receive requests by order number. For more information about a document, refer to the Report Number Index.

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DE90008209	WHC-EP-0300	DE91001180	WHC-EP-0342-Add.26	DE91010034	WHC-EP-0398
DE90010367	WHC-EP-0253	DE91001181	WHC-EP-0342-Add.11	DE91010106	WHC-SA-1158
DE90010826	DOE/HWP-99	DE91001182	WHC-EP-0342-Add.14	DE91010107	WHC-SA-1092
DE90011520	WHC-SA-0826	DE91001183	WHC-EP-0342-Add.15	DE91010108	WHC-SA-1010
DE90012640	WHC-EP-0145-2	DE91001184	WHC-EP-0342-Add.16	DE91010109	WHC-SA-1008
DE90013647	WHC-EP-0182-23	DE91001185	WHC-EP-0342-Add.13	DE91010111	WHC-EP-0402
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DE90013937	WHC-EP-0250-Draft-Rev.B-Vol.3	DE91001282	WHC-SA-0934	DE91010283	ANL/CP-71331
DE90013938	WHC-EP-0250-Draft-Rev.B-Vol.4	DE91001283	WHC-SA-0935	DE91010444	ORNL/TM-10352
DE90014060	WHC-EP-0250-Draft-Rev.B-App.	DE91001284	WHC-EP-0348	DE91010445	ORNL/TM-11360
DE90014061	WHC-EP-0338-Draft	DE91001287	WHC-EP-0377-Rev.1	DE91010628	ANL/CP-70819
DE90014062	WHC-EP-0333-Draft	DE91001289	WHC-EP-0299	DE91010717	PNL-SA-19337-Vol.1
DE90014063	WHC-SA-0646	DE91001290	WHC-EP-0359-Rev.1	DE91010718	PNL-SA-19337-Vol.2
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DE90014764	WHC-EP-0339	DE91001523	CONF-910223-1	DE91010836	WHC-SA-1035
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DE90015397	WHC-EP-0352	DE91002447	WHC-EP-0355	DE91011061	WHC-EP-0347
DE90015473	DOE/ID-10253	DE91002448	WHC-EP-0342-Add.33	DE91011062	WHC-SA-0975
DE90015477	WHC-EP-0182-25	DE91002453	WHC-EP-0342-Add.22	DE91011065	WHC-EP-0182-33
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DE90017232	WHC-EP-0125-2	DE91004515	CONF-910223-8	DE91011439	LA-UR-91-1303
DE90017233	WHC-SA-0872	DE91004544	WHC-EP-0475-Rev.0	DE91011440	LA-UR-91-1295
DE90017234	WHC-SA-0937	DE91004550	WHC-EP-0375	DE91012191	DOE/EM-0011P
DE90017235	WHC-SA-0880	DE91004557	WHC-SA-0939	DE91012198	WHC-SA-1017
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DE91001163	WHC-EP-0342-Add.20	DE91007159	WHC-MR-0229	DE91014083	ANL-91/17
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DE91001169	WHC-EP-0342-Add.32	DE91007925	DOE/RL-90-45	DE91014167	EGG-WTD-9336
DE91001170	WHC-EP-0342-Add.17	DE91007974	WHC-SA-1001	DE91014168	EGG-WTD-9291-Rev.1
DE91001172	WHC-EP-0342-Add.23	DE91008026	DOE/EM-0007T-Vol.1	DE91014169	EGG-WTD-9423
DE91001173	WHC-EP-0342-Add.28	DE91008027	DOE/EM-0007T-Vol.2	DE91014301	DOE/EA-0489
DE91001174	WHC-EP-0342-Add.10	DE91008028	DOE/EM-0007T-Vol.3	DE91014597	LA-UR-91-2077
DE91001175	WHC-EP-0342	DE91008573	SAND-90-3065C	DE91014645	WHC-SA-1044
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DE91015815	DOE/EA-0491	DE91018993	ORNL/ER-52	DE92003019	WHC-SA-1306
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DE91016009	LA-UR-91-2408	DE91019067	SAND-91-1738C	DE92003022	WHC-EP-0508-Vol.1
DE91016282	CONF-9109234-2	DE92000057	PNL-SA-19908	DE92003025	WHC-EP-0416
DE91016284	CONF-9002111-3	DE92000063	CONF-910981-9	DE92003026	CONF-911268-1
DE91016389	WHC-EP-0436	DE92000067	CONF-9109234-6	DE92003070	WHC-EP-0504-Vol.2
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DE91016628	WHC-SA-1133	DE92000311	LA-UR-91-2874	DE92003262	CONF-901285-
DE91016629	WHC-SA-1155	DE92000389	ORNL-6485	DE92003263	EGG-WTD-9672
DE91016731	WHC-SA-1240	DE92000418	ORNL/ER-17	DE92003267	EGG-WTD-9194
DE91016732	WHC-EP-0403	DE92000434	CONF-9110229-1	DE92003268	DOE/ID-10057(90)
DE91016733	WHC-SA-1130	DE92000528	WHC-EP-0363-Rev.1	DE92003269	EGG-WTD-9799
DE91016734	WHC-SA-1132	DE92000733	CONF-9108124-2	DE92003283	WHC-EP-0427-Pt.1
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DE91016782	DOE/RL-91-14	DE92001720	WHC-SA-1297	DE92003303	EGG-WTD-9723
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DE91016946	WHC-SA-0999	DE92001923	ANL/CP-73431	DE92003326	EGG-WTD-9594-Vol.1
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DE91017778	ORNL/RASA-90/7	DE92002049	WHC-SA-1182	DE92003384	EGG-WTD-9807
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DE91018138	WHC-EP-0182-37	DE92002108	WHC-SA-1228	DE92003489	DOE/RL/12253-T3
DE91018139	WHC-SA-1209	DE92002110	WHC-EP-0496	DE92003490	DOE/RL/12253-T1
DE91018143	WHC-EP-0182-36	DE92002111	WHC-SA-1304	DE92003522	ANL/CP-74663
DE91018146	WHC-EP-0392	DE92002112	WHC-SA-0980	DE92003552	WHC-EP-0405-Draft.A-Vol.4-Pt.1
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DE91018165	WHC-SA-1019	DE92002234	WHC-EP-0182-40	DE92003728	ORNL/ER-36
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DE91018447	DOE/HWP-69/R1	DE92002260	WHC-EP-0182-39	DE92003900	Y/ER-19
DE91018509	ORNL/TM-11864	DE92002343	WHC-SA-1189	DE92004142	ANL/CP-73172
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DE91018544	ANL/CP-72668	DE92002393	ORNL/TM-11799	DE92004279	CONF-8909163-17
DE91018561	ANL/CP-73026	DE92002436	ORNL/ER-55	DE92004280	CONF-8909163-16
DE91018562	ANL/CP-73007	DE92002628	DOE/EM-0057P	DE92004281	CONF-8909163-15
DE91018563	ANL/CP-72987	DE92002685	CONF-9110168-8	DE92004341	LA-12216-MS
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DE91018726	BNL-46540	DE92002740	PNL-SA-20048	DE92004452	PNL-7836
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DE91018786	EGG-WTD-9765	DE92002803	CONF-920501-2	DE92004542	WHC-EP-0489
DE91018787	EGG-WTD-9671	DE92002804	CONF-920107-2	DE92004569	WHC-MR-0289-Rev.1
DE91018829	EGG-WTD-9735	DE92002912	WHC-EP-0379	DE92004570	WHC-SA-1300
DE91018830	EGG-WTD-9736	DE92002913	WHC-SA-1368	DE92004585	ORNL/ER-65
DE91018833	EGG-WTD-9780	DE92002914	WHC-EP-0412	DE92004589	ORNL/RASA-89/18
DE91018846	CONF-910849-5	DE92002917	WHC-SA-1039	DE92004675	ORNL/M-1814
DE91018920	DOE/OR/21949-287	DE92002919	WHC-EP-0405-Draft.A-Vol.1		
DE91018921	DOE/OR/21949-284	DE92002920	WHC-EP-0405-Draft.A-Vol.2		

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DE92004747	Y/ER/Sub-91-ALV96/3-Draft	DE92008212	ORNL/RASA-91/8	DE92010726	ORNL/M-1871
DE92005028	BNL-46158	DE92008254	CONF-9111188-1	DE92010806	DOE/LLW-93
DE92005054	LA-UR-91-4069	DE92008281	CONF-920307-19	DE92010845	DOE/LLW-116
DE92005242	ANL/CP-73611	DE92008358	WHC-SA-1221	DE92010848	EGG-WTD-9594-Vol.4
DE92005255	DOE/HWP-116	DE92008359	WHC-SA-1216	DE92010865	PNL-SA-19718
DE92005308	ES/ER/TM-25	DE92008360	WHC-SA-1269	DE92010866	PNL-SA-20508
DE92005309	ORNL/M-1851	DE92008364	WHC-EP-0426-Rev.2	DE92010873	ORNL/ER-91
DE92005316	ORNL/ER-59	DE92008365	DOE/RL-89-18-Rev.1	DE92010887	ANL/CP-74206
DE92005401	Y/ER/Sub-90/97777/2	DE92008366	WHC-EP-0517	DE92010937	ORNL/ER-19
DE92005402	Y/ER/Sub-91-ALV96/1	DE92008368	WHC-SA-1224	DE92011092	CONF-920466-4
DE92005403	Y/ER/Sub-91-ALV96/2-Draft	DE92008369	WHC-SA-1345	DE92011191	WHC-MR-0293-Rev.1
DE92005452	PNL-SA-19796	DE92008374	WHC-SA-1222	DE92011282	PNL-SA-20057
DE92006437	WHC-EP-0523	DE92008375	WHC-SA-1369	DE92011288	WHC-EP-0533
DE92006492	WHC-EP-0063-3	DE92008377	WHC-SA-1350	DE92011334	WHC-SA-1343
DE92006494	WHC-EP-0464	DE92008378	WHC-SA-0648	DE92011456	WHC-EP-0533-Draft
DE92006495	WHC-EP-0500	DE92008379	WHC-SA-1207	DE92011654	SAND-92-0247C
DE92006497	WHC-SA-1225	DE92008380	WHC-SA-1202	DE92011699	EGG-GEO-9987
DE92006498	WHC-EP-0394-3	DE92008382	WHC-SA-1426	DE92011785	CONF-920466-7
DE92006503	WHC-SA-1219	DE92008383	WHC-EP-0537	DE92012161	WHC-EP-0539
DE92006507	PNL-SA-19511	DE92008384	WHC-SA-1355	DE92012197	WHC-EP-0474-3
DE92006521	WHC-SA-1203	DE92008386	WHC-SA-1460	DE92012198	WHC-SA-1511
DE92006522	WHC-EP-0521	DE92008389	WHC-SA-1204	DE92012199	WHC-SA-1364
DE92006556	GRI-91/0046	DE92008479	LA-UR-92-662	DE92012201	WHC-SA-1471
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DE92006590	ORNL/RASA-91/7	DE92008491	LA-UR-92-654	DE92012205	WHC-EP-0505
DE92006666	Y/ER-20/V2	DE92008499	ES/ER-17-D1	DE92012215	EGG-WTD-9845
DE92006667	Y/ER-21	DE92008519	K/QT-407	DE92012216	EGG-WTD-9980
DE92006764	ORNL/TM-11536	DE92008545	WHC-SA-1411	DE92012222	INEL/MISC-91107
DE92006765	SAND-91-1988C	DE92008547	WHC-EP-0472	DE92012223	EGG-WTD-9870-Rev.1
