WSRC-TR-95-100-3

Savannah River Technology Center **Monthly Report**

March 1995

**Westinghouse Savannah River Company
Savannah River Site
Aiken, SC 29808**

Prepared for the U.S. Department of Energy under contract no. DE-AC09-89SR18035

MASTER

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED *DL*

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

This report has been reproduced directly from the best available copy.

Available to DOE and DOE contractors from the Office of Scientific and Technical Information, P.O. Box 62, Oak Ridge, TN 37831; prices available from (615) 576-8401.

Available to the public from the National Technical Information Service, U.S. Department of Commerce, 5285 Port Royal Road, Springfield, VA 22161.

WSRC-TR-95-100-3

**Savannah River Technology Center
Monthly Report**

March 1995

Executive Summary

TRITIUM

- Tritium testing in support of burst disks for the design agencies has been further defined to include accelerated aging and post-burst evaluations. LANL is pushing hard to handle all of the tritium mission associated with this program.
- As part of the Site's full scale D₂-filled capability demonstration, the resistance weld was radiographically examined and was judged to be acceptable. At the present time radiography provides the analyst with the geometrical "profile" of the resistance weld. A library of resistance weld profiles is being developed. Details of the laser drilling and welding effort were also provided by radiography.
- The full scale deuterium-loaded Terrazzo reservoir was successfully function tested, which demonstrated that no damage was caused to the unit by any of the reclamation steps. Preparations are being made to laser drill and laser weld tritium-exposed fill stems to look for any ³He effects on the laser weld.
- Recently, the Alloy Development Working Group held a meeting at LANL to discuss their latest findings and to plan a path forward. The group is tasked with developing new metal hydrides for tritium processing applications, and SRTC is providing the tritium data. An overview of the meeting is discussed.
- Plans are underway to re-establish the capability at Savannah River to expose laboratory samples to tritium at elevated temperatures and pressures. The capability is needed to support three programs: Conventional Forging Suitability, Burst Disk Development, and Weapons R&D.
- SRS personnel visited SNL/CA to discuss their inventory in the Life Storage Program as well as a five year plan for work.
- ADS led a multidivisional effort to resolve issues relating to the cleanliness of reservoirs.
- In-Bed Accountability tritium calibration of one of the RTF Product Beds has been completed. Analysis of calibration data for the bed indicates a full-bed measurement error of 1.2 percent.
- ADS provided technical assistance for the development of the Tritium Facilities Waste Characterization Plan.

- A classified report, "Tritium Reservoir Closure Weld Technical Data Summary" (WSRC-TR-95-0086, 2/22/95) has been completed and issued. This report is an extensive technical summary of the several types of resistance welds developed at Savannah River since 1957 to seal tritium reservoirs.
- Development of test plans and building of apparatus for prototype testing of a hydride storage vessel is in progress.
- Following the Tritium Facility loading line Operational Readiness Review (ORR), hot targets that are presently held in various Reactor basins will be processed.
- Fabrication of the experimental apparatus to evaluate poison resistance of coated hydrides has been completed with flow tests beginning after start-up of the equipment.
- The Advanced Test Reactor (ATR) is being studied as a contingency tritium production source. As part of this study, WSRC is participating in a program designed to establish the feasibility of producing tritium in the ATR. Aluminum-Lithium targets, produced in 300 Area, was irradiated in the ATR and will be extracted in Tritium facilities.
- EES has designed the necessary fixturing for laser drilling and re-welding tritium-exposed stems.
- The Hydraulic Burst System was turned over to EES for system check

SEPARATIONS

- A Pu-238 transfer package was delivered to Separations which allowed movement of 15 Pu-238 heat source spheres from F-Area to HB-Line (an award fee milestone). The deliverables included the package design, supporting hardware, On-site Safety Assessment, Safety Evaluation Report, and Onsite Package Authorization Form.
- A detailed Hydraulic Analysis for the FB-Line ion exchange column vent system has been completed. With normal gas production due to radiolysis and chemical oxidation of the resin and normal liquid height in the vent lines, the system was found to be adequate. In the unlikely event of a violent reaction, the system is not adequate to prevent possible column rupture. Strict adherence to administrative controls is necessary to prevent the initiation of a violent reaction.
- A mixing quality study was completed for process tanks in support of the heat transfer analysis in the F and H-Canyon BIOs. performed to assess the effectiveness of the canyon ventilation systems in removing heat generated from TBP/HNO₃ reactions. The study quantified layer formation as a function of organic concentration and liquid level and concluded the motion of the fluid in a geometrically similar tank is substantially greater than the movement one would expect from temperature driven natural convection.

- One of the residue processing options for recovery of plutonium in F-Canyon involves formation of a solid solution with UO_2 and the high-fired plutonium oxide using a microwave. This technology previously was demonstrated with equimolar mixtures of pure PuO_2 and UO_2 and is being scouted to see if it is feasible for ash and other impure PuO_2 residues.
- EES shipped the IAEA coulometer to F-Area on March 8th to undergo hot testing in the F-Area Analytical Labs.

ENVIRONMENTAL

- Storing fuel in SRS reactor disassembly basins after the cessation of reactor operations resulted in corrosion problems. This corrosion is not uniform throughout the basins, suggesting a possible relationship between corrosion rates and varying water quality conditions in various regions of the basins.
- Fish, sediment, and water samples were collected from Par Pond to evaluate the status of aquatic communities before it is refilled.
- Tree seedlings were planted in the delta and the upper corridor of Pen Branch. Monitoring plots will be installed in the delta to monitor survival and growth. A draft of the Mitigation Action Plan Update was submitted for the 1994 Environmental Report.
- The utility of a glow discharge (GD) ion source that replaces the ICP source on the SOLA mass spectrometer was demonstrated using a variety of bulk solids. Preliminary results indicate that direct ionization using the GD source provides a viable alternative to ICP-MS analysis, which requires dissolution of the solid sample.
- ICP-MS analysis of trace metals in twelve water samples were collected at various points along the Savannah River estuary and a report summarizing the results was issued.
- A small portable 256-channel multichannel analyzer is being tested for field-use in conjunction with a 1" x 1" NaI(Tl) detector. This system is under field testing as part of the RADMAPS project to develop field analysis methods for scintillation spectra.
- The TEWM-2 installed in the 400-D process sewer successfully operated and improvements to the water purification system are underway to permit an expanded choice of ion exchange resin media.
- A proposal was submitted to AMTEX to use SRTC's technology base on sizing and waste bioremediation for the textile industry.
- Representatives of the Biotechnology Group visited a South Carolina fermentation complex as part of the Industrial Assistance Program. The purpose of the trip was to assist company personnel in developing process changes designed to reduce the solid waste currently being placed into a landfill at the facility. After reviewing the waste composition, analyzing samples, and examining the process, it was determined that the waste cake

from the bottom of the fermentors is actually non-toxic and may be an excellent high-nitrogen fertilizer.

- As part of the Industrial Assistance Program, a meeting was held at the English China Clay (ECC) Plant in Sandersville, GA. ECC wishes to fund more extensive experiments at the lower radiation range in combination with various concentrations of biocides as well as other physical treatments such as elevated temperatures and shearing.
- Researchers from the Blackhawk Geosciences Division of Coleman Energy and Environmental System presented the results from the field work at A and M Areas. The work was completed as the Phase II and III portion of the METC/PRDA geophysical data fusion program. The seismic results clearly demonstrate that the top of the aquitard is an irregular undulating surface that varies in elevation, but that the unit is continuous across the traverse. The results show that these techniques have the potential to collect critical information about the subsurface hydrological regime that can be used to optimize remedial system designs resulting in significant cost savings.
- Researchers from the United States Geological Survey Geophysics (USGS) Branch of Geophysics presented the results of the preliminary phase of field work focusing on applying geophysical methods to characterization and monitoring of dense nonaqueous phase liquids (DNAPL). Results from initial field feasibility testing of borehole radar and seismic techniques for DNAPL characterization and monitoring studies were also presented.
- As part of the DOE-SR Special Consolidated Solicitation, a demonstration is being conducted to test a regenerative adsorption system for recovering chlorinated organic solvents for reuse. Tetra Tech and Purus, Inc. personnel returned to the site to prepare for resumed testing to begin in mid-March 1995. SRTC is installing the solvent separation equipment (settling tank and filter units). Because of the reduced field test, the volume of solvent collected is estimated to be between 200 and 300 gallons.
- Scientists from SRS, the South Carolina Department of Natural Resources, and the University of South Carolina met to discuss efforts at SRS to develop biotic assessment methods for determining stream integrity. A workshop was scheduled in April 1995 to exchange information and chart directions for future research.
- An Environmental Protection Agency Remediation Technologies Development Forum (RTDF) for Permeable Barriers Work Group is being formed with representatives of industry, government, government contractors, and academia. M. A. Phifer of the ESS Groundwater Group is a member of this group and is participating in its formation and organization.
- HAZWRAP (Martin Marietta Energy Systems) of Oak Ridge, TN requested that SRS provide our site, services, and expertise in conducting a demonstration of an emerging technology for treating air streams containing chlorinated volatile organic compounds. The technology demonstration being proposed involves a flameless thermal oxidation (FTO) technique developed and patented by Thermatrix Inc. (San Jose, CA). The design employs a controlled, high-temperature (800–1000°C) inert-ceramic packed-bed reactor to thermally oxidize the organics.

- A demonstration of DataDelve/HOPS was given to the Risk-Based Standards Working Group.
- Well installation and environmental sampling for the Sanitary Landfill Optimization Test Demonstration is back in full swing. The well installation at the vinyl chloride and chlorobenzene site (Site 2) is complete and the well development process is continuing on schedule. Fourteen piezometer clusters were installed with two vadose zones and one water monitoring point in each cluster. Three 50-ft stainless steel air and nutrient injection wells and one centralized air extraction well were also installed.
- SRTC and the Environmental Protection Department began testing new immunoassays for total petroleum hydrocarbons (TPH). Two of the companies that make these test kits will be collaborating on the project.
- The TNX groundwater is contaminated with chlorinated volatile organic compounds (CVOC). Environmental Restoration (ER) requested that the Environmental Science Section install a test recovery well and perform a pump test on the test well to obtain design parameters for a full-scale recovery well system.
- The TNX Groundwater Interim Record of Decision (IROD) calls for the installation of a hybrid groundwater remediation system consisting of conventional pump and treat wells and an innovative vertical recirculation well. SRTC is the design and technical agency for the recirculation well. A design review is complete and comments are being incorporated into the drawings.
- Representatives from ESS participated in an inter-site workshop on Data Quality Objectives for Ecological Risk Assessment. The workshop was organized by the DOE-HQ EH-412, Risk-Based Standards Working Group.
- WSRC, met with Dr. S. Clark, SREL, and Dr. D. Dzombak, Carnegie Mellon University, to discuss the application of contaminant sorption models to field and laboratory data for the F- and H-Seepage Basin groundwater studies. Dr. Dzombak agreed with the modeling approach being taken for this project.

WASTE MANAGEMENT

- Shrinkage Compensating Concrete (SCC) has been evaluated for use at SRS. The developed mix has been recommended for field testing on actual slabs at SRS.
- The Proposed Site Treatment Plan (PSTP) is being submitted to DOE-SR on schedule. This plan proposes treatments for each of the seventy plus mixed waste streams at SRS.
- SRTC personnel completed design of a filtration unit for the Shielded Cells of Building 773-A. Late Wash and In-Tank Precipitation personnel reviewed and concurred with the design.

The equipment installation supports sampling and characterization of Tank 48H slurries prior to startup of the ITP facility.

- A review comment for the ITP Process Requirements asked whether the existing constraints on chemical composition assure compliance with the various safety analyses for combustion hazards. A document issued this month provides technical bases defining why the restrictions in Revision 4 are necessary and sufficient.
- IWT is supporting an ESP Start-up Team program to replace the slurry pumps in Tank 51. The existing pumps are leaking excessive bearing water into Tank 51. TNX has received three pumps for modifications and run-in testing. IWT will coordinate the pump modifications, including preparing the test facility, revising the test procedure, and providing technical support during pump tests. Recent efforts included generating a draft pump modification schedule/logic, reviewing pump modification guidelines, and initiating test facility checkout and calibration of instrumentation. Plans are to modify and test the first pump by May.
- EES is continuing the design of the Annulus Camera System for High Level Waste. The camera package will now house a color camera and a motorized zoom lens allowing the camera to focus from 6 inches to infinity.
- EES completed assembly of the Gas Chromatograph Sample Drying System for DWPF.

GENERAL

- SRTC has prepared a total of 23 Site Baseline Change Control Packages during FY-95 and 18 of the packages have been approved by DOE.
- EES is developing a tool to streamline the process of unloading fuel coming into the RBOF facility.
- EES completed development of an improved version of the torch deployment tool for use on the Elbow Cutting Pipe Crawler.
- As part of the OTD Robotics for D&D program, EES is coordinating surveillance and maintenance risk and cost reduction evaluation methodologies.
- EES completed installation of the fixed portion of the inspection mast on the equipment frame of SWAMI (Stored Waste Autonomous Inspector).
- EES met the Underground Storage Tank (UST) Integrated Demo Surveillance and Inspection Milestone #4 on schedule with the issue of the detailed design report on the Optical Alignment System (OAS).

TRITIUM

Burst Disks

D. L. Fish, J. Morin M. J. Morgan

Support is being provided to the Design Agencies (DA's), LANL and SNL/CA, to support activities related to accelerated aging studies of burst disks to be used in tritium service. A meeting was held at SNL/AL with representatives from SRTC, KC-ASD, LANL, SNL/CA and SNL/AL to discuss further details of this program. Additional discussion was provided by SRTC on our proposal for the accelerated testing program. Current plans by the DA's are to examine both single and dual disk assemblies. They will look at both commercially available and in-house built assemblies. Initial disks will contain a surface coating to minimize tritium permeation into the disk since the effects of helium build-up in the metal on the metal's properties are not thoroughly enough understood at this time. Tests will be conducted with both multiple disks simultaneously exposed to tritium in a single container as well as some exposed to tritium in individual containers. The test program was revised from earlier designs and the number of units to be tritium tested reduced to approximately 90. The tritium testing will include bursting of the disks after extended tritium exposure along with monitoring of the burst rate and associated pressure measurements, sectioning and metallography, measurement of the residual ^3He content and physical examination of the fracture location, and examination of burst effects on the coating. The initial units would be loaded in September 1995.

Acorn

Loading of Prototype Acorn Units in RTF - D. L. Fish

Estimates of the loading time required for prototype Acorn units in RTF were developed jointly with Tritium Technical personnel and then refined by review with Tritium Operations personnel. Based on these estimates, the

current prototype Acorn unit would be expected to require approximately the same time for loading as is currently required for the Heather system. Focal Point units from SNL/CA would be expected to take slightly longer. This information provided a basis for estimating the costs for loading of development units in RTF. Estimates for the cost of loading both Acorn development units and Focal Point units were developed jointly with Mark Shramko and Geoff Netzley. Rex Buley and I have reviewed these cost estimates with Dennis Hayes as a preliminary step toward the issuance of an official cost to be given to the Design Agencies. Dennis Hayes will have his cost accounting personnel review the numbers for concurrence or modification.

Acorn - D. L. Fish

The Process Realization Team meeting was held this month at LANL. The PRT communicated that the delivery of development units which will be used for cleaning, loading and function testing development at SRTC has been delayed by an additional 2 months (to 3/96) from Kansas City due to delayed release of the Acorn design from the Design Agencies. This has the potential to result in subsequent delays in the delivery of the cleaning, loading, and functioning information to Tritium for their procedure development.

Additional support by the SRS function test facility will be required by the Qualification Plan for testing of units during routine production. A production sampling plan will be established which combined with periodic testing of field return units could result in substantially higher work loads for the facility than previously recognized. The production sampling plan will be utilized to address reliability issues to ensure that the production processes are not changing as a function of time.

The cleaning process for Acorns was discussed in a separate meeting with B. Meyer of LANL. Brad is responsible for the cleaning as head of the Acorn Technology Task Team. He agreed in principle to several modifications of the standard AFR method to reduce unnecessary time in the procedure and to increase the number

of flushes. These changes were based upon data obtained in the Acorn Cleaning Study completed at the SRTC in 1994. However, an agreement to enable shortening the length of the final pumpdown was not reached and is pending the collection of additional experimental data. A partial path forward on this issue has been worked out but I anticipate that an agreement on this time will not be reached easily due to concerns expressed by Brad with shortened pumpouts.

W-76 Status of Demonstration Tests of Ca_{0.2}M_{0.8}Ni₅D₃ for Use in Reservoir Loadings

W. N. Posey, D. L. Fish, T. J. Warren, W. C. Moseley

A high pressure gas manifold is being built to test a Ca_{0.2}M_{0.8}Ni₅ hydride bed in a cell of Building 774-A, to determine if sufficient pressure can be generated at $\leq 150^{\circ}\text{C}$ for future W-76 reservoir loadings in RTF's loading line. Construction of the test manifold will be completed by 3/17/95, and D₂ compression tests with the bed should begin early in April.

The test bed, which is constructed of 1" diameter 316SS tubing rated for service up to 10,000 psig, will be loaded with ~ 500 grams of Ca_{0.2}M_{0.8}Ni₅ and activated with D₂ at low temperature to reach a D/M ratio of 1:1. The receiver container for the compressed D₂ is an 80cc calibrated volume rated for service to 10,000 psig. The bed will be cooled with dry ice (Co²) to 40° to -50° for maximum D₂ absorption at a pressure of 300 psig which will simulate its use as a 2nd stage hydride compressor. The bed will be heated with a tape heater at $\leq 150^{\circ}\text{C}$ to generate a pressurized D₂. The test bed and receiver volume is scheduled for the proof and leak test by EES by 3/2/95. The bed will then be loaded with the Ca_{0.2}M_{0.8}Ni₅, retested for leaks by EED, connected to the test manifold, and D₂ activated. The demonstration test of this should begin early in April and will require ~ one month.

Terrazzo Resistance Weld Nondestructive Testing

B. D. Howard, R. W. Poland,
B. Z. Meets III

As part of the Site's full scale D₂-filled capability demonstration, the resistance weld was radiographically examined and was judged to be acceptable. At the present time radiography provides the analyst with the geometrical "profile" of the resistance weld (much the same as pinch weld radiography provides). A library of resistance weld profiles is being developed. Details of the laser drilling and welding effort were also provided by radiography.

Conventional radiography was used on this capability demonstration resistance weld. Conventional radiography was used in developing the technique parameters; however, very satisfactory digital radiographic images were acquired on resistance weld specimens. Digital radiography provides geometrical profile images immediately since no film processing is required. Multiple "views" of the resistance weld may be acquired in a very few minutes; thus, providing assurance that the integrity of the bond extends a full 360° between the cap and the top of the unit. ASET has been discussing the possibility of incorporating digital radiography in the Replacement Tritium Facility.

Terrazzo Reclamation

T. J. Warren, W. J. Rogier E. A.
Franco-Ferreira, B. D. Howard, C. E.
Sweeney, W. R. Kanne

The full scale deuterium-loaded Terrazzo reservoir, which was previously successfully reclaimed using laser drilling and laser welding techniques, was successfully function tested. This test produced good, nominal deliveries, demonstrating that no damage was caused to the unit by any of the reclamation steps.

The functioned reservoir is currently being prepared for destructive metallographical examination of the laser weld in the fill stem and of the cap upset weld made at the base of the fill stem boss.