DE92006870	WHC-SA-1465	DE92008548	WHC-EP-0480	DE92012224	EGG-WTD-9752
DE92007044	SAND-91-2775C	DE92008550	WHC-EP-0467	DE92012237	EGG-GEO-9990
DE92007162	DOE/EM-0059P	DE92008552	WHC-EP-0468	DE92012301	WHC-SA-1456
DE92007163	DOE/EM-0058P	DE92008568	WHC-EP-0497	DE92012308	DOE/LLW-147
DE92007197	ORNL/ER-51	DE92008569	WHC-EP-0481	DE92012310	EGG-WTD-9868
DE92007252	CONF-920307-7	DE92008570	WHC-EP-0476	DE92012320	EGG-GEO-10068
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DE92007386	DOE/EM-0061P	DE92008572	WHC-EP-0501	DE92012359	EGG-WTD-9993
DE92007387	DOE/EM-0062P	DE92008574	WHC-EP-0466	DE92012364	DOE/ID-12123
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DE92007721	WHC-SA-1384	DE92008595	WHC-EP-0471	DE92012373	EGG-WTD-10129
DE92007723	WHC-EP-0431	DE92008625	WHC-EP-0477	DE92012374	EGG-WM-9857
DE92007724	WHC-SA-1434	DE92008627	WHC-SA-1328	DE92012510	EGG-WTD-10056
DE92007763	ORNL/ER/Sub-87/99053/5/V1	DE92008628	WHC-EP-0509	DE92012512	EGG-WTD-10036
DE92007764	ORNL/ER/Sub-87/99053/5/V2	DE92008629	WHC-EP-0479	DE92012513	EGG-WTD-9985-Vol.1
DE92007771	ORNL/ER/Sub-87/99053/5/V3	DE92008630	WHC-EP-0210-Rev.3-App.I	DE92012514	EGG-WTD-9985-Vol.2
DE92007772	ORNL/ER/Sub-87/99053/5/V4	DE92008631	WHC-SA-1288	DE92012515	EGG-WTD-9520
DE92007773	ORNL/ER/Sub-87/99053/5/V5	DE92008762	ORNL/ER-63	DE92012522	EGG-WTD-10035
DE92007774	ORNL/ER/Sub-87/99053/5/V6	DE92008894	CONF-920606-11	DE92012523	EGG-WTD-9923
DE92007776	ES/ER/TM-20	DE92008900	CONF-9205121-2	DE92012526	EGG-WTD-9872
DE92007780	ORNL/TM-12017	DE92008974	SAND-91-2742	DE92012532	EGG-GEO-10158
DE92007783	ORNL/TM-11817	DE92009587	WSRC-MS-91-290-Draft	DE92012533	EGG-WTD-9594-Vol.3
DE92007787	ORNL/TM-11979	DE92009625	PNL-8011	DE92012534	EGG-WTD-9594-Vol.5
DE92007832	CONF-920606-8	DE92009715	ANL/CP-74216	DE92012536	EGG-WTD-9594-Vol.7
DE92007842	PNL-7872	DE92010266	ORNL/ER-53	DE92012537	EGG-WTD-9594-Vol.8
DE92007917	WHC-MR-0293	DE92010291	CONF-911114-8	DE92012568	EGG-WTD-9432-Vol.1-Rev.1
DE92008025	ORNL/ER-30	DE92010371	ORNL/ER-9	DE92012569	EGG-WTD-9432-Vol.2
DE92008046	Y/ER/Sub-90/VK168/4-D1	DE92010382	DOE/EA-0489-Rev.1	DE92012588	ORNL/ER-24
DE92008081	WHC-SA-1427	DE92010403	SAND-92-0426C	DE92012589	ORNL/ER-23
DE92008084	WHC-SA-1318	DE92010488	EGG-MS-9879	DE92012591	ORNL/ER-25
DE92008135	DOE/EW/40017-T1	DE92010489	PNL-SA-19974	DE92012593	DOE/RL-91/09
DE92008208	WHC-EP-0417	DE92010490	PNL-SA-20547	DE92012601	EGG-WTD-9432-Vol.3
		DE92010491	PNL-SA-20489	DE92012656	WHC-SA-1396
		DE92010493	PNL-SA-20059	DE92013062	ANL/CP-75814
		DE92010495	PNL-SA-20510	DE92013100	EGG-WTD-9214
		DE92010516	ANL/CP-74200	DE92013101	EGG-WTD-10180
		DE92010543	CONF-920851-2	DE92013287	CONF-920527-2
		DE92010708	WHC-SA-1365	DE92013478	ORNL/ER-116

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DE92013534	LA-UR-92-1312	DE92016615	ORNL/ER/Sub-87-99053/49	DE92019216	ORNL/ER-119
DE92013562	IS-M-705	DE92016826	EGG-2656	DE92019232	PNL-7810
DE92013661	SAND-92-0374C	DE92016907	CONF-9207100-2	DE92019302	ORNL/RASA-92/1
DE92013662	SAND-92-1072C	DE92017092	ANL/CP-75634	DE92019422	SAND-92-1364C
DE92013663	SAND-92-0959C	DE92017133	CONF-921102-9-Extd.Abst.	DE92019476	CONF-9209165-1
DE92013693	SAND-92-0409C	DE92017136	PNL-SA-20991	DE92019484	ORNL/RASA-91/11
DE92013860	CONF-920527-6	DE92017158	CONF-921102-10	DE92019492	ORNL/ER/Sub-87-99053/50
DE92013865	CONF-920883-1	DE92017237	ANL/RE-92/2	DE92019495	ORNL/ER-130
DE92013873	CONF-920851-11	DE92017348	SAND-92-0364	DE92019509	ORNL/ER-126
DE92013944	LA-UR-92-1383	DE92017512	LA-UR-92-1948	DE92019612	EGG-WMO-10244-Vol.1-Vol.2
DE92014041	WHC-EP-0182-42	DE92017553	PNL-7999	DE92019627	Y/ER-3
DE92014113	IS-M-709	DE92017750	DOE/LLW-145	DE92019629	Y/ER-10
DE92014210	WHC-EP-0182-44	DE92017804	ORNL/RASA-91/13	DE92019630	Y/ER-17
DE92014211	WHC-EP-0475	DE92017835	DOE/LLW-135	DE92019636	Y/ER-16
DE92014212	WHC-EP-0420	DE92017836	DOE/LLW-101	DE92019687	EGG-WTD-10325
DE92014214	WHC-SA-1505	DE92017837	DOE/LLW-137	DE92019690	EGG-WTD-10360
DE92014217	WHC-SA-1463	DE92017840	EGG-M-91481	DE92019691	EGG-GEO-10368
DE92014218	WHC-EP-0182-45	DE92017842	EGG-M-91394	DE92019699	WHC-EP-0474-4
DE92014219	WHC-EP-0182-43	DE92017843	EGG-M-92051	DE92019702	DOE/ID-10382-App.A-F
DE92014220	WHC-EP-0145-4-Rev.4	DE92017856	DOE/ID-10253(FY92)	DE92019704	PNL-8122
DE92014256	FEMP-2266	DE92017857	EGG-M-91416	DE92019760	EGG-GEO-10329
DE92014273	LA-12332-MS	DE92017864	EGG-WTD-9876	DE92019762	EGG-M-92121
DE92014390	IS-M-708	DE92017888	EGG-M-92186	DE92019768	EGG-GEO-10330
DE92014413	WHC-MR-0375	DE92017889	EGG-M-91419	DE92019777	WHC-SA-1418
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DE92014619	SAND-92-0387C	DE92017951	PNL-8152	DE92019799	PNL-8231
DE92014800	CONF-920851-19	DE92017990	EGG-WTD-10037	DE92019841	DOE/RL/11946-2-Vol.1
DE92014913	FEMP-2248	DE92017992	EGG-WM-10146	DE92019842	DOE/RL/11946-2-Vol.2
DE92014926	ORNL/TM-11927	DE92017996	EGG-WTD-10255	DE92019843	DOE/RL/11946-2-Vol.3
DE92014936	ORNL/TM-11999	DE92017998	EGG-WTD-10194	DE92019844	DOE/RL/11946-2-Vol.5
DE92014958	ORNL/ER-118	DE92017999	EGG-WTD-9422-Rev.1	DE92019851	EGG-WMO-10244-Vol.3
DE92014960	WHC-SA-1431	DE92018000	EGG-WTD-9989	DE92019852	EGG-WMO-10244-App.A
DE92014961	WHC-SA-1541	DE92018001	EGG-WTD-9928	DE92019853	EGG-WMO-10244-App.B-Pt.1
DE92014963	WHC-SA-1322	DE92018003	UCRL-JC-110356	DE92019854	EGG-WMO-10244-App.B-Pt.2
DE92015005	SAND-92-1139C	DE92018012	EGG-M-92342	DE92019877	WHC-EP-0403A
DE92015017	DOE/RL/11946-1-Vol.3	DE92018014	EGG-M-92308	DE92019878	WHC-EP-0394-4
DE92015018	DOE/RL/11946-1-Vol.4	DE92018016	EGG-M-92226	DE92019882	WHC-EP-0459
DE92015019	DOE/RL/11946-1-Vol.5	DE92018028	EGG-M-92301	DE92019884	WHC-SA-1504
DE92015020	DOE/RL/11946-1-Vol.6	DE92018036	EGG-WTD-10092	DE92019885	WHC-EP-0458
DE92015021	DOE/RL/11946-1-Vol.7	DE92018038	EGG-GEO-10274	DE92019892	DOE/LLW-141
DE92015085	CONF-920851-22	DE92018039	EGG-WTD-9985-Vol.3	DE92019893	DOE/LLW-146
DE92015094	PNL-SA-20486	DE92018049	EGG-WTD-10058	DE92019945	CONF-9207102-60
DE92015336	WSRC-MS-92-155	DE92018050	EGG-WTD-10172	DE92040268	SAND-92-0685C
DE92015392	SAND-92-0052	DE92018070	ORNL/ER-87	DE92040322	DOE/OR-1047-D1
DE92015548	WHC-EP-0566-DRAFT	DE92018071	ORNL/ER-7	DE92040404	UCRL-JC-111199
DE92015555	WHC-SA-1513	DE92018072	ORNL/ER-93	DE92040413	WHC-EP-0399-Rev.2
DE92015617	PNL-SA-20526	DE92018073	ORNL/ER-123	DE92040414	WHC-EP-0567
DE92015818	WHC-SA-1520	DE92018074	ORNL/ER-80	DE92040416	WHC-SA-1600
DE92015826	WHC-EP-0182-46	DE92018076	ORNL/ER-82	DE92040479	WHC-EP-0524
DE92015828	WHC-EP-0182-47	DE92018097	ORNL/TM-12031	DE92040482	WHC-MR-0387-1
DE92015829	WHC-EP-0347-Suppl.	DE92018155	WHC-SA-1206	DE92040493	WHC-EP-0574
DE92015832	WHC-SA-1545	DE92018160	DOE/RL-90-08	DE92040571	WHC-SA-1585
DE92015833	WHC-SA-1492	DE92018162	WHC-EP-0514	DE92040575	BNL-47775
DE92015834	WHC-SA-1516	DE92018263	SAND-92-1541C	DE92040695	ORNL/RASA-92/2
DE92015835	WHC-SA-1525	DE92018401	ORNL/ER-62	DE92040793	WHC-EP-0182-49
DE92015895	WHC-SA-1549	DE92018415	KY/ER-8	DE92040796	WHC-SP-0835
DE92015896	WHC-SA-1451	DE92018517	ORNL/RASA-91/16	DE92040797	WHC-EP-0474-5
DE92015898	WHC-MR-0300	DE92018602	LA-UR-92-2425	DE92040798	WHC-SA-1540
DE92015899	WHC-MR-0300-Suppl.1	DE92018664	PNL-8170	DE92040848	ORNL/ER-122
DE92015900	WHC-SA-1406	DE92018815	DOE/LLW-111-Draft	DE92040849	ES/ER/TM-4/R2
DE92015901	WHC-SA-1405	DE92018819	SAND-92-1690C	DE92040870	CONF-921029-3
DE92015906	WHC-EP-0526	DE92018955	ORNL/RASA-91/10	DE92040889	DOE/ID/12584-97
DE92015909	WHC-SA-1665	DE92018983	LA-UR-92-2071	DE92041014	ORNL/ER-136
DE92015910	WHC-SA-1489	DE92018995	LA-UR-92-2508	DE92041105	ANL/CP-76005
DE92015975	LA-12221-MS	DE92019010	ES/ER/TM-33	DE92041218	ORNL/ER/Sub-90-LJ068/1
DE92016095	DOE/EW/40017-T2	DE92019071	ORNL/RASA-91/20	DE92041220	DOE/OR-1060-D1
DE92016188	ANL/CP-75817	DE92019072	ORNL/RASA-91/21	DE92041265	CONF-9210168-1
DE92016331	SAND-92-1161C	DE92019087	PNL-SA-21033		
DE92016336	SAND-92-1256C	DE92019125	PNL-SA-20622		
DE92016386	ORISE-92/E-41	DE92019187	CONF-921029-1		

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DE92041271	DOE/OR-1054-D1	DE93001672	WHC-EP-0550	DE93004070	WHC-EP-0337-Rev.2
DE92041274	Y/ER-29	DE93001673	WHC-SP-0852	DE93004112	CONF-921137-2
DE92041328	PNL-SA-20941	DE93001676	WHC-EP-0516	DE93004115	CONF-921137-4
DE92041332	PNL-SA-21233	DE93001677	WHC-SP-0850	DE93004161	CONF-930403-8
DE92041340	PNL-SA-20912	DE93001717	CONF-921029-10	DE93004173	CONF-921137-5
DE92041348	ORNL/RASA-91/17	DE93001752	WHC-EP-0570	DE93004190	ANL/CMT/CP-76415
DE92041349	ORNL/RASA-91/12	DE93001753	WHC-EP-0531-Rev.1	DE93004202	ANL/EAIS/CP-77680
DE92041351	ORNL/RASA-91/15	DE93001754	WHC-EP-0182-48	DE93004232	ANL/EWM/CP-78035
DE92041364	DOE/MWIP-1	DE93001755	WHC-EP-0182-51	DE93004277	PNL-8358
DE92041365	ORNL/RASA-91/9	DE93001758	DOE/EM-0095P	DE93004309	ORNL/TM-12152
DE92041366	ORNL/RASA-91/14	DE93001787	ORNL/ER-135	DE93004327	PNL-SA-21471
DE92041368	ORNL/RASA-91/19	DE93001895	LA-12195-MS	DE93004381	ANL/EAIS/TM-80
DE92041369	ORNL/RASA-91/18	DE93001932	EGG-WTD-10254	DE93004404	PNL-SA-20937
DE92041370	ORNL/RASA-91/30	DE93001933	ES/ER/TM-38	DE93004428	POEF/ER-4549
DE93000420	ORNL/RASA-91/29	DE93001935	INEL/MISC-92065	DE93004483	PNL-8332
DE93000428	CONF-9210174-1	DE93001936	DOE/EA-0499	DE93004487	WHC-SA-1450
DE93000433	CONF-921029-5	DE93001938	EGG-WTD-10204	DE93004488	WHC-EP-0581
DE93000438	CONF-921029-7	DE93001939	EGG-WTD-10354	DE93004490	WHC-EP-0588
DE93000479	PNL-8294	DE93001944	DOE/EA-0809	DE93004494	WHC-SA-1555
DE93000481	PNL-8219	DE93002043	PNL-8173	DE93004495	WHC-SA-1416
DE93000503	ORNL-6638	DE93002050	WHC-EP-0572	DE93004496	WHC-SA-1679
DE93000547	ORNL/ER-137	DE93002053	WHC-EP-0402-Rev.1	DE93004508	WHC-SA-1667
DE93000548	ORNL/ER-154	DE93002117	ANL/ESD/TM-32	DE93004510	WHC-SA-1713
DE93000549	ORNL/ER-62/R1	DE93002176	DOE/RL-90-04-Rev.1	DE93004518	WHC-SA-1756
DE93000550	ORNL/RASA-91/25	DE93002182	PNL-8333	DE93004612	ORNL/RASA-92/4
DE93000551	ORNL/RASA-92/3	DE93002197	DOE/RL-90-20	DE93004613	ORNL/ER-39
DE93000552	ORNL/RASA-91/27	DE93002240	WHC-MR-0392	DE93004619	CONF-930519-6
DE93000553	ORNL/ER-84	DE93002241	WHC-SA-1205	DE93004698	Y/ER-50
DE93000554	ES/ER/TM-41	DE93002255	POEF/ER-4547	DE93004789	CONF-921137-7
DE93000555	ORNL/RASA-91/26	DE93002292	SAND-92-2254C	DE93004842	PNL-SA-21166
DE93000556	ORNL/RASA-91/22	DE93002311	DOE/EW/40017-T3	DE93004979	WHC-EP-0182-52
DE93000557	ORNL/RASA-91/24	DE93002342	CONF-930205-1	DE93004980	WHC-SA-1492-Rev.1
DE93000558	ORNL/RASA-91/28	DE93002378	CONF-9208125-	DE93004981	WHC-SA-1191
DE93000559	ORNL/RASA-91/23	DE93002410	ORNL/TM-12036	DE93004982	WHC-EP-0182-53
DE93000588	ORNL/ER-124	DE93002479	SAND-92-0818C	DE93004983	WHC-MR-0398
DE93000719	ORNL/ER-139	DE93002545	IS-M-730	DE93004985	WHC-EP-0365-2
DE93000741	SAND-92-0817C	DE93002706	ORNL/ER-121	DE93004986	WHC-EP-0589
DE93000788	ES/ER/TM-26/R1	DE93002708	LA-12356	DE93004988	WHC-SA-1501
DE93000823	ORNL/ER-117	DE93002805	WHC-SA-1591	DE93004989	WHC-MR-0302-Suppl.1
DE93000946	DOE/EM-0079	DE93002870	DOE/ID/12584-103	DE93004995	WHC-SA-1565
DE93000965	PNL-8281	DE93002871	DOE/ID/12584-T2	DE93004996	WHC-EP-0584
DE93000977	ORNL/ER-85	DE93002874	ORNL/TM-12185	DE93004997	WHC-SA-1669
DE93000978	CONF-921029-4	DE93003020	CONF-921029-11	DE93004998	WHC-SA-1411-Rev.2
DE93001262	DOE/OR/21949-343	DE93003021	CONF-921029-12	DE93005000	WHC-EP-0535-1
DE93001263	DOE/OR/21949-344	DE93003025	CONF-921029-13	DE93005012	WHC-MR-0302
DE93001264	DOE/OR/21949-345	DE93003030	CONF-921029-15	DE93005014	WHC-EP-0560
DE93001265	DOE/OR/21949-346	DE93003135	DOE/EM-0088P	DE93005036	PNL-SA-20888
DE93001266	DOE/OR/21949-340	DE93003226	SAND-92-1952	DE93005040	PNL-8286
DE93001267	DOE/OR/21949-341	DE93003254	DOE/ID/13042-T4	DE93005068	DOE/LLW-152
DE93001268	DOE/OR/21949-342	DE93003320	POEF/ER-4548	DE93005134	WHC-SD-WM-ES-219
DE93001287	LA-SUB-92-9-Pt.11	DE93003366	ORNL/ER-146	DE93005143	DOE/DP/48075-7
DE93001297	ORNL/ER-90	DE93003385	WHC-EP-0601	DE93005144	DOE/DP/48075-8
DE93001307	PNL-SA-21215	DE93003590	DOE/OR-1077	DE93005152	CONF-930160-2
DE93001308	PNL-SA-20978	DE93003602	CONF-930403-4	DE93005173	ES/ER/TM-52
DE93001310	PNL-SA-20710	DE93003627	DOE/EIS-0185D-091	DE93005176	ORNL/ER-125
DE93001312	PNL-SA-20868	DE93003638	WHC-EP-0554	DE93005177	DOE/LLW-156
DE93001380	PNL-SA-20623	DE93003667	ORNL/TM-12191	DE93005190	EGG-M-92644
DE93001420	ORNL/ER/Sub-91-KA931/4	DE93003672	ORNL/RASA-92/12	DE93005192	EGG-M-92605
DE93001421	DOE/OR-1070-D2	DE93003756	ORNL/TM-12198	DE93005202	EGG-WTD-10397
DE93001423	ORNL/ER-141	DE93003758	ORNL/RASA-92/5	DE93005233	EGG-WTD-10450
DE93001464	WHC-EP-0548	DE93003759	ORNL/RASA-92/6	DE93005247	DOE/LLW-151
DE93001465	WHC-SP-0434-14	DE93003760	ORNL/RASA-92/7	DE93005260	EGG-WTD-10386
DE93001477	WHC-SA-1613	DE93003761	ORNL/RASA-92/8	DE93005261	EGG-WTD-10429
DE93001478	WHC-SA-1574	DE93003762	ORNL/RASA-92/9	DE93005268	EGG-PHY-10446
DE93001516	PNL-SA-21009	DE93003923	DOE/EIS-0185D-160	DE93005279	DOE/OR/00033-T517
DE93001661	WHC-EP-0562	DE93003924	DOE/EIS-0185D-148-Vol.2	DE93005282	DOE/OR/00033-T514
DE93001663	WHC-SA-0873	DE93003925	DOE/EIS-0185D-148-Vol.1	DE93005316	CONF-9108226-Summ.
DE93001666	WHC-EP-0182-50	DE93003926	DOE/EIS-0185D-074-Vol.1	DE93005318	CONF-920791-
DE93001667	WHC-EP-0563	DE93003927	DOE/EIS-0185D-074-Vol.2	DE93005343	SAND-92-2773C
DE93001668	WHC-EP-0573	DE93003984	WHC-EP-0489-1	DE93005344	SAND-92-2727C
DE93001669	WHC-SP-0851	DE93003997	SAND-92-1570C	DE93005365	SAND-92-2737C

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DE93005393	CONF-911133-13	DE93007272	BNL-48363	DE93008962	DOE/UMTRA-400690-0000
DE93005446	LA-UR-92-4053	DE93007421	SAND-91-7083	DE93008963	DOE/UMTRA-400679-0000
DE93005456	LA-UR-92-3977	DE93007465	WHC-EP-0372-Vol.1-Rev.1	DE93008964	DOE/UMTRA-400665-0000
DE93005574	ANL/CMT/CP-76241	DE93007636	EGG-WMO-10244-Pt.2	DE93008965	DOE/UMTRA-400689-0000
DE93005693	DOE/AL-150329.0001	DE93007637	EGG-WMO-10244-Pt.1	DE93008966	DOE/UMTRA-400669-0000
DE93005694	DOE/AL-150329.0002	DE93007638	WM-PD-91-003-Vol.1	DE93008967	DOE/UMTRA-050510-GRNO-Vol.1
DE93005695	DOE/UMTRA-150329-0003	DE93007641	EGG-WTD-10566	DE93008968	DOE/UMTRA-050510-GRNO-Vol.2A
DE93005763	CONF-921137-14	DE93007647	DOE/LLW-159	DE93009025	DOE/UMTRA-050510-0000-Rev.1-Vol.3
DE93005778	CONF-930519-8	DE93007698	LBL-33252	DE93009066	UCRL-JC-112985
DE93005781	ANL/EAIS/TM-77	DE93007790	ORNL/TM-12201	DE93009099	DOE/UMTRA-050510-GRNO-Vol.3
DE93005823	UCRL-JC-109768-Rev.1	DE93007796	ORNL/TM-12169	DE93009100	DOE/UMTRA-050510-CARD
DE93005828	UCRL-JC-112062	DE93007798	ORNL/TM-12074	DE93009101	DOE/UMTRA-050510-0000-Rev.1-Vol.1
DE93005843	WHC-EP-0587	DE93007801	ES/ER/TM-48/Pt.1	DE93009102	DOE/UMTRA-050510-GRNO
DE93005876	WHC-EP-0475-1	DE93007802	ES/ER/TM-48/Pt.2	DE93009137	DOE/UMTRA-050516-0000-Vol.1
DE93005877	WHC-EP-0469-1	DE93007819	CONF-930205-13	DE93009138	DOE/UMTRA-050516-0000-Vol.2
DE93005878	WHC-EP-0472-1	DE93007877	PNL-SA-21731	DE93009139	DOE/UMTRA-050516-0000-Vol.3
DE93005889	WHC-SA-1741	DE93007878	PNL-SA-21730	DE93009140	DOE/UMTRA-400670-0000
DE93005890	WHC-EP-0468-1	DE93007880	PNL-SA-21706	DE93009141	DOE/UMTRA-0505125-0000
DE93005898	WHC-MR-0289-Rev.2	DE93007993	PNL-SA-21710	DE93009143	DOE/UMTRA-050512-0000
DE93005911	SAND-92-1303	DE93008008	LA-SUB-93-29	DE93009144	DOE/UMTRA-050512-App.B-Attach.1
DE93005948	DOE/UMTRA-400671-0000	DE93008024	UCRL-JC-109769	DE93009145	DOE/UMTRA-050512-0000-Attach.2
DE93005953	DOE/UMTRA-350214-0000	DE93008145	WHC-EP-0182-54	DE93009146	DOE/UMTRA-050512-0000-App.B-Attach.3
DE93005955	DOE/UMTRA-350125-0000-Rev.1	DE93008147	WHC-SA-1581	DE93009147	DOE/UMTRA-050512-0000-Attach.4
DE93006033	ANL/EAIS/TM-78	DE93008148	WHC-EP-0426-Rev.3	DE93009154	PNL-8478
DE93006214	CONF-930589-1	DE93008156	WHC-EP-0347-Suppl.2	DE93009205	ANL/CMT/CP-78935
DE93006222	CONF-930160-4	DE93008159	WHC-SP-0850-Rev.1	DE93009207	ANL/CMT/CP-77506
DE93006250	WHC-EP-0462	DE93008160	WHC-EP-0606	DE93009282	UCRL-JC-110827