Preparations are being made to laser drill and weld tritium-exposed fill stems to demonstrate that the expected ³He dissolved in the inner

regions of the fill stem wall will not prevent making a good reclamation laser weld in returning tritium reservoirs. These stems had been sealed with tritium inside a number of years ago as part of another shelf storage program that is no longer active. Tritium diffusing into the stem walls creates a T₂ profile and also creates a ³He profile in the wall of the fill stem, which is high on the inner surface and tapers off to essentially zero in the outer radius of the stem wall. Since the reclamation laser weld is only required to penetrate about the outer .006"-.008" depth of a stem that has a .032" wall thickness, it is expected that ³He embrittlement will not effect the laser weld region. However, experimental verification of the ability to make good laser welds in stems that have seen tritium exposure is needed to reduce the technical uncertainties and concerns relating to the viability of the reclamation process.

The tritium-containing stems will be drilled and cut off in RTF to remove the bulk of the tritium. Only outgassing quantities will have to be dealt with during the rest of the handling steps. A high pressure mechanical union will connect a fresh fill stem to the contaminated stem. Clean gas will be loaded into the stem and sealed by pinch welding the new stem, which will provide internal pressure for gas outflow during the laser drill part of the test. The newly loaded stem will be sealed in a fixture with a laser window, the outside of which will be sufficiently decontaminated to allow laser drilling and welding of the stem sealed in this fixture in the clean laser cubicle. A small, clean sample-sized gas cylinder will be part of the laser fixture to provide refill gas for the laser weld part of the experiment. The laser welded samples will be metallographically examined to look for any defects that might be attributed to ³He in the stem wall. Tests on six stems are currently planned. Step-by-step procedures and a Technical Task Plan is currently being prepared to cover these tests, and coordination with HP has been initiated to avoid any transfer of contamination during the processing steps.

Reserve RTF Pd/Z

W. C. Mosley, A. R. Jurgensen

Palladium deposited on zeolite (Pd/Z) made by SRTC/ETS is used in the RTF Purge Stripper System. In March 1991, the RTF Project Group requested that SRTC/CHTS procure an additional 100 liters of Pd/Z as reserve material for the RTF with half to be made off site. Specifications required that the Pd/Z be made using type 4A zeolite in the form of 4 X 8 mesh beads, have a palladium content in the range of 1.5-2.5 weight percent (w/o) as metal, and have a chlorine content less than 250 ppm. SRTC/ETS prepared ten batches of Pd/Z totaling 40.4 kilograms (about 56 liters) during September- December 1991. 34.3 kilograms (about 48 liters) of Pd/Z produced by Ionex Research Corp. were received at SRTC in November 1993.

Initial measurements of the palladium content of the Reserve RTF Pd/Z were made using a hydrogen absorption method. However, this method was found to be invalid because hydrogen was absorbed by the zeolite as well as the palladium. Therefore, an alternate method for measuring palladium content was developed by SRTC/ADS using x-ray fluorescence (XRF) and calibration standards made by blending palladium powder with pulverized zeolite. Measurements by both wavelength dispersive and energy dispersive XRF yielded consistent results. Batches of Reserve RTF Pd/Z made by SRTC/EDS had palladium contents within the range of 2.00-2.22 w/o with an average value of 2.13 w/o. Samples from three drums of Reserve RTF Pd/Z made by Ionex had palladium contents between 2.11 and 2.17 w/o with an average value of 2.15 w/o.

Initial neutron activation analysis (NAA) measurements of chlorine in Reserve RTF Pd/Z indicated concentrations to be less than the specified 250 ppm maximum. However, a re-evaluation of NAA in October 1994 revealed that the detection limit for chlorine in Pd/Z was really 300 ppm because of interference from magnesium in the zeolite. Therefore, an alternate method for analysis of chlorine in Reserve RTF Pd/Z was developed by SRTC/ADS based on wavelength dispersive XRF using a standard additions calibration

method. XRF analysis of a composite sample consisting of equal portions from the ten batches of Reserve RTF Pd/Z made by SRTC/ETS yielded 43 ppm chlorine. Another composite sample consisting of equal portions from the three drums of Reserve RTF Pd/Z made by Ionex contained 60 ppm chlorine.

Results of analyses for palladium and chlorine in Pd/Z by recently developed XRF methods show that Reserve RTF Pd/Z made by both SRTC/ETS and Ionex Research Corporation meets the specifications for use in the RTF.

Alloy Development for Tritium Processing - J. S. Hölder

The Alloy Development Working Group was formed in 1993 to investigate new metal hydride alloys for tritium processing applications. The group is directed by personnel at Los Alamos National Laboratory (LANL), and consists of physicists, chemists, and material scientists from LANL, Sandia National Laboratory, and SRTC, along with Professor Flanagan and his associates at the University of Vermont. LANL synthesized the new alloys, and Prof. Flanagan characterized their hydriding behavior with hydrogen and deuterium. SRTC got involved in the Fall of 1993 to determine the tritiding behavior of these materials. The latest meeting was held on January 26, 1995, at LANL.

Work to date has focused on alloys of palladium (Pd) with one of three transition metals in varying concentrations. These binary alloys have the general formula $Pd_{1-x}M_x$ ($0 < x < 0.1$), where M is either chromium (Cr), cobalt (Co), or nickel (Ni). Materials characterization techniques are employed to determine the chemical homogeneity of the alloys, an important factor for well behaved metal hydrides, and to perfect the synthesis technique. In order to characterize the hydriding behavior of the alloys, pressure-composition-temperature (PCT) data is acquired at a variety of conditions; from these data the thermodynamics of the hydriding reaction (phase transition) may be determined.

Sherri Bingert (LANL) discussed solidification theory and micro-segregation as related to alloy synthesis. Her group is perfecting the spin-melt

method of alloy ribbon production, and has found that ribbon thickness is an important parameter (above a critical thickness, segregation occurs). Synthesis development is proceeding with work on ternary palladium alloys.

Prof. Flanagan presented PCT data collected with hydrogen and deuterium on the Pd-Co and Pd-Cr alloys. He has found that repeated absorption-desorption cycling is required to produce stable PCT behavior, along with a flattening of the pressure plateau and a reduction in hysteresis. He also noted that the change in enthalpy is the important parameter for the hydride phase transition, while the change in entropy is largely constant from one alloy to the next. Prof. Flanagan plans to investigate the stability of these hydrides in a high pressure and temperature cell, and to begin work on ternary alloys.

Jeffrey Hölder (SRTC) reviewed PCT data collected with tritium on the Pd-Co and Pd-Cr alloys. He found that the initial activation of the alloys became more difficult as the atomic percent (at.%) of the solute element increased, and that at a given at.% the tritium capacity of the alloy decreases as the solute element changes from Ni to Co to Cr. Plateau pressures at a given at.% were found to follow the opposite trend, with the Pd-Cr alloys being highest. He noted that tritium data is needed on the parent metal, pure Pd ribbon, and plans to pursue that along with beginning work on ternary alloys.

Art Nobile, Jr., (LANL) discussed results from deuterium micro-PCT measurement on Pd powder. He has run a series of PCT measurements on a small sample of a highly compactable Pd powder which exhibited anomalous behavior. When a thin rod of glass wool was inserted down the center of the cylindrically shaped sample, the anomaly disappeared. It is thought that the self-compacted cylinder of Pd powder had lost intimate contact with the gas phase and that the glass wool rod restored the equilibrium conditions. It was concluded that sample configuration may influence the hydriding behavior of compactable powders.

Tritium Charging Facility at SRS **M. J. Morgan, J. A. Morin**

Plans are underway to re-establish the capability at Savannah River to expose laboratory test samples to tritium at high pressure and elevated temperatures. Three programs are driving the need for this capability:

1. Conventional Forging Suitability Program
2. Burst Disk Development Program
3. Effects of Tritium and Decay Helium On Welded Steels

The three programs require that laboratory samples be exposed to tritium at pressures ranging from 5000-10000 psi, temperatures from 200-350°C, and times from one-three weeks. The vessels needed for the tritium charging will have to be between 1 and 2 inches in diameter and several inches long. The exposed samples will have to be stored for two to three years at temperatures less than -40°C to build-in helium from tritium decay, while minimizing losses of tritium due to offgassing. Rapid recovery (~ one day) of the samples is required in two of the programs to ensure a minimum loss of tritium from outgassing prior to the low temperature storage.

The tritium charging will most likely be conducted on one of the RTF loading lines and use custom-made, mechanically sealed pressure vessels designed and fabricated by Autoclave Engineering, Inc. Mechanical seals were chosen to enable a fairly rapid recovery of the samples following the tritium exposure. Heating jackets will be used to attain the charging temperatures required. Our plans call for the facility to be ready by the end of this fiscal year.

Test samples are needed for the Conventional Forging Suitability program because DOE has recommended the 1995 closure of the high-energy-rate forging (HERF) facility in Oxnard, California, after completion of a ten year prebuild. HERF stainless steels are used as the construction materials for tritium reservoirs. In support of this closure, a plan was proposed and accepted by DOE that establishes the tests and evaluations required to establish the suitability of conventional forgings for reservoirs. Savannah River was asked to help evaluate the suitability of conventionally forged

steels for tritium service by testing tritium-exposed laboratory samples fabricated from conventionally forged stainless steels. The effects of tritium and decay helium on the tensile properties (yield, ultimate, elongation, and ductility) and fracture toughness properties (K_{th}, J-R curves, crack-growth rates) of two steels, Type 304L and 21-6-9 will be measured. The results will be compared with existing Savannah River data on high-energy-rate-forged steels to determine the suitability of conventionally forged reservoir steels for tritium service.

Secondly, Los Alamos has requested that Savannah River estimate the costs associated with establishing a facility for exposing rupture discs to tritium. The Burst Disk Development Program is a joint design agency program established to qualify rupture discs for tritium service. The objective of the program is to measure the rupture pressure and failure modes of rupture discs that have seen extended exposure to hydrogen and tritium. The rupture discs would then be tested, most likely at Savannah River, to determine to what extent their rupture properties have changed because of the build-in of helium from tritium diffusion and decay.

The third program is part of the Weapons R & D Program, Tritium Effects on Reservoir Materials. The design agencies agreed with our recommendations that future R & D activities in this program concentrate on the effects of tritium and decay helium on the properties of welded steels. Data on the properties of welded microstructures are needed to complement our existing data on tritium effects on base material properties.

Inventory And Scheduling Meeting With SNL/CA

K. A. Dunn, C. S. Kestin
J. R. Dollar

SRS personnel visited SNL/CA to discuss their inventory in the Life Storage Program as well as a five year plan for work. The inventory was reviewed by Steve Robinson with few comments. In addition, input to the five year plan for work was made by Robinson.

Work in the Life Storage Program completed for SNL/CA throughout 1994 was discussed. This work included unloading 30 units (SP-940, SP-949, SP-1042, Type C, Zinfandel) and burst testing 3 units (SP-800). SRS requested further details of required work in support of examinations of SP-981 and SP-1042 reservoirs. The traditional method of preparation used for burst testing reservoirs at SRS is to reclaim the reservoirs. These reservoir types are not reclaimable and thus difficult to burst test. SNL/CA will determine whether they will pursue burst testing of the reservoirs or examine them metallurgically only. If burst testing is still the option a tube welder will be available 9/95 for attachment of a tube for burst testing rather than using reclamation.

SNL/CA requested SRS to conduct a metallurgical examination on the wedge opened and loaded (WOL) samples from the Type C units. This metallurgical examination will include heat tinting the samples and then pulling the sample apart. Fractography and metallography of the WOL samples will then be done to analyze the data from the test.

In support of the SNL/CA request to place some "on hold" SP-981 reservoirs in the Life Storage Program at elevated temperatures, SRS provided a proposed plan for this work and asked for suggestions. Approximately six "on hold" SP-981 reservoirs will be placed at $\approx 120^{\circ}\text{C}$ for a period of about two weeks. Ion Current Measurements (ICM) will be done at the beginning, middle and end of test to determine whether any tritium is diffusing through the pinch weld. Following storage, metallography and auto radiography of the pinch weld stems will be conducted for signs of excess tritium permeation along the pinch weld.

Reservoir Cleaning Study

R. A. Malstrom, A. A. Ekechukwu
T. L. Ivy, R. J. Reed

ADS led a multidivisional effort to resolve issues relating to the cleanliness of reservoirs. Questions were raised by the Design Agency regarding the use of some reservoirs due to the potential presence of foreign material. The reservoirs were analytically rinsed and the rinses were analyzed for particulates, fibers and possible oil contamination. Based on the results of this work, the Design Agency accepted that the reservoirs were clean, thereby saving \$200,000.

233-H In-Bed Accountability Support J. E. Klein

The 233-H In-Bed Accountability (IBA) process will be used to determine the amount of tritium stored on the 233-H metal hydride beds by measuring the steady-state temperature rise (SS DT) of a gas flowing through the nitrogen jacket of a bed. To "calibrate" the beds using the IBA method, different amounts of high purity tritium need to be loaded onto the bed using calibrated tanks to develop the SS DT versus tritium loading, expressed as the atomic tritium to metal atom ratio, correlation for the bed.

IBA calibration data collection has been completed recently for one of the Product Beds. The data obtained show a SS DT-versus-tritium loading relationship which is similar to those obtained for the Recovery Beds. The accuracy of the IBA technique, estimated as the product of the t parameter at the 95% confidence level times the inverse regression standard deviation, was estimated to be 1.15% for a bed loaded to a tritium-to-metal hydride ratio (T/M) of 0.6. This gives a measurement error of 12.9 grams of tritium which is comparable to tritium measurement errors obtained on some of the "standard" size storage beds. Completion of the bed calibration will allow its calibration curve to be used for this quarter's tritium inventory measurement.

Tritium Facilities Waste Characterization Plan R. A. Malstrom, T. L. Ivy

A waste characterization plan must be approved before any waste is sent to the E-area vaults. This characterization plan covers all waste streams generated in a building, and for the

Tritium Facilities each building is considered separately. ADS has worked with the Generator Certification Official for the Tritium Facilities, Craig Johnson, on the development of this plan. One issue raised by the Waste Characterization Board was mercury contamination of waste from work in hoods in 232-H and 234-H. Mercury pumps were used and there is a potential for waste removed from certain hoods to exceed the RCRA limits for mercury (.2 milligrams/liter).

As part of the Tritium Facilities Waste Characterization Plan, a series of non-radioactive job control wastes were contacted with mercury in a stainless steel pan. This was done to simulate incidental contact with mercury which might be seen in the process hoods. In this experiment, mercury was added to the pan and cleaned-up using the equipment and procedures specified for mercury clean-up in the Tritium Facilities. The work was performed by a Tritium Operator. After the pan was cleaned, various materials commonly found in job control waste (paper, rags, shoe covers, gloves, etc.) were contacted with the residual mercury in the pan. The job control wastes were sized and then submitted for TCLP leaching followed by mercury analysis.

Tritium Reservoir Closure Weld Technical Data Summary

E. A. Clark

Currently tritium reservoirs are sealed after loading at SRS using a resistance tube pinch weld. Two tungsten tipped copper electrodes are applied on both sides of the stainless steel reservoir fill stem with a controlled force, and a controlled alternating current then heats the tube between the electrodes. This crushes the tube and seals the inside walls of the tube by either a solid state or fusion (melted) bond. This weld was developed at SRS when tritium production began in 1957.

A classified report, "Tritium Reservoir Closure Weld Technical Data Summary" (WSRC-TR-95-0086, 2/22/95), has been written that describes reservoir resistance closure welds used at Savannah River. Several different welds, including unconfined and confined tube

pinch welds and wafer welds, are described. The influence of weld variables such as current, time, electrode force, electrode design, weld station design, reservoir fixturing (mounting), and tube properties (size, material) on welding is presented. Production weld quality measures are discussed. Weld performance, especially in the Life Storage Program, is also described. Research and development programs supporting pinch welding are documented. In addition, this report will serve as a guide to the extensive literature covering pinch welding at the Savannah River Site.

LF-7 Support

W. R. Kanne, J. A. Morin,
G. J. McKinney, V. W. Walker,
C. E. Sweeney

Stems were attached to two LF-7 reservoirs and the reservoirs were loaded and pinch welded as part of the program to qualify LF-7 reservoirs made from 304L stainless steel and cleaned with Oakite. In the past, LF-7 reservoirs were made from 21-6-9 stainless steel and were acid cleaned with Nitradd. These two reservoirs will undergo functional verification in the SRTC function test facility in preparation for production reclamation and loading later this year.

In preparation for attachment of stems, fixtures were designed and fabricated. The new fixtures align the stem with the counterbore in the reservoir and provide support for the reservoir body. In addition, a dummy reservoir was prepared to accommodate test pieces to replicate the reservoir welding process as closely as possible. Stems were welded into four test pieces prior to welding stems to the reservoirs. Two test pieces were hydro tested to failure in the tube, demonstrating good weld strength. The other two were used for pinch welding tests. After stem attachment, the two reservoirs were proof and leak tested prior to loading. The reservoirs were loaded with deuterium at production conditions and closed with confined tube pinch welds.

Long Term Tritium Storage

J. E. Klein, L. K. Heung,

J. R. Wermer

Due to the reduction of the nuclear weapons stockpile, the excess of tritium returned from the field will exceed facility process storage capacity. A hydride storage vessel (HSV) using titanium is being designed to store the excess tritium while it awaits reuse. CHTS/PTG has been asked to develop an experimental program to evaluate HSV absorption and desorption conditions needed for plant operations. Helium retention/release rates will also need to be investigated.

Testing of activation, absorption, desorption, and isotopic exchange conditions will be performed on bench scale beds and verified on a full-scale prototype. Helium-3 retention/release data will be obtained by loading bench scale beds with titanium and either pure tritium or a tritium/deuterium mix representative of plant loading conditions. These beds will be monitored for pressure increases while in storage, due to decay induced helium-3 production, and will generate useful helium-3 retention/release data. Stress measurements of the HSV under hydriding conditions may also be done to verify vessel pressure design limits, but will not impact the design schedule or loading of the HSVs in the plant. Design and procurement of materials and equipment to conduct these tests is in progress.

Tritium Crucible Package Transport Design and Safety Assessment

P. S. Blanton

Following the Tritium Facility loading line Operational Readiness Review (ORR), hot targets that are presently held in various Reactor basins will be processed. In the past, bare tritium crucibles were transported to Solid Waste Disposal Facility (SWDF) Burial Grounds in a shielded cask. This cask provided confinement but was not designed to provide containment. New site restrictions require that this mode of movement be revised. SRTC Packaging and Transportation (P&T) is providing Tritium with necessary design criteria for a package to transport processed spent melts to the Interim Level Tritium (ILT) vault and with documentation in the form of a safety assessment to support such a move.

The present path forward will have P&T act as the cognizant packaging design agency in determining necessary design criteria to transport the spent melt in an alternate Type B package per the 19Q Transportation Safety Manual (TSM) to the ILT vault.

The initial approach considered for the new crucible packaging divided the packaging into two independent functional components, shielding and containment. For containment, an overpack, which is a slightly larger diameter tube than the crucible, would be used to house a full length crucible (19 feet long) and provide containment. Because the resulting overpack is larger than the existing shielded transport cask a new shielded cask design similar to Tritium's existing cask would be required for transport use.

However, it was proposed that there would be many advantages, if the waste, "the crucible", could be reduced in size prior to transport. A few of these advantages would include.

- Possible use of existing transport packaging . This potentially decreases project cost by eliminating or reducing the size of the shielded cask which is now required.
- Burial ground capacity for tritium crucible waste could be increased and,
- Reduced Waste.

Two options were considered for this proposal but only one was pursued; a collapsible crucible concept.

The collapsible crucible concept comprises a series of 3 to 4 overlapping tubes which comprises the 19 foot crucible length. The tubes are held together by circumferential break away joints. After the tritium extraction process is complete and the melt is solidified, the tubes would be axially loaded until the circumferential break away joints that hold the tubes together fail. This allows the tubes to collapse thus reducing the volumetric size of the waste by 3 to 4 times.

Tests joints have been fabricated and tested. Initial results were very favorable and the tested joints parted as expected. These results were reported and approval has been given to pursue

full scale testing of the collapsible crucible concept.