DE93006269	DOE/OR-01-1110-D2	DE93008161	WHC-EP-0586	DE93009284	UCRL-JC-110055
DE93006272	ORNL/ER-155	DE93008162	WHC-EP-0474-6	DE93009291	UCRL-JC-110525
DE93006273	DOE/OR-01-1111-D1	DE93008163	WHC-SA-1680	DE93009335	ORNL/ER/Sub-87-99053/64
DE93006363	ORNL/ER-142	DE93008164	WHC-EP-0392-Rev.1	DE93009362	WHC-EP-0566
DE93006364	ORNL/ER-81	DE93008174	WHC-EP-0596	DE93009419	WHC-SA-1668
DE93006402	ANL/CMT/CP-76242	DE93008175	WHC-SA-1833	DE93009421	WHC-SA-1673
DE93006403	ANL/CMT/CP-76239	DE93008176	WHC-EP-0610	DE93009423	WHC-SA-1687
DE93006405	ANL/CMT/CP-76238	DE93008179	WHC-SA-1830	DE93009425	WHC-SA-1608
DE93006419	ANL/CMT/CP-76240	DE93008243	WHC-MR-0402	DE93009426	WHC-SA-1825
DE93006525	WHC-EP-0430-Rev.1	DE93008244	WHC-EP-0473	DE93009427	WHC-MR-0387-2
DE93006526	WHC-MR-0388	DE93008259	PNL-SA-20802	DE93009428	WHC-EP-0577
DE93006532	WHC-MR-0382	DE93008261	PNL-SA-20984	DE93009429	WHC-SA-1662
DE93006533	WHC-MR-0386	DE93008338	SAND-93-0207C	DE93009430	WHC-SA-1551
DE93006605	PNL-8167	DE93008487	ORNL/M-2563	DE93009431	WHC-SA-1609
DE93006622	CONF-9306100-1	DE93008500	DOE/UMTRA-400681-0000	DE93009466	DOE/UMTRA-400655-0000
DE93006723	ORNL/ER-134	DE93008563	BNL-48252	DE93009467	DOE/UMTRA-400662-0000
DE93006773	SAND-92-1604C	DE93008616	NVO-325-Rev.1	DE93009468	DOE/UMTRA-400730-0000
DE93006841	ORNL/ER-150	DE93008622	UCID-21536-Add.2	DE93009469	DOE/UMTRA-400663-0000
DE93006901	WHC-SP-0704	DE93008646	ANL/MCT/CP-77586	DE93009470	DOE/UMTRA-050126-0000
DE93006904	WHC-SA-1763	DE93008653	ANL/CMT/CP-77656	DE93009474	WHC-EP-0603
DE93006905	WHC-SA-1796	DE93008654	ANL/CMT/CP-77587	DE93009475	PNL-SA-21463
DE93006906	WHC-MR-0284	DE93008655	ANL/CMT/CP-77655	DE93009477	PNL-SA-21537
DE93006907	WHC-SA-1722	DE93008674	LA-SUB-93-48	DE93009485	K-2073-Vol.1
DE93006957	DOE/EM-0091P	DE93008679	LA-SUB-93-92	DE93009486	K-2073-Vol.2
DE93006967	UCRL-ID-110534	DE93008690	KER-56	DE93009487	K-2073-Vol.3A
DE93006986	SAND-92-0556	DE93008714	LA-UR-93-456	DE93009488	K-2073-Vol.3B
DE93007031	WHC-SP-0822	DE93008728	LA-UR-93-656	DE93009532	DOE/CH-9212
DE93007046	DOE/LLW-117	DE93008838	WHC-EP-0578	DE93009593	DOE/UMTRA-050518-0000-App.A-C
DE93007047	DOE/LLW-118	DE93008840	WHC-EP-0609	DE93009595	DOE/UMTRA-050518-0000-App.E
DE93007048	DOE/LLW-119	DE93008899	BNL-52357	DE93009610	ANL/EAIS/TM-79
DE93007049	DOE/LLW-120	DE93008906	WHC-EP-0569		
DE93007120	DOE/ID-10412	DE93008910	LA-SUB-93-83		
DE93007121	DOE/ID-10408	DE93008915	PNL-SA-20853		
DE93007122	DOE/ID-10411	DE93008948	PNL-8144		
DE93007123	DOE/ID-10409	DE93008950	PNL-8528		
DE93007124	DOE/ID-10410	DE93008951	DOE/UMTRA-150129-0000		
DE93007125	DOE/ID-10317-Rev.1	DE93008952	DOE/UMTRA-150312-0000		
DE93007145	EGG-ME-10522	DE93008953	DOE/UMTRA-050510-0000-Rev.1-Vol.2		
DE93007177	PNL-8403	DE93008955	DOE/UMTRA-400661-0000		
DE93007226	DOE/LLW-133	DE93008956	DOE/UMTRA-150306-MITI		
DE93007229	DOE/LLW-164	DE93008958	DOE/UMTRA-150128-0000		
DE93007247	CONF-930255-1	DE93008959	DOE/UMTRA-050130-0000		
DE93007249	CONF-930403-15	DE93008960	DOE/UMTRA-400668-0000		

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DE93009627	SAND-92-2182C	DE93010485	DOE/UMTRA-050508-0000- Attach.3-App.C	DE93011793	BNL-52361
DE93009664	CONF-930257-3	DE93010493	DOE/FTR-93010493	DE93011817	ORNL/FTR-4562
DE93009720	CONF-930304-12	DE93010498	UCRL-JC-109668	DE93011828	ES/ER/TM-62
DE93009728	CONF-930205-55	DE93010559	ES/ER/TM-60	DE93011831	Y/ER-69
DE93009796	SAND-93-0003C	DE93010588	DOE/UMTRA-400134-0000	DE93011891	UCRL-JC-112832
DE93009811	PNL-SA-21857	DE93010591	DOE/UMTRA-400680-0000	DE93011903	WHC-EP-0617-Draft
DE93009813	PNL-SA-22047	DE93010604	PNL-8498	DE93011904	WHC-EP-0616
DE93009814	PNL-SA-21891	DE93010607	PNL-8589	DE93011937	WHC-EP-0501-Rev.1-Draft
DE93009831	SAND-92-2312C	DE93010639	DOE/FTR-93010639	DE93011938	WHC-EP-0627
DE93009837	SAND-93-0589C	DE93010652	CONF-910981-	DE93011940	WHC-SA-1734
DE93009850	SAND-93-0588C	DE93010665	ANL/ER/CP-77595	DE93012033	ORNL/TM-12139
DE93009983	ANL/CMT/CP-79163	DE93010726	LA-UR-93-998	DE93012076	ES/ER/TM-54
DE93010094	DOE/UMTRA-400666-0000	DE93010756	EGG-ESQ-10614	DE93012077	KY/ER-15
DE93010096	DOE/UMTRA-400677-0000	DE93010759	DOE/UMTRA-400327-0000	DE93012082	LA-SUB-93-118
DE93010097	DOE/UMTRA-400675-0000	DE93010763	DOE/UMTRA-050506-0000- Vol.2	DE93012093	ORNL/TM-12337
DE93010138	DOE/EW/40017-T4	DE93010782	DOE/FTR-93010782	DE93012097	DOE/NBM-1100-Vol.2
DE93010167	PNL-SA-21856	DE93010803	EGG-M-92580	DE93012098	DOE/NBM-1100-Vol.3
DE93010172	PNL-SA-21987	DE93010810	FEMP-93010810	DE93012099	DOE/NBM-1100-Vol.4
DE93010203	DOE/UMTRA-050506-0000- Vol.1	DE93010814	LA-SUB-93-138	DE93012101	DOE/NBM-1100-Vol.6
DE93010256	ORNL/ER-138	DE93010819	CONF-930403-35	DE93012142	EGG-2683
DE93010257	ORNL/RASA-92/14	DE93010822	CONF-930403-41	DE93012163	EGG-WTD-10677
DE93010258	K/TCO-1054	DE93010829	CONF-930403-34	DE93012166	EGG-WM-10630
DE93010268	CONF-930403-37	DE93010831	CONF-930364-1	DE93012167	EGG-WTD-10539
DE93010273	CONF-930403-38	DE93010833	ES/ER/TM-61	DE93012170	DOE/LLW-162
DE93010274	CONF-930403-39	DE93010842	DOE/OR-01-1138-D1	DE93012171	DOE/ID-10415
DE93010275	CONF-930403-40	DE93010884	ES/ER/TM-59	DE93012182	EGG-WTD-10612
DE93010322	DOE/UMTRA-400673-0000	DE93010885	DOE/OR-1051	DE93012183	EGG-WTD-10635
DE93010324	DOE/UMTRA-150320-EADR	DE93010886	DOE/UMTRA-050520-0000	DE93012185	EGG-WTD-10507
DE93010327	DOE/OR-01-1129-D1	DE93010888	DOE/UMTRA-050522-0000- Vol.1	DE93012188	EGG-WTD-10610
DE93010334	CONF-930403-48	DE93010889	DOE/UMTRA-050522-0000- Vol.2	DE93012189	EGG-WM-10533
DE93010335	CONF-930396-9	DE93010923	DOE/FTR-93010923	DE93012240	PNL-8539
DE93010339	CONF-930403-42	DE93011057	DOE/FTR-93011057	DE93012241	ORNL/RASA-93/1
DE93010340	CONF-930403-33	DE93011104	ORNL/FTR-4194	DE93012248	DOE/FTR-93012248
DE93010341	CONF-930403-31	DE93011105	ORNL/FTR-4208	DE93012258	LA-12464
DE93010352	DOE/UMTRA-050503-0000	DE93011235	PNL-8557	DE93012331	EGG-EELS-10666
DE93010384	DOE/UMTRA-050503- Attach.2	DE93011252	WHC-SA-1731	DE93012344	PNL-8295
DE93010385	DOE/UMTRA-050503- Attach.3	DE93011253	DOE/RL-92-20-Draft	DE93012360	DOE/FTR-93012360
DE93010386	DOE/UMTRA-050503-0000- Attach.4	DE93011254	WHC-SP-0920	DE93012400	PNL-8559
DE93010387	DOE/UMTRA-050503- Attach.5	DE93011274	WHC-SA-1810	DE93012428	ORNL/TM-12142
DE93010388	DOE/UMTRA-050503- Attach.6	DE93011275	WHC-SA-1772	DE93012477	UCRL-JC-110353
DE93010390	DOE/UMTRA-150308-GAME	DE93011276	WHC-SA-1770	DE93012513	ORNL/TM-11838
DE93010391	DOE/UMTRA-150308-MIT	DE93011277	WHC-SA-1735	DE93012520	BNL-48776
DE93010392	DOE/UMTRA-050128-0000	DE93011278	WHC-SA-1738	DE93012535	BNL-48777
DE93010393	DOE/UMTRA-050129-0000	DE93011280	WHC-SA-1733	DE93012585	UCRL-JC-111345
DE93010395	DOE/UMTRA-050127-0000	DE93011281	WHC-EP-0630	DE93012611	WHC-SA-1788
DE93010408	LBL-32529	DE93011282	WHC-SA-1698	DE93012612	WHC-MR-0391
DE93010428	ORNL/TM-12177	DE93011285	WHC-SP-1689	DE93012615	WHC-SA-1896
DE93010465	DOE/UMTRA-050515-0000- Vol.1	DE93011297	WHC-EP-0623	DE93012616	WHC-SA-1795
DE93010466	DOE/UMTRA-050515-0000- Vol.2-App.F	DE93011298	WHC-EP-0471-1	DE93012617	DOE/RL-92-51
DE93010469	DOE/UMTRA-400653-0000	DE93011299	WHC-SP-0615-Rev.3-Vol.1	DE93012619	WHC-SA-1883
DE93010471	DOE/UMTRA-050508-0000- Attach.4	DE93011352	WHC-SA-1867	DE93012620	DOE/RL-92-71
DE93010472	DOE/UMTRA-050508-0000- Attach.5	DE93011354	WHC-SA-1723	DE93012659	LA-UR-93-1206
DE93010473	DOE/UMTRA-050508-0000	DE93011357	WHC-SA-1544	DE93012660	LA-UR-93-1205
DE93010474	DOE/UMTRA-050508-0000- Attach.2	DE93011376	WHC-SD-EN-TP-020	DE93012661	LA-UR-93-1204
DE93010475	DOE/UMTRA-050508-0000- Attach.3	DE93011397	DOE/MWIP-2	DE93012725	LA-UR-93-1598
DE93010476	DOE/UMTRA-050508-0000- Attach.3-App.A	DE93011412	DOE/FTR-93011412	DE93012726	ORNL/TM-12329
DE93010484	DOE/UMTRA-050508-0000- Attach.3-App.B	DE93011432	DOE/FTR-93011432	DE93012769	PNL-8597
		DE93011518	DOE/EW/40017-T5	DE93012771	PNL-8617
		DE93011557	SAND-93-0678C	DE93012832	PNL-3777-Rev.2
		DE93011563	IS-5096	DE93012836	SAND-93-8558C
		DE93011578	SAND-93-0469C	DE93012860	SAND-93-0466C
		DE93011595	SAND-92-1537C	DE93012861	PNL-8492
		DE93011684	SAND-92-2296C	DE93012862	SAND-93-1027C
		DE93011691	PNL-8548	DE93012892	ANL/EAIS/CP-78705
		DE93011692	ORNL/TM-12243	DE93012898	ANL/CMT/CP-78025
		DE93011693	ES/ER/TM-55	DE93012903	ANL/CMT/CP-79523
		DE93011699	DOE/UMTRA-400135-0000	DE93012909	ANL/EAIS/CP-79173
				DE93012927	DOE/UMTRA-050506-Vol.5
				DE93012928	DOE/UMTRA-050506-Vol.3- App.F
				DE93012929	DOE/UMTRA-050506-Vol.4

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DE93012946	DOE/ID/13042-18	DE93014506	WHC-EP-0182-57	DE93016371	EGG-WTD-10443
DE93012947	DOE/ID/13042-22	DE93014589	WHC-SA-1637	DE93016374	EGG-WTD-10744
DE93012950	DOE/ID/13042-7	DE93014616	WHC-EP-0631	DE93016377	DOE/RL-89-08-02
DE93012955	DOE/ID/13042-17	DE93014619	WHC-EP-0648	DE93016379	WHC-EP-0394-5
DE93012956	DOE/ID/13042-16	DE93014623	WHC-EP-0466-1-Rev.1	DE93016401	DOE/ID-10054(91)
DE93012976	DOE/FTR-93012976	DE93014624	WHC-SA-1835	DE93016470	FEMP-2267
DE93013002	WHC-SA-1789	DE93014625	WHC-SA-1694	DE93016475	WHC-SA-1773
DE93013004	WHC-EP-0619-Vol.2	DE93014626	WHC-SA-1661	DE93016476	WHC-SA-1846
DE93013005	WHC-SA-1866	DE93014627	WHC-SA-1671	DE93016478	WHC-SA-1729
DE93013008	ORNL/FTR-4358	DE93014628	WHC-EP-0635	DE93016480	EGG-MS-10613
DE93013032	DOE/RL-92-12	DE93014631	WHC-EP-0474-7	DE93016484	EGG-MS-10646
DE93013050	WHC-SA-1921	DE93014632	WHC-EP-0182-58	DE93016485	LA-UR-93-2377
DE93013051	DOE/RL-92-18	DE93014633	WHC-EP-0182-55	DE93016511	SAND-93-0715C
DE93013110	PNL-8618	DE93014634	WHC-EP-0658	DE93016556	EGG-M-92597
DE93013113	ANL/EAIS/TM-94	DE93014637	ORNL/FTR-4601	DE93016575	PNL-8675
DE93013133	UCRL-JC-109902	DE93014660	ORNL/FTR-4611	DE93016595	EGG-MS-10657
DE93013160	PNL-SA-22251	DE93014810	DOE/FTR-93014810	DE93016606	LA-UR-93-2171
DE93013164	PNL-SA-21511	DE93014836	WHC-EP-0569-Rev.1	DE93016636	EGG-WTD-10717
DE93013166	PNL-SA-21559	DE93014916	WHC-SA-1623	DE93016637	EGG-M-92598
DE93013168	PNL-SA-21560	DE93015092	DOE/ID/13167-T2	DE93016654	ORNL/TM-12101
DE93013201	DOE/OR-01-1100-D2	DE93015161	ANL/CMT/CP-79597	DE93016668	EGG-EEL-10498
DE93013202	DOE/OR-1054-D2	DE93015206	CONF-930205-75	DE93016684	DOE/ID-10253-FY93
DE93013251	DOE/OR-01-1100-D3	DE93015212	CONF-930873-18	DE93016687	DOE/ID-10437(92)
DE93013397	DOE/FTR-93013397	DE93015266	LBL-32418	DE93016704	LBL-27170(1993)
DE93013457	ORNL/TM-12265	DE93015270	LBL-33957	DE93016708	PNL-8662
DE93013459	ORNL/TM-12297	DE93015303	DOE/FTR-93015303	DE93016709	PNL-8626
DE93013460	ORNL/TM-12315	DE93015433	CONF-9206116-5	DE93016710	PNL-8391
DE93013501	PNL-8632	DE93015435	CONF-930570-2	DE93016762	DOE/OR-01-1159-D1
DE93013504	PNL-SA-22303	DE93015439	CONF-930445-15	DE93016767	WHC-SD-WM-ES-218-Rev.1
DE93013505	PNL-SA-22322	DE93015445	CONF-930160-15	DE93016776	PNL-8655
DE93013558	DOE/FTR-93013558	DE93015461	CONF-930205-76	DE93016826	WHC-EP-0659
DE93013560	DOE/FTR-93013560	DE93015478	ORNL/ER-165	DE93016829	WHC-EP-0646
DE93013595	LA-12528	DE93015482	CONF-930205-73	DE93016830	PNL-8537
DE93013658	DOE/FTR-93013658	DE93015529	DOE/FTR-93015529	DE93016873	DOE/EA-0785
DE93013660	EGG-M-93176	DE93015547	ANL/RE/CP-79030	DE93016874	ORNL/TM-12362
DE93013668	EGG-M-92702	DE93015551	ANL/ES/CP-79581	DE93016908	DOE/OR-01-1135-D2
DE93013677	EGG-M-93135	DE93015567	WINCO-11926	DE93016909	DOE/OR-03-1150-D1
DE93013681	EGG-M-92586	DE93015579	DOE/METC/C-93/7063	DE93016912	ORNL/ER-166
DE93013696	DOE/LLW-166	DE93015606	ANL/EAIS-8	DE93016925	PNL-SA-21775
DE93013730	DOE/ID-10433	DE93015658	SAND-92-2630C	DE93016990	UCRL-JC-113854
DE93013738	DOE/LLW-172	DE93015672	PNL-SA-21452	DE93017124	PNL-SA-22070
DE93013739	DOE/LLW-161	DE93015673	PNL-SA-22530	DE93017128	DOE/FTR-93017128
DE93013740	DOE/LLW-171	DE93015697	PNL-SA-21683	DE93017148	PNL-SA-22574
DE93013742	EGG-MS-10617	DE93015861	DOE/MC/29467-93/C0192	DE93017180	UCRL-JC-110348
DE93013744	DOE/LLW-165	DE93015913	BNL-48921	DE93017184	UCRL-JC-112934
DE93013749	DOE/ID-10432	DE93015923	CONF-930570-4	DE93017226	YWM-162
DE93013843	UCRL-JC-112037	DE93015930	DOE/MC/29115-93/C0190	DE93017234	DOE/OR-01-1128-D1
DE93013897	SAND-92-1777	DE93015963	CONF-930572-7	DE93017236	ORNL/FTR-4655
DE93013930	BNL-52372	DE93016143	ORNL/M-2751/ES	DE93017241	ORNL/TM-12283
DE93013933	PNL-8596	DE93016144	ORNL/M-2751/V1/Pt.A	DE93017302	DOE/OR/21949-364
DE93013934	PNL-8334	DE93016146	ORNL/M-2751/V1/Pt.C	DE93017303	DOE/OR/21949-365
DE93014140	WHC-EP-0655-Draft	DE93016147	ORNL/M-2751/V2/Pt.A	DE93017304	DOE/OR/21949-366
DE93014164	WHC-SA-1920	DE93016149	ORNL/M-2751/V2/Pt.C	DE93017380	ORNL/RASA-93/3
DE93014186	WHC-EP-0621	DE93016221	WHC-EP-0125-5	DE93017394	DOE/LLW-144
DE93014189	WHC-SA-1748	DE93016222	WHC-EP-0643	DE93017395	DOE/LLW-170
DE93014190	WHC-SA-1423	DE93016223	WHC-SA-1812	DE93017444	ANL/FC/CP-77558
DE93014339	ORNL/ER-12	DE93016224	WHC-SA-1963	DE93017490	SAND-93-1403C
DE93014372	PNL-8653	DE93016225	WHC-SA-1964	DE93017497	SAND-93-1361C
DE93014394	DOE/OR-01-1136	DE93016228	WHC-EP-0591	DE93017560	ORNL/TM-12272
DE93014405	DOE/FTR-93014405	DE93016234	CONF-930483-10	DE93017594	WHC-EP-0595
DE93014485	WHC-SA-1708	DE93016331	SAND-93-8010	DE93017596	WHC-SA-1902
DE93014486	WHC-EP-0628	DE93016333	UCRL-LR-113891	DE93017637	SAND-93-0377C
DE93014487	WHC-EP-0461	DE93016347	WHC-SA-1928	DE93017680	WHC-SD-EN-TP-028
DE93014488	WHC-SA-1697	DE93016348	WHC-SA-1831	DE93017705	ANL/ER/CP-79013
DE93014489	WHC-EP-0532	DE93016351	WHC-EP-0480-1	DE93017730	BNL-52378
DE93014490	WHC-SA-1837	DE93016353	DOE/RL-93-11	DE93017754	ES/ER/TM-1/R2
DE93014491	WHC-SA-1701	DE93016354	WHC-EP-0489-2	DE93017755	DOE/OR-01-1168-D1
DE93014498	DOE/FTR-93014498	DE93016355	DOE/RL-93-16	DE93017799	WHC-MR-0416
DE93014503	WHC-EP-0576	DE93016356	DOE/RL-93-15	DE93017850	ORNL/TM-12317
DE93014504	WHC-EP-0182-56	DE93016357	DOE/RL-93-18	DE93017914	DOE/OR-01-1122-D3
DE93014505	WHC-SA-1630	DE93016369	EGG-WM-10496	DE93017955	ORNL/TM-12235

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DE93017973	UCRL-JC-113731	DE93040097	LA-UR-93-2935	DE93041041	ORNL/TM-11785
DE93017987	ORNL/TM-12225	DE93040098	LA-UR-93-2934	DE93041106	WHC-SD-EN-AP-145
DE93018059	WHC-EP-0661	DE93040140	LA-UR-93-3089	DE93041107	WHC-SD-EN-TI-181
DE93018060	WHC-EP-0182-60	DE93040236	ANL/CMT/CP-78476	DE93041109	WHC-SD-EN-TI-164
DE93018061	WHC-EP-0629	DE93040246	ANL/CMT/CP-79432	DE93041114	DOE/RL-91-40
DE93018062	WHC-EP-0640	DE93040274	ANL/CMT/CP-80618	DE93041131	DOE/METC/C-93/7098
DE93018064	WHC-EP-0182-61	DE93040313	WHC-SA-1811	DE93041132	WSRC-RP-93-610
DE93018065	WHC-MR-0413	DE93040315	WHC-EP-0461-Rev.1	DE93041171	ANL/CMT/CP-80310
DE93018125	DOE/FTR-93018125	DE93040316	WHC-SA-1482	DE93041217	DOE/MC/29109-3356
DE93018126	DOE/FTR-93018126	DE93040322	WHC-EP-0625	DE93041342	WHC-SD-C018H-ER-004
DE93018259	DOE/FTR-93018259	DE93040334	DOE/MWIP-4	DE94000049	DOE/MC/29119-3524
DE93018260	DOE/FTR-93018260	DE93040335	WHC-EP-0671	DE94000056	DOE/MC/29106-3531
DE93018338	DOE/OR/21949-369	DE93040336	WHC-SA-1805	DE94000059	DOE/MC/29120-3498
DE93018372	LA-UR-93-2516	DE93040337	WHC-SP-0918	DE94000062	DOE/MC/29113-3536
DE93018386	DOE/EM-0096	DE93040338	WHC-EP-0599	DE94000085	DOE/METC-94/1003
DE93018409	HWVP-89-007-Rev.3	DE93040339	WHC-EP-0662	DE94000304	UCRL-JC-110327
DE93018462	LA-UR-93-2673	DE93040340	WHC-EP-0474-08	DE94000334	CONF-9308180-1
DE93018501	WHC-EP-0644	DE93040363	DOE/ID/13215-T1	DE94000338	CONF-9308150-5
DE93018518	WHC-SD-EN-TP-030	DE93040370	WHC-SA-1997	DE94000349	PNL-8797
DE93018548	LA-UR-93-2584	DE93040382	WHC-SA-1821	DE94000394	UCRL-JC-114126
DE93018593	DOE/OR-1060-D3	DE93040391	WHC-EP-0597	DE94000411	CONF-9305181-
DE93018599	DOE/OR/21949-367	DE93040392	WHC-EP-0664	DE94000424	DOE/OR-01-1167-D1
DE93018600	DOE/OR/21949-368	DE93040393	WHC-SD-EN-AP-141	DE94000443	ANL/CMT/CP-79321
DE93018609	DOE/FTR-93018609	DE93040394	WHC-SD-EN-TI-174	DE94000468	ANL/EAIS/CP-80710
DE93018729	HWVP-89-001-Rev.1	DE93040395	WHC-MR-0420	DE94000547	PNL-8789
DE93018731	WHC-MR-0406	DE93040403	WHC-SD-EN-AP-134	DE94000552	DOE/EM-0104