The present path forward will be fabrication of a full scale test crucible. In parallel with this effort existing packaging will be examined for possible use with the shortened crucible.

Exxon CRADA

J. E. Klein, L. K. Heung

The goal of the Exxon CRADA is to develop a metal hydride packing material to recovery hydrogen from gas mixtures. Metal hydrides encapsulated in a sol gel or fumed silica will be tested in a flow apparatus for their ability to remove hydrogen from a flowing gas stream in the presence of hydride poisons such as carbon monoxide and hydrogen sulfide. Tests will compare hydrogen adsorption rates and capacity in the absence and presence of hydride poisons at different flow rates and temperatures.

An experimental apparatus has been fabricated in 773-A, to perform these flow tests. Flows of the carrier gas, currently nitrogen, hydrogen, and poisons will be feed to a bed packed with the encapsulated hydride. Performance of the encapsulated hydride will be determined by changes in thermal conductivity changes of the bed outlet gas composition relative to the feed composition. The first sample has been loaded into the apparatus and testing will begin after start-up of the data acquisition equipment and support systems.

Aluminum-Lithium Targets for the Advanced Test Reactor (ATR)

H. B. Peacock

The Advanced Test Reactor (ATR) is being evaluated as a contingency tritium production source. As part of this study, WSRC is participating in a program designed to establish the feasibility of producing tritium in the ATR. Aluminum-Lithium targets, produced in the 300 Area, were irradiated in the ATR and will be extracted in Tritium facilities. In support of this program, the Materials Technology Section was requested to establish the feasibility, costs

and schedule for fabricating Aluminum-Lithium targets for the ATR using commercial facilities/vendors. The engineering estimates for materials costs, one-time tooling costs and commercial production costs were based on knowledge and data of metalworking industry costs on similar projects. It was assumed for this study that one commercial vendor would produce the aluminum-lithium casting and a different vendor would complete fabrication of the targets. The total manufacturing costs for the annual requirement of ATR targets, using commercial facilities, ranged from \$1.3M to \$1.7M depending on the ATR target design. The SRS costs for technology transfer was estimated at ~\$175K. The result of this study was issued in a report.

Tritium Support

EES has designed the necessary fixturing for laser drilling and re-welding tritium-exposed stems. This is one more step in demonstrating the ability to laser drill and reclaim a tritium-exposed 3T reservoir. The first stem is scheduled to be drilled and re-welded in the laser cubicle of Building 723-A by the end of March.

EES has completed the design and fabrication of the Z-bed recovery adapter plate for the Function Test Facility. The adapter plate connects the EES-designed stripper bed to the existing Z-bed recovery furnace.

EES is completing as-built drawings for the fireset chassis and the data acquisition and control system. EES is also working with Design Engineering on the drawings for the instrument loops for the Function Test Facility. Additionally, EES has completed all pressure and temperature calibrations. Overall, more than 40 loop calibrations have been completed.

Software changes have been incorporated into the 234-H Container Management Facility Automated Leak Test Systems. These changes, which include a pressure decay check prior to performing a helium leak test, have eliminated helium flooding and contamination of the recertification manifold. This has dramatically

reduced the maintenance time required on the leak detectors as well as system down-time required for clean-up.

EES has submitted a Scope of Work and Cost Estimate for reservoir processing on the Loading Lines. These documents, which cover work to be performed by EES, MTS, and SPS, will be included in the project Conceptual Design Report to be submitted to DOE.

Non-Nuclear Reconfiguration

The Hydraulic Burst System was turned over to EES for system check on March 21 following a preliminary walk-down with Construction, Tritium Projects, and Safety. Procedures are currently being drafted that will allow practice reservoir burst-testing in Building 238-H as part of the check-out. Approximately 65% of the software development for the data acquisition system (DAS) has been completed; and 90% of the DAS cables have been fabricated. All strain gauge materials (gauges, glue, etc.) and a strain gauge simulator have been procured and received.

EES has begun work on an Ion Current Manifold for sampling secondary containers. The containers to be sampled are being used to store tritium reservoirs from EG&G Mound Labs. Work has also begun on the Kanne monitor skids for the NNR Environmental Chamber Room.

SEPARATIONS

Second Plutonium Cycle Solvent Quality

J. H. Gray, K. J. Kalbaugh, K. N. Forrest, Y. J. Simpkins, and ADS

With processing of plutonium solution stored in Tank 9.6 expected to begin early in March, additional samples of solvent from Tanks 906 and 10.5 were received for determination of solvent quality. Results from analysis of these samples, combined with previous results on the behavior of Tank 9.6 plutonium feed solution, will be used to establish the suitability of both aqueous and organic solutions for hot operation in the second plutonium cycle.

Results reported earlier indicated plutonium in the 9.6 feed solution will extract and then strip from the 906 solvent without significant plutonium losses. This suitability (readiness) of the solvent inventory in the second plutonium cycle was reconfirmed from extraction and strip pickup test results and by analyzing for dibutyl phosphate (DBP) concentration in solvent samples taken February 24.

The final alpha activity remaining in 906 solvent after nine strip stages was down to 6.88×10^3 dpm/ml. An alpha activity value in the 10^3 dpm/ml range assures minimal plutonium losses to the carbonate washer. The alpha activity in the 10.5 solvent was higher, at 1.45×10^4 dpm/ml after nine strip stages. Although this residual alpha activity value is acceptable, the Tank 10.5 solvent quality will improve even further as it passes through the carbonate and acid wash tanks when hot operations begin.

With the DBP concentration at 15 ppm in the 906 solvent, and at 21.5 ppm in the 10.5 solvent, the solvent inventories in Tanks 906 and 10.5 are ready for the next hot feed.

Processing Tank 9.6 Plutonium Through the Second Plutonium Cycle

(J. H. Gray, K. J. Kalbaugh, Y. J. Simpkins, and ADS)

The first batch of plutonium feed from Tank 9.6 has been successfully processed through the Second Plutonium Cycle. Since this plutonium solution has a high phosphorus content, one of the solvent issues was to determine if 906 solvent had been degraded during hot operations with 9.6 feed. A sample from Tank 10.5 was taken and solvent quality parameters measured before the solvent was washed in the carbonate and acid wash tanks.

The solvent sample taken from Tank 10.5 shows a small effect of processing plutonium feed from Tank 9.6. The initial alpha activity was 2.94×10^4 dpm per ml. This value is not a high number, but is an order of magnitude higher than 906 solvent that was fed to the Second Plutonium Cycle. The final alpha activity after nine strip stages was down only to 5.14×10^4 dpm per ml. This indicates stripping plutonium from the solvent in the 2B bank has become more difficult; probably due to the 30 ppm of dibutyl phosphate that was detected in the 10.5 solvent.

The additional scrubbing 10.5 solvent will receive when hot operations resume has and should continue to remove impurities necessary to produce the good solvent quality needed to minimize plutonium losses.

F-Canyon Dissolution of Sand, Slag, and Crucible

(J. H. Gray, K. N. Forrest, K. J. Kalbaugh, and ADS)

Scoping studies to determine dissolution behavior of sand, slag, and crucible (S,S,&C) material in canyon dissolvers have not yet identified conditions necessary to accelerate the dissolution rate of calcium fluoride (CaF_2). Since CaF_2 is one of the more abundant materials present in S,S,&C, slow dissolution of CaF_2 could result in fragments remaining in dissolver well inserts, increasing dissolution time, and reducing throughput.

Earlier scoping studies established that large chunks of slag did not fragment during dissolution; they just became smaller until dissolution unexpectedly stopped. X-Ray

Diffraction analysis of the undissolved material found only pure CaF_2 remaining. The current scoping studies are to determine if an equilibrium concentration of fluoride is reached; at which point dissolution of CaF_2 apparently stops. The influence of aluminum nitrate in solution on fluoride equilibrium is being determined.

Pretreatment Development Program for Americium/Curium Vitrification (T. S. Rudisill)

Approximately 15,000 liters of solution containing isotopes of americium (Am) and curium (Cm) are currently stored in tank 17.1 in F-Canyon. An analysis of disposition alternatives has resulted in the recommendation to stabilize the Am/Cm in a borosilicate glass for shipment to Oak Ridge National Laboratory. Separations Planning has requested CHTS assistance to define the pretreatment flowsheet for the proposed vitrification process. Optimal conditions must be defined for the acid adjustment, in-tank precipitation, settling/decanting, precipitate washing, and dissolution steps in the proposed flowsheet. Vitrification would take place in the Multi-Purpose Processing Facility (MPPF) in F-Canyon.

A program plan for the pretreatment operations for Am/Cm vitrification was issued. The plan makes recommendations for flowsheet development and demonstration needs to resolve unknowns associated with the pretreatment processes. Recommendations from the plan will be used to develop the Task Technical and QA Plan under which the program will be performed. Specific development and demonstrations areas include: (1) demonstration of the oxalate precipitation to measure the solubility of metallic impurities which have an impact on the glass formulation, and (2) measuring the settling rate and specific volume of the precipitate slurry to allow design of the solution transfer jet.

Mixing in Canyon Tanks - Liquid-Solid

(N. M. Hassan and Yvonne Simpkins)

The Criticality Engineering Group (NMPD) has been performing nuclear criticality safety analyses for F and H canyon tanks. Typical analyses quantify the maximum safe solids mass in the tanks by assuming that the installed paddle agitators are providing sufficient power input to uniformly disperse the fissile solids in bulk solutions and the sampling system presently used is capable of providing representative samples in tanks known to contain fissile solids. However, no documentation is available to justify that the installed agitation/sampling system in the canyon vessels are capable of providing complete and/or homogeneous suspension.

The Chemical Technology Group has been carrying out a series of test runs with liquid-solid system in a transparent, baffled, paddle-agitated, Plexiglas® tank that is a geometrically scaled down model of the 8 feet diameter x 11 feet high canyon tanks; a scale factor of 1:5.33 was used to maintain geometric similarity between the small-scale laboratory unit and plant size tanks (see WSRC-TR-95-0028). The solid material used in this study was commercially available sand with particle density of 2650 kg/m^3 . The average concentration of solids (sand) was 1 wt.% for all test runs. The liquid level in the tank was varied while holding the percent weight of the solid constant. At each liquid level, the agitator speeds were varied from values so low that the solids could be barely seen in suspension to speeds so high that coning and splashing of the water surface could be visibly observed. The grab sampling technique employed by Hixon and Tenney (1935) for solid-liquid systems and Skelland and Lee (1978) for liquid-liquid systems was used to collect samples from both axial and radial positions in various regions in the tank.

A total of 56 test runs have been completed and the data are being analyzed to establish the mixing quality of the liquid-solid system. Both axial and radial distributions of the dispersed (solid) phase as functions of total liquid height, impeller speed, and number of impellers will be determined and recurring trends of the solids suspension in the agitated tank will be identified. Scale-up correlation of the solids suspension in the bulk aqueous phase in geometrically similar tanks (small-scale vs.

Plant tanks) will be discussed with Professor A. H. P. Skelland during his upcoming visit to the site this week.

Visual Observations of Mixing Quality in a Prototype Canyon Tank

(N. M. Hassan, N. M. Askew, and T. S. Rudisill)

A recent study performed to document the quality of mixing in cylindrical tanks used in Separations facilities found the current plant impeller speed was insufficient to completely disperse an organic phase. As a result of this study, questions were raised concerning the heat transfer analysis used in the F-Canyon Basis for Interim Operation (BIO). Using a geometrically similar tank, experiments were performed to measure the thickness of an unmixed organic layer that could remain floating on the surface of a typical canyon vessel with the agitator operating. Observations were also made concerning the fluid motion within the tank to determine if the motion is greater than that attributed to natural thermal convection within the vessel.

Revision 1 of "Visual Observations of Mixing Quality in a Prototype Canyon Tank (U)" (WSRC-TR-95-0108) was issued. This report supports the heat transfer analysis in the F and H-Canyon BIOs performed to determine the effectiveness of the canyon ventilation systems in removing heat generated from TBP/HNO₃ reactions and preventing a runaway reaction in a poorly mixed vessel. The report quantifies layer formation as a function of organic concentration and liquid level and concludes the motion in the fluid in the geometrically similar tank is substantially greater than the movement one would expect from temperature driven natural convection.

Modeling of Steam Heating of TBP Solutions in Canyon Tank

J. E. Laurinat

At the request of Regulatory Programs, the heating of TBP layers in the F-Canyon tanks by live steam entering from vessel transfer jets is being modeled. Several error and failure

sequences have been postulated that would inadvertently introduce live steam into the canyon tanks. The steam would enter the vapor space at the top of the tanks and would therefore heat just the top surface of the TBP layer. The objective of the modeling is to demonstrate that this surface heating does not lead to a runaway TBP/nitric acid reaction in the TBP layer.

A finite difference code is being written to calculate temperature transients. The code uses reaction kinetic data from recent calorimetric experiments conducted by J. R. Smith and W. S. Cavin and axial dispersion data from recent two-layer mixing experiments performed by J. E. Laurinat. Preliminary calculations show that for thin TBP layers the temperature of the TBP peaks and then decreases as the TBP is consumed by reaction. Gases released during the reaction keep thin TBP layers relatively well-mixed during the reaction transient.

FB-Line Box Sweepings

D. G. Karraker, T. S. Rudisill, and J. Middleton

Occasional spills of solid materials in the FB-Line gloveboxes were swept up, packaged and stored for future treatment to recover plutonium. The sweepings contain a mixture of PuO₂, CaF₂, CaO, MgO, PuF₃, etc., and were normally dissolved in the dissolver for recovery. The possibility of dissolving the glove box sweepings in a canyon dissolver has the advantage of a much larger capacity; however, to avoid possible criticality restrictions, the sweepings must be contained in a solid matrix that permits a predictable dissolver behavior. One such concept is the incorporation of the sweepings into an A1 compact; however, the FB-Line furnaces are considered capable of only 600°C, below the A1 melting point of 659°C. Scouting experiments to explore other possibilities are reported here.

Three possible matrix materials have been tested with CaO, CeO₂, and CeF₃ as materials to simulate glove box sweepings; none were successful. A 90 At% Zn-10 At% A1 alloy melts below 600°C, but powdered materials

simply floated on the melt. Under vigorous stirring, some CeF_3 was mixed with the alloy, but remained only as inclusions.

A second material tested was a $\text{PbO-B}_2\text{O}_3$ eutectic that melts at 493°C . This is a narrow eutectic, so the addition of a small amount of material raises the melting point dramatically. Five wt. % CaO raised the melting point above 600°C ; 2.5 wt. % CaO barely melted. However, this glass did not dissolve appreciably in 8M HNO_3 -0.2M HF in three hours at boiling.

The third material tested was a MgPO_4 quick-setting cement, which was loaded to 10 wt.% with CeO_2 and in a second test, CeF_3 . These cements disintegrated within 15 minutes in 8M HNO_3 . Other tests are continuing, but without optimism.

Processing Alternative for Cabinet Sweepings - T S Rudisill

An alternative method to disposition cabinet sweepings (assumed to be primarily MgO sand) is to add a small amount (100 grams) to each reduction charge and consolidate the non-plutonium-bearing materials in the slag. This alternative appears feasible. Intuitively, one would think the high melting point of MgO (2825°C) would increase the melting point of the slag and inhibit the coalescence of the plutonium metal (i.e. the button yield would decrease). The $\text{CaF}_2\text{-CaO-MgO}$ phase diagram, shows a ternary eutectic at 1343°C and 71% CaF_2 , 19% CaO , and 10% MgO . Theoretically, a normal reduction charge (2250 g Pu) produces slag containing 81% CaF_2 and 19% CaO . This assumes a 3:1 molar ratio of PuF_4 to PuO_2 is produced during conversion and 100% yield. The slag composition is approximately the binary eutectic at 1360°C and 80% CaF_2 and 20% CaO . Adding approximately 150 grams of MgO would produce a slag composition of 73% CaF_2 , 17% CaO , and 10% MgO which is very near the ternary eutectic. The melting point of the slag may actually decrease. If this is the case, the plutonium yield may not be significantly different for charges with MgO added.

The ternary diagram for the $\text{CaF}_2\text{-CaO-MgO}$ system is in good agreement with the $\text{CaF}_2\text{-CaO}$ and $\text{CaF}_2\text{-MgO}$ binaries. In fact, the $\text{CaF}_2\text{-CaO}$ eutectic at 1360°C is at the right composition. Based on these data, CHTS will proceed with scouting experiments to examine how sensitive the ternary eutectic is to the composition. From the phase diagram, there doesn't seem to be more than a 20-30 $^\circ\text{C}$ variance in the melting point over a fairly wide range of compositions (plus or minus at least 5-10%).

Flow Interruption for Pu239 loaded Anion Column in FB-Line

E. A. Kyser and K. J. Kalbaugh

Pu processing with nitrate form anion resin is a standard technique for purification of Pu-nitric acid solutions. By the early 1960's, a number of safety limitations were recognized and controls were placed on operations at this site. The primary controls had to do with venting of columns, keeping the resin wet, the temperature below 60°C , and limiting the resin's exposure to high acid and cumulative radiation dose. Leaving Pu loaded onto organic resin in 8 M nitric acid for an extended time is recognized as a undesirable practice. During normal processing, the solution flowing through the resin bed removes both heat and degradation products. Historically FB-Line has had operating limits for flow interruptions on the order of 48 to 72 hours. The basis for these limits was operating experience, but it is not well documented. CHTS has been requested to provide assistance with a technical basis to justify a reasonable operating limit for flow interruption.

In a 48 hour flow interruption test, the Pu loaded resin bed developed a large void volume within the resin bed during the latter 16 hours of testing. This appeared to be due the resin becoming buoyant in the 8M HNO_3 and floating to the liquid surface. When the column was eluted, the resin bed collapsed and the column visually appeared to elute normally. Whether the resin bed floated due to gas bubbles internal to the bed or due to a density change due to cross-linkage breakage was unclear. In a separate test, the oxidation offgas due to HNO_3 (no Pu) was measured. A flask of Dowex 21K in 8M nitric acid was agitated

and all offgas was collected by water displacement. A steady stream of gas equal to 0.8 cc gas/ml resin per hour was generated at ambient temperature. In additional experiments with different acidities and temperatures, the results were inconsistent. Sometimes the gas generation rate was much, much lower than in the original experiment. Further investigation is revealing that a number of additional controls are going to be necessary to understand the system dynamics.

Anion Exchange - D. C. Poprik

Prior to disposal of the anion exchange resin used in FB-Line's waste recovery process, the resin needs to be converted to a more stable form, than the nitrated form used for processing. Procedures for the sulfate conversion of the resin have cautions concerning the temperature rise of the resin during the sodium sulfate flush. Other than the cautions in the procedures, no documentation exists for the thermal effects of the sulfate conversion. This study was designed to document the thermal effects of a sulfate conversion of FB-Line's anion exchange resin (Dowex 21k®).

The conversion was completed and data collected. More runs were to be completed to better estimate the heat of reaction for the conversion, because of the high flow rate through the column and the small temperature change of the resin; however, it has been determined that the data from the initial run will provide a sufficient estimate of the heat of reaction. The initial run simulated FB-Line's flows through the column. Conversion of 62% of the resin generated 23 Joules/ml of resin. With a heat capacity of 3.18 J/g °C, if all of the heat generated through the conversion is imparted directly to the resin (perfectly insulated resin), the maximum temperature rise of the resin is 10.5 °C. This is significantly below the 60°C technical standard operating limit for the resin.

Hydrogen Generation in FB-Line Tanks Containing HSA and HAN

J. R. Smith, K. J. Kalbaugh, and J. B. Schaade, FB-Line

Alpha particle-emitting radioactive materials produce hydrogen, oxygen, and traces of other gases in nitric acid solutions through radiolysis. The production rate of these gases depends on the dose rate from the emitted alpha particles and the nitric acid concentration of the solution. Calculations show radiolysis can potentially cause hydrogen build-up in unvented tanks.