DE93018734	WHC-SA-1807	DE93040404	WHC-EP-0666	DE94000561	ORNL/TM-11867
DE93018735	WHC-SA-1808	DE93040405	WHC-SA-1881	DE94000599	KY/ER-11
DE93018736	WHC-EP-0522	DE93040406	WHC-SA-1880	DE94000632	ANL/EAIS/TM-103
DE93018737	DOE/RL-93-36	DE93040407	WHC-SA-1878	DE94000633	PNL-8808
DE93018745	WHC-SD-EN-TI-110	DE93040408	WHC-SA-1799	DE94000676	LA-UR-93-3489
DE93018760	DOE/FTR-93018760	DE93040409	WHC-SA-2018	DE94000713	WINCO-1136
DE93018934	EGG-EEL-10794	DE93040412	DOE/RL-92-72-Rev.1	DE94000714	WINCO-1139
DE93018938	DOE/LLW-178	DE93040493	UCRL-21174	DE94000717	WINCO-1133
DE93018941	EGG-M-92714	DE93040571	LA-SUB-93-264	DE94000718	WINCO-1132
DE93018990	EGG-WTD-10716	DE93040579	DOE/MWIP-3-Vol.2	DE94000719	WINCO-1131
DE93019015	DOE/EIS-0185F-387	DE93040586	LA-SUB-93-200	DE94000720	WINCO-1130
DE93019019	ANL/EWM/CP-80486	DE93040592	ORNL/TM-12417	DE94000721	WINCO-1129
DE93019026	EGG-GEO-10797	DE93040594	DOE/MWIP-3-Vol.1	DE94000722	WINCO-1127
DE93019084	SAND-93-1568C	DE93040606	CONF-9307141-1	DE94000730	ORNL/TM-11824
DE93019122	WHC-EP-0651	DE93040667	PNL-SA-22904	DE94000731	ORNL/TM-12368
DE93019124	WHC-SA-1753	DE93040721	SAND-93-0070	DE94000736	WHC-SA-2078
DE93019129	WHC-SA-1816	DE93040728	DOE/EM-0001/92	DE94000737	WHC-EP-0620
DE93019130	WHC-EP-0660	DE93040745	DOE/AL/62350-33D	DE94000738	WHC-SD-EN-TI-198
DE93019165	CONF-930873-26	DE93040746	DOE/AL/62350-47D	DE94000852	DOE/OR/00033-T558
DE93019182	DOE/FTR-93019182	DE93040747	DOE/AL/62350-35F-Rev.1	DE94000903	PNL-8812
DE93019317	WHC-SA-1911	DE93040748	DOE/AL/62350-58F	DE94000904	PNL-8863
DE93019318	WHC-SA-1899	DE93040753	SAND-93-1468C	DE94000927	WINCO-11939
DE93019361	ORNL/TM-12217	DE93040823	ANL/EA/CP-78779	DE94000932	WINCO-11980
DE93019397	ORNL/TM-12260	DE93040824	ANL/CMT/CP-78043	DE94000933	WINCO-11935
DE93019470	BNL-48750	DE93040838	PNL-8817	DE94000936	WINCO-11933
DE93019471	BNL-48749	DE93040903	DOE/MWIP-8-Vol.1	DE94001007	WHC-SD-W026-TRP-006
DE93019492	WHC-EP-0626	DE93040933	IS-5082	DE94001032	ES/ER/TM-90
DE93019494	WHC-EP-0567-1	DE93041026	DOE/EA-0339	DE94001033	ES/ER/TM-89
DE93019531	ANL/EA/RP-80447	DE93041027	DOE/AL/62350-40PF- Attach.2	DE94001034	ES/ER/TM-91
DE93019549	LA-12572-ENV	DE93041028	DOE/AL/62350-40PF- Attach.3-4	DE94001035	ES/ER/TM-92
DE93019579	DOE/RL-93-63	DE93041029	DOE/AL/62350-40PF- Attach.3-App.A	DE94001080	PNL-8818
DE93019602	ORNL/ER-148	DE93041030	DOE/AL/62350-21D	DE94001085	PNL-8841
DE93019767	ANL/CMT/CP-80402	DE93041031	DOE/AL/62350-21D-Attach.2	DE94001086	PNL-8741
DE93019775	BNL-52384	DE93041032	DOE/AL/62350-21D-Attach.3	DE94001089	ORNL/TM-12437/V1
DE93019890	DOE/EW/50616-T13	DE93041033	DOE/AL/62350-21D- Attach.3-App.A	DE94001090	ORNL/TM-12437/V2
DE93019952	DOE/MWIP-10	DE93041034	DOE/AL/62350-21D- Attach.3-App.B	DE94001117	ORNL/TM-12063
DE93019953	DOE/MWIP-9	DE93041035	DOE/AL/62350-21D- Attach.3-App.C	DE94001153	ORNL/ER-180
DE93019974	WHC-MR-0423	DE93041036	DOE/AL/62350-21D-Attach.4	DE94001156	WHC-EP-0682
DE93019977	DOE/RL-93-39	DE93041037	DOE/EA-0464-Rev.1	DE94001172	DOE/RL-93-19
DE93019979	DOE/RL-93-08			DE94001173	WHC-SA-2025
DE93019981	PNL-8745			DE94001179	DOE/RL-92-29
DE93019983	DOE/RL-93-59			DE94001180	WHC-SA-2026
DE93019992	DOE/MC/29116-3406			DE94001184	WSRC-MS-93-511
DE93040018	DOE/MC/29113-3405			DE94001194	WHC-SA-1935
DE93040019	DOE/MC/29109-3392			DE94001225	WHC-EP-0688

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DE94001226	WHC-EP-0675	DE94002319	WHC-SA-2108	DE94002910	ANL/ER/CP-80564
DE94001227	WHC-SA-1939	DE94002353	WHC-SA-1943	DE94002919	DOE/LLW-181
DE94001228	WHC-EP-0679	DE94002354	WHC-EP-0643-Rev.1	DE94002926	SAND-93-1577C
DE94001230	WHC-EP-0619-Vol.3	DE94002355	WHC-EP-0365-3	DE94002935	DOE/ID-10057(92)
DE94001238	WHC-EP-0684	DE94002356	WHC-EP-0390-Rev.1	DE94002936	DOE/ID-10054(92)
DE94001273	ANL/EA/CP-79944	DE94002357	WHC-EP-0681	DE94002937	DOE/LLW-184
DE94001278	ANL/EA/CP-79850	DE94002358	WHC-EP-0640-Rev.1	DE94002979	ORNL/TM-12449
DE94001292	ANL/EAS/CP-79748	DE94002362	ANL/CMT/CP-80775	DE94003069	DOE/AL/62350-20F
DE94001293	ANL/EAS/CP-80858	DE94002363	ANL/DIS/CP-80919	DE94003070	DOE/AL/62350-44
DE94001341	ANL/RE/CP-78949	DE94002381	PNL-8875	DE94003071	DOE/AL/62350-56-Rev.4
DE94001419	SAND-93-2380C	DE94002382	PNL-8847	DE94003072	DOE/AL/62350-59
DE94001475	DOE/AL/62350-36PF	DE94002397	WHC-EP-0182-62	DE94003073	DOE/AL/62350-69F
DE94001476	ANL/DIS/CP-80955	DE94002409	WHC-SA-1941	DE94003074	DOE/AL/62350-74D
DE94001477	DOE/AL/62350-9F	DE94002411	WHC-SA-2033	DE94003075	DOE/AL/62350-79
DE94001478	DOE/AL/62350-38F	DE94002413	WHC-MR-0433	DE94003093	WHC-SA-1946
DE94001479	DOE/AL-0347	DE94002418	DOE/ID/13042-23	DE94003094	WHC-SA-1908
DE94001481	DOE/AL/62350-70F	DE94002425	WHC-EP-0668	DE94003095	WHC-EP-0650
DE94001508	DOE/AL/62350-54D	DE94002426	WHC-EP-0182-63	DE94003096	WHC-SA-2110
DE94001509	DOE/AL/62350-32D	DE94002456	CONF-930403-54	DE94003098	SAND-93-2670C
DE94001510	DOE/AL/62350-43D	DE94002477	WHC-MR-0270	DE94003175	ORNL/ER-169
DE94001511	DOE/AL/62350-53F	DE94002480	WHC-SD-EN-TI-162	DE94003177	DOE/EIS-0198-Rev.1
DE94001512	DOE/AL/62350-68F	DE94002481	WHC-EP-0674	DE94003187	FEMP-2310
DE94001513	DOE/AL/62350-48D	DE94002483	WHC-SA-1764	DE94003189	FEMP-2301
DE94001549	PNL-8813	DE94002484	WHC-EP-0394-6	DE94003207	ANL/CMT/CP-79803
DE94001551	PNL-8714	DE94002485	WHC-SD-EN-TI-188	DE94003213	ANL/EA/CP-79884
DE94001552	PNL-8876	DE94002489	CONF-930482-11	DE94003214	ANL/EA/CP-79945
DE94001554	PNL-8008	DE94002494	WHC-SD-EN-SD-001	DE94003215	ANL/EA/CP-79947
DE94001555	PNL-8871	DE94002495	WHC-SD-C018H-PLN-004	DE94003216	ANL/EA/CP-79948
DE94001564	DOE/EM-0099	DE94002499	LA-12650-MS	DE94003217	ANL/EA/CP-79949
DE94001570	LA-12654	DE94002537	ORNL/ER/Sub-87-99053/69	DE94003218	ANL/EA/CP-79950
DE94001658	DOE/OR-01-1168-D2	DE94002538	Y/TS-1016	DE94003328	WHC-EP-0573-1
DE94001670	PNL-SA-22596	DE94002540	CONF-931119-2	DE94003336	DOE/OR-01-1173-D1
DE94001674	PNL-SA-22765	DE94002547	FEMP-2288	DE94003465	DOE/RL-90-0025-Rev.1
DE94001678	PNL-8869	DE94002548	FEMP-2305	DE94003467	WHC-EP-0672
DE94001681	WHC-SA-2021	DE94002552	FEMP-2312	DE94003471	WHC-SA-1933
DE94001684	WHC-SD-EN-TP-033	DE94002557	FEMP/SUB-064	DE94003488	WHC-EP-0686
DE94001685	WHC-SD-EN-TI-195	DE94002584	DOE/OR-1152-D1	DE94003492	WHC-SA-2180
DE94001687	WHC-SA-2061	DE94002591	DOE/EM-0109P	DE94003493	WHC-EP-0683
DE94001688	WHC-SA-2059	DE94002604	EGG-2710	DE94003495	CONF-931043-3
DE94001689	WHC-SA-2058	DE94002605	PNL-8888	DE94003516	ORNL/ER/Sub-87-99053/55
DE94001690	WHC-SA-2056	DE94002687	LA-UR-93-3750	DE94003517	ORNL/ER/Sub-87-99053/62
DE94001691	WHC-SA-2055	DE94002694	LA-UR-93-3717	DE94003528	WHC-SD-WM-PRS-012
DE94001692	WHC-EP-0433	DE94002708	PNL-8830	DE94003538	PNL-8800
DE94001693	WHC-SA-2064	DE94002724	LA-UR-93-3800	DE94003540	DOE/FTR-94003540
DE94001694	WHC-SA-1929	DE94002751	ORNL/ER-143	DE94003541	ORNL/FTR-4833
DE94001696	WHC-SA-2057	DE94002752	DOE/OR-01-1169-D1	DE94003557	ORNL/FTR-4832
DE94001698	WHC-SA-1792	DE94002755	DOE/OR-01-1161-V1-D1	DE94003587	CONF-931043-6
DE94001699	WHC-SA-2175	DE94002798	CONF-931136-1	DE94003615	ORNL/TM-12251
DE94001772	UCRL-JC-115005	DE94002799	CONF-940550-8	DE94003658	DOE/OR/22160-T2
DE94001780	ORNL/TM-12403	DE94002809	EGG-MS-10642	DE94003677	PNL-8935
DE94001805	IS-M-774	DE94002810	EGG-WM-10823	DE94003699	PNL-SA-23164
DE94001823	SAND-93-2250C	DE94002831	PNL-8918	DE94003794	DOE/FTR-94003794
DE94001829	SAND-93-1244C	DE94002832	PNL-8920	DE94003803	SAND-93-2742C
DE94001837	LA-12667-MS	DE94002834	EGG-ERD-10422	DE94003819	WSRC-TR-93-459
DE94001868	PNL-8534-Vol.1	DE94002838	EGG-WTD-10812	DE94003840	DOE/EM-0108P
DE94001869	PNL-8534-Vol.2	DE94002841	EGG-WTD-10660	DE94003849	WHC-SA-1979
DE94001870	PNL-8534-Vol.3	DE94002842	EGG-WTD-10771	DE94003872	LA-12676-MS
DE94001871	PNL-8534-Vol.4	DE94002845	EGG-WTD-10878	DE94003873	WHC-EP-0415-Rev.1
DE94001872	PNL-8534-Vol.5	DE94002846	EGG-WTD-10875	DE94003874	PNL-8873
DE94001873	PNL-8534-Vol.6	DE94002847	EGG-WTD-10895	DE94003875	PNL-8927
DE94001880	DOE/OR-01-1115-D3	DE94002850	EGG-WTD-10663	DE94003904	DOE/RL-92-43
DE94001936	ES/ESH-37	DE94002861	EGG-WTD-10766	DE94003997	DOE/MWIP-14
DE94001937	ES/ESH-36	DE94002876	EGG-WTD-10703	DE94004033	WSRC-MS-93-362-Rev.1
DE94001950	DOE/OR-01-1115-D2	DE94002877	EGG-GEO-10798	DE94004053	DOE/MC/29109-3634
DE94001951	DOE/OR-01-1151-D1	DE94002878	EGG-WM-10477	DE94004062	DOE/MC/29112-3641
DE94001998	ORNL-6762	DE94002881	EGG-WTD-10813	DE94004078	DOE/MC/29103-3661
DE94001999	PNL-8620	DE94002882	EGG-ER-10792	DE94004083	DOE/MC/29119-3667
DE94002006	UCRL-JC-113790	DE94002883	EGG-ERD-10453	DE94004098	DOE/MC/29107-3701
DE94002042	SAND-93-7077C	DE94002897	EGG-2678(92)	DE94004223	PNL-8221-Rev.1
DE94002183	WHC-SA-1450-Rev.1	DE94002898	EGG-2679(92)	DE94004245	CONF-931043-7
DE94002196	CONF-9310205-1	DE94002899	EGG-WM-10728	DE94004254	WHC-EP-0182-64

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DE94004257	WHC-SD-WM-FRD-011	DE94005380	PNL-8868	DE94006305	ES/ER/TM-87/Pt.1
DE94004286	PNL-SA-22721	DE94005419	WHC-SA-1977	DE94006306	ES/ER/TM-87/Pt.2
DE94004288	PNL-SA-20825	DE94005420	WHC-SA-2132	DE94006308	DOE/MWIP-11
DE94004291	PNL-SA-22677	DE94005422	WHC-EP-0697	DE94006320	ES/ER/TM-96
DE94004292	PNL-SA-22431	DE94005424	WHC-SD-WM-ER-288	DE94006323	ES/ER/TM-102
DE94004294	PNL-SA-23141	DE94005425	WHC-MR-0440	DE94006324	ES/ER/TM-95
DE94004299	PNL-SA-22393	DE94005426	K/TCO-1090	DE94006325	WHC-MR-0442
DE94004300	PNL-8884	DE94005444	ORNL/GWPO-006	DE94006326	WHC-MR-0441
DE94004316	PNL-SA-21257	DE94005461	WHC-SD-EN-RA-014	DE94006327	WHC-SA-2263
DE94004319	PNL-SA-21763	DE94005478	ANL/CMT/CP-80027	DE94006328	WHC-SD-EN-EV-027
DE94004358	PNL-SA-22076	DE94005480	ORNL/ER/Sub-87-99053/56	DE94006329	WHC-SD-EN-TI-197
DE94004361	PNL-SA-22008	DE94005482	ANL/CMT/CP-79802	DE94006330	WHC-EP-0691
DE94004375	PNL-8949	DE94005484	ANL/ES/CP-81712	DE94006332	DOE/RL-93-35-Rev.1
DE94004410	WHC-SD-EN-SPP-003	DE94005485	WHC-SA-1529	DE94006334	SAND-94-8216
DE94004456	DOE/FTR-94004456	DE94005486	DOE/RL-93-68	DE94006345	DOE/RL-89-28-Rev.1
DE94004480	WHC-SA-2172	DE94005487	WHC-MR-0451	DE94006346	DOE/RL-93-101
DE94004483	DOE/RL-93-04	DE94005488	WHC-SD-WM-TRP-150	DE94006375	ES/ER/TM-75
DE94004484	WHC-SA-1907	DE94005489	WHC-SA-2074	DE94006381	DOE/OR/21548-243
DE94004490	WHC-SA-1976	DE94005497	PNL-8971	DE94006421	ORNL/RASA-93/7
DE94004491	WHC-SA-1576	DE94005507	BNL-49841	DE94006424	ANL/EAD/TM-9
DE94004538	ANL/EAD/TM-2	DE94005510	WHC-SP-0098-5	DE94006446	DOE/MC/29467-3475
DE94004572	ANL/CMT/CP-80026	DE94005511	WHC-MR-0426	DE94006470	SAND-93-2090C
DE94004575	ANL/CMT/CP-80025	DE94005512	DOE/RL-89-12-Rev.1	DE94006503	ES/ER/TM-97
DE94004576	ANL/CMT/CP-79780	DE94005513	WHC-EP-0680	DE94006523	FEMP-2316
DE94004591	PNL-SA-20608	DE94005514	WHC-EP-0701	DE94006536	ANL/EA/CP-80957
DE94004592	PNL-SA-22386	DE94005515	WHC-EP-0690	DE94006549	CONF-940159-1
DE94004594	PNL-SA-23363	DE94005568	IS-5085	DE94006580	SAND-93-0489C
DE94004600	PNL-SA-23357	DE94005569	IS-5093	DE94006587	SAND-93-4075C
DE94004601	ANL/CMT/CP-80024	DE94005571	IS-5099	DE94006601	SAND-94-0276C
DE94004713	DOE/RL-93-38-Exec.Summ.	DE94005597	DOE/NBM-1101	DE94006668	WSRC-TR-93-565
DE94004745	ORNL/ER-208	DE94005790	DOE/MC/29467-3559	DE94006720	UCRL-JC-116144
DE94004760	PNL-SA-22649	DE94005893	DOE/MC/29113-3608	DE94006722	UCRL-JC-115362
DE94004771	PNL-SA-23271	DE94005896	DOE/MC/29116-3575	DE94006804	DOE/ID/12584-148
DE94004776	PNL-SA-23098	DE94005902	DOE/MC/29116-3606	DE94006813	ANL/EA/CP-82021
DE94004784	PNL-SA-22817	DE94005914	DOE/MC/29113-3574	DE94006815	ANL/EA/CP-80969
DE94004786	PNL-SA-23007	DE94005920	ANL/CMT/CP-80123	DE94006823	ANL/EA/CP-80825
DE94004790	ORNL/ER-209	DE94005933	BNL-52402	DE94006825	ANL/EA/CP-80956
DE94004822	WHC-SA-1985	DE94005967	WHC-SA-2131	DE94006827	ANL/DIS/CP-80940
DE94004823	WHC-SA-1927	DE94005973	WHC-MR-0435	DE94006828	ANL/EA/CP-80958
DE94004824	WHC-EP-0474-9	DE94005974	WHC-EP-0713	DE94006829	ANL/EA/CP-80824
DE94004825	WHC-MR-0437	DE94005975	WHC-EP-0669	DE94006831	ANL/CMT/CP-80854
DE94004827	WHC-MR-0429	DE94005976	WHC-EP-0728	DE94006991	WHC-SD-EN-AP-151
DE94004829	DOE/AL/62350-10F	DE94005977	WHC-EP-0476-Rev.1	DE94006993	WHC-SD-EN-TI-216
DE94004830	DOE/AL/62350-19F-Rev.2	DE94005978	WHC-EP-0709	DE94006994	WHC-SD-EN-TI-212
DE94004831	DOE/AL/62350-57D	DE94005980	WHC-EP-0532-Rev.1	DE94006995	WHC-SD-EN-TP-039
DE94004832	DOE/AL/62350-60F	DE94005981	WHC-EP-0693	DE94006997	DOE/RL-93-94
DE94004833	DOE/AL/62350-61	DE94005982	DOE/RL-91-59	DE94007053	DOE/EM-94007053
DE94004834	DOE/AL/62350-68F-Rev.1	DE94005983	WHC-EP-0638	DE94007062	SAND-94-0537C
DE94004836	DOE/AL/62350-76-Rev.5	DE94005985	WHC-EP-0695	DE94007070	UCRL-JC-115724
DE94004837	DOE/AL/62350-86D	DE94005986	WHC-EP-0182-66	DE94007082	FEMP/SUB-074
DE94004838	DOE/AL/62350-88	DE94005987	WHC-EP-0470-1	DE94007146	WHC-SD-EN-AP-154
DE94004839	DOE/AL/62350-88F	DE94005996	ORNL/ER-169/S1	DE94007147	WHC-SD-EN-AP-122
DE94004841	K/TCO-1076	DE94006006	DOE/MC/29115-94/C0274	DE94007148	WHC-SD-EN-TI-219
DE94004845	WHC-EP-0468-2	DE94006110	PNL-8998	DE94007149	WHC-EP-0394-7
DE94004869	WHC-EP-0063-4	DE94006112	ORNL/TM-12258	DE94007150	DOE/RL-90-03-Rev.2
DE94004895	WHC-EP-0678	DE94006140	SAND-93-3987C	DE94007156	WHC-SD-EN-EV-026
DE94004896	DOE/RL-93-90	DE94006147	LA-UR-94-0337	DE94007158	DOE/RL-93-23
DE94004931	K/TCO-1089	DE94006152	LA-UR-94-361	DE94007161	DOE/OR/22160-T5
DE94005097	SAND-93-3846C	DE94006154	LA-UR-94-363	DE94007198	DOE/AL/62350-92
DE94005099	SAND-93-7113C	DE94006186	ORNL/RASA-93/5	DE94007199	DOE/AL/62350-100
DE94005100	SAND-93-7112C	DE94006196	SAND-93-2231C	DE94007200	DOE/AL/62350-90D
DE94005121	ANL/EA/CP-81474	DE94006199	DOE/AL/62350-68F-Rev.2	DE94007201	DOE/AL/62350-78
DE94005145	BNL-49709	DE94006200	DOE/AL/62350-87D	DE94007202	DOE/EA-0464-Rev.3
DE94005146	DOE/HWP-147	DE94006201	DOE/EA-0464-Rev.2	DE94007203	DOE/AL/62350-97D
DE94005183	DOE/LLW-99	DE94006202	DOE/AL/62350-53F-Rev.1	DE94007205	DOE/UMTRA-3050-93-1235-Vol.1
DE94005243	LA-12701-MS	DE94006226	LA-UR-94-52	DE94007206	DOE/UMTRA-3050-93-1235-Vol.2
DE94005295	PNL-8991	DE94006246	LA-UR-94-0130	DE94007213	CONF-940501-2
DE94005296	PNL-8992	DE94006263	LA-UR-94-186	DE94007244	DOE/OR-01-1192-D1
DE94005329	ORNL/TM-12401	DE94006283	DOE/OR-01-1175/V1	DE94007312	DOE/METC/C-94/7119
DE94005359	DOE/MWIP-13	DE94006284	DOE/OR-01-1175/V2		
DE94005364	FEMP/SUB-068	DE94006285	DOE/OR-01-1175-V3		

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DE94007344	PATENTS-US-A7841108	DE94008603	DOE/AL/62350-21PF- Attach.4	DE94009385	WHC-SD-W100-TP-002
DE94007408	ORNL/TM-12679	DE94008604	CONF-940225-79	DE94009386	WHC-SA-2100
DE94007415	CONF-940353-3	DE94008606	CONF-940225-76	DE94009387	WHC-EP-0774
DE94007424	DOE/RL-93-56-3	DE94008607	CONF-940225-77	DE94009388	WHC-MR-0289-Rev.3
DE94007425	WHC-EP-0698	DE94008609	CONF-940225-74	DE94009389	WHC-EP-0619-Vol.1
DE94007459	IS-5104	DE94008611	WHC-SD-ER-DTR-001	DE94009390	WHC-EP-0619-Vol.4
DE94007487	PNL-SA-21829	DE94008618	SAND-94-0797C	DE94009433	WHC-SA-2288
DE94007526	LA-UR-94-400	DE94008633	DOE/MC/29113-3689	DE94009436	WHC-SA-2113
DE94007541	LA-UR-94-493	DE94008645	DOE/RL-93-21-Vol.1	DE94009437	WHC-SA-2123
DE94007563	LA-UR-94-607	DE94008646	DOE/RL-93-21-Vol.2	DE94009438	WHC-MR-0438
DE94007570	LA-UR-94-593	DE94008647	DOE/NV/11432-32	DE94009439	WHC-SA-2341
DE94007576	LA-UR-94-572	DE94008656	WHC-EP-0673	DE94009442	WHC-EP-0734
DE94007577	LA-UR-94-570	DE94008658	WHC-EP-0726	DE94009443	ORNL/ER-186
DE94007578	LA-UR-94-557	DE94008659	WHC-SA-1917	DE94009444	DOE/OR-01-1254-D1
DE94007646	ANL/EA/CP-80790	DE94008733	PNL-SA-23181	DE94009445	ORNL/ER-173
DE94007651	ANL/DIS/CP-82018	DE94008748	ORNL/TM-12657	DE94009461	PNL-9368
DE94007652	ANL/EA/CP-82020	DE94008749	ORNL/FTR-4921	DE94009491	ORNL/ER-220
DE94007655	ANL/EA/CP-80977	DE94008794	UCRL-CR-116354	DE94009494	ORNL/ER-223
DE94007658	DOE/EH-94007658	DE94008798	WINCO-1187	DE94009495	ES/ER/TM-78
DE94007674	ANL/EA/CP-80972	DE94008799	WINCO-1178	DE94009501	ORNL/ER-219