Earlier conservative calculations for the hydrogen concentration in the radiolysis off-gas of nitric acid solutions (2.5 to 3.0M) containing 0.165M HSA (sulfamic acid) and 0.023M HAN (hydroxylamine nitrate) ranged from about 4.5 to 3.9%. The calculated values are influenced by data generated at 3.3M nitrate (bounding upper nitrate concentration). At this nitrate concentration HAN is oxidized to produce species such as HNO which can reduce the rate of radiolytically generated O₂ gas. This reduction in the total off-gas rate increases the hydrogen concentration due to limiting its dilution. Data has now been acquired at 2.9M nitrate concentration which shows no reduction in total off-gas generation rate in the presence of HAN. This result was expected since the literature describing the reaction rates and mechanisms for nitric acid and HAN show a sharp drop-off in reactivity at 2.9 to 3.1M nitrate. Not only is the total off-gas rate not reduced but it has been found to be higher in Pu³⁺ solutions because of the production of nitrite (NO₂⁻).

The NO₂⁻ reacts with HSA or HAN to form more N₂ or N₂O gases respectively. The generated off-gas has been analyzed by gas chromatography (GC) to give 2.7% H₂, 5.5% N₂O, 19% O₂, and 69% N₂.

Hydraulic Analysis of FB-Line Ion Exchange Column Vent Lines

M. E. Hodges and M. C. Thompson

The Defense Nuclear Safety Board has requested that the design of the vent systems on the ion exchange columns in FB-Line be

reviewed to determine their adequacy to handle normal gas evolution and also violent reactions.

A detailed Hydraulic Analysis of the column vent system has been completed. With normal gas production due to radiolysis and chemical oxidation of the resin and normal liquid height in the vent lines, the system was found to be adequate. In the unlikely event of a violent reaction, the system is not adequate to prevent possible column rupture. Because of nuclear safety considerations, rupture disks on the columns are not practicable. Strict adherence to administrative controls is necessary to prevent the initiation of a violent reaction.

These calculations confirm work done by DuPont design engineers in 1986.

Processing Plutonium Residues

J. H. Gray, R. A. Pierce, and J. D. Clark

One of the processing options for recovery of plutonium from residues involves addition of depleted uranium oxide (UO_2) to form a solid solution with the high-fired plutonium oxide (PuO_2). This technology previously was demonstrated when equimolar mixtures of pure PuO_2 and UO_2 were heated in a microwave oven to form a $\text{PuO}_2\text{-UO}_2$ solid solution. The resulting plutonium-uranium compound then dissolved in $\text{HNO}_3\text{-HF}$ solutions even though the plutonium starting material was high-fired PuO_2 .

A similar approach is being considered for plutonium residues such as FB-Line glovebox floor sweepings and incinerator ash. The first series of "cold experiments" will involve addition of UO_2 to flyash and heating in a microwave oven to determine the impact of flyash on pellet formation. If the cold tests are successful, subsequent experiments will involve addition of UO_2 to plutonium bearing residues to determine if dissolution of plutonium is possible without the release of fine particles.

On-site Spheres Transfer Package

M. N. Van Alstine

In response to a DOE plutonium stabilization award fee milestone, Separations successfully transferred 15 Pu-238 heat source spheres from F-Area to HB-Line before March 1, 1995. This move was made possible by Packaging and Transportation (P&T) providing an approved transfer package.

Separations tasked P&T to provide an approved package and supporting hardware in time to achieve the milestone. P&T expedited the Onsite Spheres Transfer Package (OSSTP) design by combining components from the SRS 9965 and Mound 1 kW packages. As subtasked by P&T, the ASET Engineering, Modeling & Simulation group and Materials Applications & Corrosion Technology group developed and prototyped the OSSTP. ASET's Experimental Thermal Fluids confirmed OSSTP thermal performance by testing. Materials Applications & Corrosion Technology provided Separations with all necessary aluminum packing material and handling hardware.

Supporting documentation included the On-site Safety Assessment, the Safety Evaluation Report, and the On-site Package Authorization Form (OPAF). The OPAF provided the necessary approval to use the OSSTP and was delivered as scheduled on February 17, 1995.

This task demonstrated that the WSRC 19Q manual requirements for on-site package development and approval can be done in a timely manner.

H-Canyon LAW Training

R. A. Pierce and W. S. Cavin

A series of training classes for H-Canyon operators was completed this month. H-Canyon management asked that the Chemical Technology Group conduct a training session for their Low Activity Waste Evaporator operators. Based on our work with the Tomsk accident scenarios and the evaporator demonstration model, it was viewed that we could provide a more "hands-on" level of training. The class was given five consecutive Mondays for each H-Canyon shift, and it proved to be a valuable learning experience for both the operators and the trainers.

Characterization of Tank 12.1 and 18.3 Solids

J. H. Gray, K. J. Kalbaugh, and ADS

The justification for taking monthly samples from Tanks 12.1 and 18.3 for solids characterization is being reevaluated. The volume of solids has remained small and plutonium concentrations low in samples collected over the last nine months. Under consideration is combining the sample frequency with the accountability samples taken every other month. At this time, both accountability solution analyses and characterization of solids found in these solutions will be performed.

The volume of solids in both February and March Tank 18.3 solutions continued to be small. Plutonium concentrations were low, at 8×10^{-6} and 3.5×10^{-6} grams, respectively. Most of the material was muscovite, a potassium-aluminum-silicate, and included small amounts of iron-chromium-nickel corrosion products, calcium, and zirconium.

The February Tank 12.1 sample was the one exception to the trend displayed over the last nine months. The volume of solids was up slightly and the plutonium concentration increased to 37×10^{-6} grams. Although this is not an unacceptable high number, it is an order of magnitude higher than most of the recent 12.1 samples. These solids were corrosion products, muscovite, zirconium, and minor amounts of niobium, tantalum, and uranium.

The March 12.1 solution sample did not contain any solids. The change to a bimonthly frequency will start with the next set of samples scheduled to be pulled in May.

Separations, Robotics, & New Missions **Ivan Lewis**

EES issued SRT-EES-950023 detailing the analysis of a failed steam valve for Separations Engineering. The valve was disassembled and inspected, and a metallographic analysis was performed on the valve seat ring and pilot valve by MTS. It was determined that the most

probable cause of the regulator failure was undersizing of the pilot valve adjusting spring which is used to adjust the pressure setpoint.

EES shipped the IAEA coulometer to F-Area on March 8th to undergo hot testing in the F-Area Analytical Labs. EES was requested by Analytical Laboratories Department to provide electronic upgrades on two existing coulometer systems located in 772-F and 772-1F. The planned upgrades will use components identical to those that EES designed for use in a new coulometer for the IAEA in Vienna, Austria. Upon successful completion of hot testing, the IAEA coulometer will be shipped to Vienna, and EES will make modifications to the existing coulometers to bring them up to date with the IAEA coulometer.

EES completed fabrication of a prototype alpha Constant Air Monitor (CAM) in November and has been working with Separations Engineering and HP Tech on finalizing design of the new CAM. EES has been asked to build Rev. 1 of the prototype CAM which utilizes a slightly modified count rate meter, a new chart recorder, and an improved electronics enclosure. Redesign of the prototype has been completed, and the new components have been ordered. Fabrication of the Rev. 1 prototype should be complete April 30th.

ENVIRONMENTAL

Evaluation of Water Quality Parameters in L-Reactor Disassembly Basin

E. W. Wilde

Storing fuel in SRS reactor disassembly basins after the cessation of reactor operations resulted in corrosion problems. The release of radionuclides into the basin water caused by pitting corrosion of the aluminum clad fuel and target alloys is of particular concern. This corrosion is not uniform throughout the basins, suggesting a possible relationship between corrosion rates and varying water quality conditions in various regions of the basins. To begin evaluating this concept, E. Wilde of the Biotechnology Group assisted J. Howell of SRTC/Materials Technology and R. Deible of SNF Technology in measuring water quality parameters in the L-Reactor disassembly basin on March 9, 1995. A Horiba water quality checker was used to measure dissolved oxygen (DO), pH, conductivity, temperature, salinity, and turbidity at 5-ft depth intervals from top to bottom in the vertical tube storage area (east and west ends), the horizontal tube storage area (east and west ends), the machine basin, and the transfer bay. Results indicated that water quality was relatively homogenous throughout the basin. DO was near saturation and pH was above neutral throughout the water column at all locations sampled. Turbidity and salinity values were negligible in all cases. Thus, a correlation between water quality and differing corrosion rates within the L-Area disassembly basin was not established. Future plans are to use the Horiba to make similar measurements in the disassembly basins of other SRS reactors, especially P and K.

Par Pond Sediment and Vegetation Sampling - M. Paller, M. Westbury, C. Cummins

Fish, sediment, and water samples were collected from Par Pond to evaluate the status of aquatic communities before it is refilled. Additional samples will be collected after the pond is filled to determine changes resulting

from the refill and to ensure the continued health of aquatic organisms in the reservoir.

Pen Branch Mitigation Action Plan E. Nelson

Tree seedlings were planted in the delta and the upper corridor of Pen Branch. Mainly cypress and water tupelo trees were planted in the delta and a mixture of bottomland hardwood species were planted in the upper corridor. This completes the major planting program, with only small replanting remaining in the future, as needed. Monitoring plots will be installed in the delta to monitor survival and growth. A draft of the Mitigation Action Plan Update was submitted for the 1994 Environmental Report.

Glow Discharge Source for the ICP-MS Paula R. Cable

The utility of a glow discharge (GD) ion source that replaces the ICP source on the SOLA mass spectrometer was demonstrated using a variety of bulk solids. The samples analyzed included standard reference materials, metallic powders, and a precipitate collected from the Savannah River estuary. Preliminary results indicate that direct ionization using the GD source provides a viable alternative to ICP-MS analysis, which requires dissolution of the solid sample.

Savannah River Estuary Analysis Paula R. Cable

ICP-MS analysis of trace metals in twelve water samples were collected at various points along the Savannah River estuary and a report (SRTC-ETS-95166) summarizing the results was issued. A metal hydroxide precipitate collected in the same vicinity as the aqueous samples was analyzed using ICP-MS and glow discharge (GD) mass spectrometry with comparable results for each respective ionization technique.