DE94007696	ANL/EA/CP-80976	DE94008800	WINCO-1177	DE94009504	ORNL/ER-200
DE94007699	ANL/CMT/CP-80028	DE94008801	WINCO-1176	DE94009505	DOE/OR-03-1195-D1
DE94007727	LA-12742-MS	DE94008802	WINCO-1173	DE94009523	ORNL/TM-12656
DE94007730	SAND-93-3966C	DE94008803	WINCO-1171	DE94009548	DOE/MC/29107-94/C0331
DE94007741	SAND-94-0658C	DE94008807	WINCO-1150	DE94009555	SAND-94-0680C
DE94007758	UCRL-ID-115373	DE94008808	WINCO-1165	DE94009569	FEMP-2334
DE94007838	DOE/EM-0139P	DE94008809	WINCO-1164	DE94009608	WHC-SA-2101
DE94007852	SAND-94-0488C	DE94008810	WINCO-1163	DE94009609	WHC-SA-2065
DE94007918	ORNL/TM-12642	DE94008811	WINCO-1153	DE94009662	WHC-SA-2264
DE94007919	ES/ER/TM-101	DE94008822	DOE/ID/13042-26	DE94009663	WHC-SA-2118
DE94007974	DOE/CH-9202	DE94008823	DOE/ID/13042-27	DE94009664	WHC-SD-EN-TI-218
DE94007981	SAND-93-2330/1	DE94008824	DOE/ID/13042-28	DE94009665	DOE/RL-93-88
DE94007983	DOE/RL-93-104	DE94008825	DOE/ID/13042-29	DE94009728	ANL/EA/CP-82328
DE94007991	DOE/RL-93-76	DE94008826	DOE/ID/13042-30	DE94009753	WHC-EP-0733
DE94007992	DOE/RL-93-38	DE94008853	DOE/EM-0121P	DE94009754	WHC-EP-0719
DE94008056	PNL-SA-23035	DE94008854	DOE/EM-0122P	DE94009756	WHC-SA-2105
DE94008058	PNL-SA-23686	DE94008855	DOE/EM-0123P	DE94009757	WHC-SA-2098
DE94008061	ORNL/ER-172	DE94008856	DOE/EM-0124P	DE94009760	WHC-SA-2361
DE94008062	ORNL/ER-204	DE94008857	DOE/EM-0125P	DE94009762	WHC-SA-2140
DE94008076	WHC-SD-EN-TP-038	DE94008858	DOE/EM-0126P	DE94009764	WHC-SA-2185
DE94008077	WHC-SA-2304	DE94008859	DOE/EM-0127P	DE94009765	WHC-SA-2159
DE94008091	BNL-49736	DE94008860	DOE/EM-0128P	DE94009766	WHC-SA-2186
DE94008102	ANL/CMT/CP-80987	DE94008861	DOE/EM-0129P	DE94009786	WHC-EP-0642
DE94008110	SAND-93-2330/2	DE94008862	DOE/EM-0134P	DE94009787	WHC-SA-2190
DE94008245	DOE/AL/62350-108	DE94008863	DOE/EM-0135P	DE94009804	ANL/CMT/PP-79479
DE94008246	DOE/AL/62350-109	DE94008864	DOE/EM-0136P	DE94009818	ANL/ET/CP-80828
DE94008313	SAND-94-0065	DE94008866	DOE/EM-0138P	DE94009843	PNL-9423
DE94008458	ANL/CMT/CP-82230	DE94008867	ORNL/RASA-93/4	DE94009862	ORNL/TM-12722
DE94008463	ANL/EWM/VU-82273	DE94008911	WINCO-1146	DE94009871	ORNL/M-2751/I
DE94008464	ANL/CMT/CP-80571	DE94008914	WINCO-1155	DE94009875	ES/ER/TM-85
DE94008512	EGG-WTD-10935	DE94008916	WINCO-1172	DE94009878	PNL-9408
DE94008513	DOE/LLW-193	DE94008918	WINCO-1180	DE94009882	PNL-SA-23721
DE94008516	EGG-WTD-10719	DE94008920	WINCO-1182	DE94009948	BNL-52417
DE94008520	EGG-CIET-11061	DE94008921	WINCO-1183	DE94009974	UCRL-ID-111623
DE94008521	EGG-WM-10823-Rev.1	DE94008922	WINCO-1184	DE94010000	UCRL-ID-113852
DE94008524	EGG-WM-10974	DE94008925	WINCO-1191	DE94010028	ORNL/ER-192
DE94008561	ORNL/TM-12687	DE94008926	WINCO-1192	DE94010029	ORNL/ER-203
DE94008589	EGG-WTD-10784-Vol.1	DE94008950	SAND-94-0857C	DE94010030	DOE/OR-01-1214-D2
DE94008590	EGG-WTD-10784-Vol.2	DE94008981	DOE/EM-0143P	DE94010094	DOE/OR-01-1214-D1
DE94008591	EGG-WTD-10784-Vol.3	DE94009007	PNL-8887	DE94010115	DOE/HWP-139
DE94008596	DOE/AL/62350-21PF	DE94009036	UCRL-ID-115626	DE94010118	ORNL/TM-12638
DE94008597	DOE/AL/62350-21PF- Attach.2	DE94009055	WSRC-MS-93-362	DE94010119	ORNL/M-3183
DE94008598	DOE/AL/62350-21PF- Attach.3	DE94009135	ORNL/RASA-94/1	DE94010123	CONF-940178-1
DE94008599	DOE/AL/62350-21PF- Attach.3-App.A	DE94009161	CONF-931136-3	DE94010130	CONF-940225-99
DE94008600	DOE/AL/62350-21PF- Attach.3-App.B	DE94009162	CONF-940553-25	DE94010131	CONF-9403102-1
DE94008601	DOE/AL/62350-21PF- Attach.3-App.C	DE94009174	CONF-940225-82	DE94010337	DOE/RL-94-32
		DE94009179	ORNL/ER/Sub-87-99053/70	DE94010338	DOE/RL-94-15
		DE94009188	DOE/EM-0141P	DE94010339	DOE/RL-93-06
		DE94009295	LA-UR-94-739	DE94010340	WHC-EP-0721
		DE94009334	LA-UR-94-1056	DE94010341	WHC-EP-0747-11
				DE94010342	WHC-SA-2152

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DE94010343	WHC-SA-2124	DE94011048	DOE/AL/62350-40F-Attach.2	DE94012312	DOE/RL-94-10-Vol.1-Pt.2
DE94010345	WHC-EP-0182-68	DE94011049	DOE/AL/62350-40F-Attach.3-App.A	DE94012313	DOE/RL-94-10-Vol.2
DE94010346	WHC-SA-2269			DE94012314	DOE/RL-94-10-Vol.3-Pt.1
DE94010347	WHC-SA-2129	DE94011050	K/TCO-1080	DE94012315	DOE/RL-94-10-Vol.3-Pt.2
DE94010348	WHC-SA-2102	DE94011114	DOE/ID/13215-T2	DE94012316	DOE/RL-94-10-Vol.4
DE94010349	WHC-SA-2130	DE94011115	DOE/ID/13215-T2-Attach.	DE94012317	DOE/RL-94-10-Vol.5
DE94010350	WHC-SA-2372	DE94011140	ANL/EAD/TM-13	DE94012321	CONF-940225-110
DE94010355	WHC-MR-0456	DE94011166	WSRC-MS-94-0233	DE94012322	CONF-940225-109
DE94010356	WHC-SD-EN-AP-157	DE94011238	PNL-SA-22430	DE94012331	CONF-940212-3
DE94010369	WHC-SD-EN-TI-173	DE94011245	SAND-93-2765	DE94012332	CONF-940225-111
DE94010371	WHC-SD-EN-TI-214	DE94011247	SAND-93-7040	DE94012393	WHC-EP-0723
DE94010373	WHC-SA-2111	DE94011330	WHC-SD-WM-RD-044	DE94012399	WHC-EP-0737
DE94010374	WHC-SA-2112	DE94011332	DOE/RL-93-57	DE94012400	WHC-EP-0747
DE94010376	WHC-SA-2336	DE94011338	WHC-SA-2169	DE94012402	WHC-EP-0717
DE94010377	WHC-MR-0293-Rev.2	DE94011388	WHC-SA-1982	DE94012403	ANL-94/9
DE94010378	WHC-SD-EN-TP-031	DE94011389	WHC-SA-1983	DE94012485	DOE/NE/37969-5
DE94010433	ANL/ET/CP-81294	DE94011390	WHC-EP-0474-12	DE94012580	DOE/EM-0147P
DE94010670	PNL-9439	DE94011393	WHC-EP-0734-Rev.1	DE94012619	BNL-52420
DE94010674	SAND-93-3884	DE94011394	WHC-EP-0436-Rev.1	DE94012653	CONF-940433-6
DE94010709	DOE/LLW-198	DE94011395	WHC-EP-0182-69	DE94012719	DOE/OR/21949-378
DE94010764	EGG-WM-11205	DE94011396	WHC-SA-2345	DE94012720	DOE/OR/21949-374
DE94010765	EGG-WM-11179	DE94011404	PNL-9426	DE94012721	DOE/OR/21949-379
DE94010776	EGG-WTD-10988	DE94011405	PNL-9459	DE94012752	CONF-940386-3
DE94010777	EGG-WTD-10931	DE94011414	WHC-SP-1072	DE94012772	DOE/EM-0149P
DE94010778	EGG-LLW-11140	DE94011439	PNL-SA-23921	DE94012775	PNL-9747
DE94010795	EGG-WM-11066	DE94011443	DOE/RL-94-37	DE94012831	DOE/RL/11946-T1-Vol.1
DE94010796	EGG-ENV-10975	DE94011444	WHC-SA-2094	DE94012832	DOE/RL/11946-T1-Vol.2
DE94010797	EGG-NRP-10991	DE94011445	WHC-SA-2143	DE94012833	DOE/RL/11946-T1-Vol.3A
DE94010799	SAND-94-0982C	DE94011448	WHC-SA-2300	DE94012834	DOE/RL/11946-T1-Vol.3B
DE94010803	SAND-94-1111C	DE94011450	WHC-EP-0636	DE94012855	DOE/EM-0142P
DE94010812	ORNL/ER-199	DE94011474	ANL/CMT/CP-81047	DE94012885	LA-UR-94-1361
DE94010887	WHC-EP-0757	DE94011475	ANL/CMT/CP-81229	DE94012919	SAND-94-1202C
DE94010889	WHC-EP-0749	DE94011476	ANL/CMT-ACL/CP-82220	DE94012934	DOE/RL-93-56-4
DE94010930	ORNL/TM-12715	DE94011491	ANL/CMT-ACL/CP-82554	DE94012987	UCRL-ID-115789
DE94011003	SAND-94-0214	DE94011592	WHC-SD-WM-SARR-001	DE94013012	WHC-SD-EN-TP-036
DE94011024	DOE/ID-10253-FY94	DE94011598	DOE/MWIP-15	DE94013040	DOE/EM-0157P
DE94011032	DOE/AL/62350-36-Rev.1	DE94011606	ORNL/TM-11358	DE94013041	DOE/EM-0158P
DE94011033	DOE/AL/62350-57D-Rev.1	DE94011738	BNL-49761	DE94013042	DOE/EM-0159P
DE94011034	DOE/AL/62350-111D	DE94011740	UCRL-JC-116132	DE94013043	DOE/EM-0160P
DE94011035	DOE/AL/62350-115	DE94011932	DOE/MWIP-19	DE94013083	WHC-SA-2439
DE94011036	DOE/EA-0339-Rev.1	DE94012120	PNL-9434	DE94013173	DOE/OR/22000-1
DE94011037	DOE/AL/62350-122	DE94012127	DOE/EM-0153P	DE94013376	DOE/EM-0161P
DE94011038	DOE/AL/62350-48F-Rev.1	DE94012136	PNL-9428	T192003986	DOE/RW-0006-Rev.7
DE94011039	DOE/AL/62350-118	DE94012245	PNL-SA-23793	T192015016	CAPE-3030
DE94011040	DOE/AL/62350-117	DE94012249	WHC-EP-0750-Vol.1	T192019845	CAPE-3035
DE94011041	DOE/AL/62350-40F-Attach.3-4	DE94012250	WHC-EP-0750-Vol.2	T193003928	CAPE-3064
DE94011042	DOE/EIS-0198-Rev.3	DE94012301	WHC-EP-0750-Vol.3	T193005041	DOE/RW-0006-Rev.8
DE94011043	DOE/AL/62350-110	DE94012302	WHC-EP-0750-Vol.4	T193012988	CAPE-3054
DE94011044	DOE/EIS-0198-Rev.2	DE94012303	WHC-EP-0750-Vol.5	T193017277	CAPE-3063
DE94011045	DOE/AL/62350-72D	DE94012304	WHC-EP-0750-Vol.6	T193017800	CAPE-3065
DE94011046	DOE/AL/62350-95D	DE94012305	WHC-EP-0750-Vol.7	T193040698	PNL-7840-Rev.1
DE94011047	DOE/AL/62350-77	DE94012310	DOE/MWIP-25		
		DE94012311	DOE/RL-94-10-Vol.1-Pt.1		