RADMAPS Radiation/Position Detection Unit - K. J. Hofstetter, R. F. Eakle, and D. W. Hayes

A small portable 256-channel multichannel analyzer is being tested for field-use in conjunction with a 1" x 1" NaI(Tl) detector. This system uses a HP100LX palm-top computer to store the spectra, which then can be

downloaded to a PC using a standard serial interface. Software is being developed to deconvolute the resulting spectra and determine the isotopes responsible for the gamma rays in the radiation field. This system is under field testing as part of the RADMAPS project to develop field analysis methods for scintillation spectra.

Aerial Monitoring System

K. J. Hofstetter, R. F. Eakle, and
G. E. Reeves

Preparations are underway to collect gamma-ray spectra of transuranic (TRU) waste drums stored in the burial ground using a HPGe portable gamma-ray spectrometer. These data will support a Office of Technology Development-funded project to develop a three-dimensional scanner for TRU waste using multi-detector, topographical techniques.

Second-Generation Tritium Effluent Water Monitor - K. J. Hofstetter

The TEWM-2 installed in the 400-D process sewer successfully operated in March. ETS technicians monitored the performance daily by recording sensor readings and performing water quality analyses. Improvements to the water purification system are underway to permit an expanded choice of ion exchange resin media.

GPS Tracker - K. J. Hofstetter

The GPS Tracker was returned from the field for additional modifications. The electronic power supervisor circuit was modified and the unit is being prepared to be returned to the field for continued testing.

Assay of Burial Ground Wells with HPGe and NaI Detectors - W. G. Winn

On March 24, Total Quality Awards were given to participants of the Assay of Burial Ground Wells with HPGe and NaI Detectors project. The repaired HPGe sonde was also returned.

Economic Development AMTEX Proposal - C. B. Fliermans, E. W. Wilde, and C. J. Berry

A proposal was submitted to AMTEX to use SRTC's technology base on sizing and waste bioremediation for the textile industry. More than 50 AMTEX representatives toured SRS and the SRTC Bioremediation facilities at TNX on March 12, 1995. AMTEX representatives were impressed with the TNX laboratories, pilot, and full-scale facilities. The proposal seeks \$2-3 million in funding.

SRTC Assists Fermentation Plant with Waste Problem - T. C. Hazen, J. D. Young, M. M. Franck, R. Brigmon

Representatives of the Biotechnology Group visited a South Carolina fermentation complex as part of the Industrial Assistance Program. The purpose of the trip was to assist company personnel in developing process changes designed to reduce the solid waste currently being placed into a landfill at the facility. After reviewing the waste composition, analyzing samples, and examining the process, it was determined that the waste cake from the bottom of the fermentors is actually non-toxic and may be an excellent high-nitrogen fertilizer. A new local company specializing in bioremediation was contacted and discussions began between the two companies. This could not only save the fermentation company over \$200,000 per year in waste disposal costs, but also provide them with a new secondary product. The Biotechnology Group completed several tests of waste biomass from the fermentation plant. This waste, because of its high nutrient value, will act as an excellent fertilizer for the bioremediation of soil contaminated with biodegradable pollutants (e.g., sanitary landfills). On March 10, 1995, the bioremediation company began negotiations with the South Carolina fermentation plant for acquiring their new product and for producing contaminant biodegraders.

SRTC Assists English China Clay Company in Solving Bacteriological Contamination Problems - C. B. Fliermans and M. M. Franck, S. Wach

As part of the Industrial Assistance Program, a meeting was held at the English China Clay (ECC) Plant in Sandersville, GA to update the company on the research effort assessing the company microbiological contamination of their clay material. ESS and Interim Waste Technology scientists were investigating the use of chemical biocides and ^{60}Co to provide radiation as a means of reducing the microbiological contamination of the clays. Based on the initial encouraging results, ECC wishes to fund more extensive experiments at the lower radiation range in combination with various concentrations of biocides as well as other physical treatments such as elevated temperatures and shearing.

**SRTC Bioremediation Technologies
Featured in DOE's Publication,
Technology Transfer 1995**

T. C. Hazen, K. H. Lombard,
C. B. Fliermans

DOE's latest publication of, Technology Transfer 1995 features "Savannah River Technology Center Bioremediation Technologies: SOILS Facility for Bioremediation of Petroleum-contaminates Soils and In Situ Bioremediation of Chlorinated Solvents via Methane Biostimulation."

**Technology Development Coleman
Energy and Environmental and
Blackhawk Geosciences Geophysical
Data Fusion Presentation**

C. A. Eddy-Dilek and B. Pemberton

Researchers from the Blackhawk Geosciences Division of Coleman Energy and Environmental System presented the results from the field work at A and M Areas. The work was completed as the Phase II and III portion of the METC/PRDA geophysical data fusion program.

The purpose of this study is to use innovative geophysical methods to collect high-quality data from multiple geophysical sensors. The collection and preliminary interpretation of Phase II and III geophysical data collected at SRS is complete. A critical environmental restoration need provided the focus for the work—determination of the competence of the layer separating the two major regional aquifer systems. Baseline approaches applied

previously did not provide critical information to characterize this important layer, leading to the potential for expensive clean-up requirements. Definition of areas where the "aquitard" is competent versus areas where it is leaky may allow DOE to pursue a strategy of a "surgical," or limited, pump and treat system to protect the deep aquifer rather than installing a large area wide system in this zone. The geophysical results from TDEM and high-resolution seismic studies clearly demonstrate that the combination of these geophysical techniques provides important and unique information. Typically, surface TDEM studies are used to delineate areas where an aquitard is thin or absent. Along the M-Area traverse where the TDEM shows an increase in resistivity of the aquitard leading to questions about the competence of the unit, the seismic results clearly demonstrate that the top of the aquitard is an irregular undulating surface that varies in elevation, but that the unit is continuous across the traverse. The results show that these techniques have the potential to collect critical information about the subsurface hydrological regime that can be used to optimize remedial system designs resulting in significant cost savings.

**United States Geological Survey
Geophysics Interim Progress Report for
Dense Nonaqueous Phase Liquids**

C. A. Eddy-Dilek, J. Rossabi, and
B. B. Looney

Researchers from the United States Geological Survey Geophysics (USGS) Branch of Geophysics presented the results of the preliminary phase of field work focusing on applying geophysical methods to characterization and monitoring of dense nonaqueous phase liquids (DNAPL). The Office of Technology Development sponsored SRTC in initiating a program to demonstrate innovative technologies for characterizing and remediating DNAPLs. The goals of this program are to provide a focus to expedite development and application of technologies for DNAPL characterization and remediation, to provide a well-characterized field site to perform the work, and to facilitate DNAPL remediation at SRS. Geophysical measurements are a critical tool to support DNAPL remediation efforts. Geologic and stratigraphic information can be obtained from borehole logs, borehole to

borehole measurements, and surface geophysical data. This information is useful in identifying changes in physical properties that affect contaminant flow. They presented the results from the comparison of the standard SRS resistivity logs to microresistivity data collected with the cone penetrometer as well as general observations about interpretation of borehole logs at SRS. Results from initial field feasibility testing of borehole radar and seismic techniques for DNAPL characterization and monitoring studies were also presented.

MAG*SEP Demonstration

K. Jerome, R. Nichols, M. Phifer, F. Sappington, C. Betivas, J. Bibler

The MAG*SEP Demonstration will provide for the development, the design, and the first field tests of the Magnetic Separation System (MAG*SEP), and the EnviroWall Barrier. This demonstration brings DOE, national laboratories, operating facilities, and private vendors together to develop and test new technologies that are targeted for environmental restoration needs. SRS is hosting the demonstration and providing process chemistry support and all site support and site characterization.

Several key tasks were completed this month. Revision 0 of the Treatability Study Workplan is complete and was transmitted to EPD for DOE signature and subsequent transmittal to the regulator agencies on March 7, 1995. A meeting was held with Effluent Treatment Facility's personnel to discuss acceptance of some MAG*SEP waste for disposal. A meeting was held March 9, 1995 with EPD personnel to discuss handling and disposal of waste from the MAG*SEP and barrier wall pump test.

Ongoing activities of significance are provided as follows:

- Construction of the barrier wall by BMC Corporation is continuing.
- The pass-thru was re-installed on February 24, 1995.
- Weather has slowed the installation rate of the walls of the barrier.
- WSRC staff is providing oversight of the construction activities.

- The Process Hazards Review of the MAG*SEP treatment system is on hold pending completion of the process chemistry and redesign of the regeneration system.
- Process chemistry tests conducted by Bradtec are not producing promising results.

Special Consolidated Solicitation Solvent Recycle Demonstration: Offgas Treatment - T. R. Jarosch and J. S. Haselow

As part of the DOE-SR Special Consolidated Solicitation, a demonstration is being conducted to test a regenerative adsorption system for recovering chlorinated organic solvents for reuse. The project is being managed by Tetra Tech, Inc. (Pasadena, CA) and uses the Purus Adsorb-Desorb Remediation Equipment (PADRE™) system developed by Purus, Inc. (San Jose, CA). SRTC is operating the vacuum extraction system and providing logistical and analytical support. Tetra Tech and Purus, Inc. personnel returned to the site to prepare for resumed testing to begin in mid-March 1995. The PADRE's condenser unit was thoroughly tested to ensure minimal problems on start-up and operation over the planned six-week test duration. SRTC is installing the solvent separation equipment (settling tank and filter units). Because of the reduced field test, the volume of solvent collected is estimated to be between 200 and 300 gallons. Therefore, the solvent will be stored in Department of Transportation approved drums that can be shipped directly to the recycling firm. Health Physics Technical personnel are assisting the demonstration with dosimetry support. Sixteen dosimeters were placed at the test site to identify and quantify exposure at eight locations in the process resulting from natural radon that concentrates on the adsorption beds and in the solvent. In addition, periodic count rates will be monitored to determine transient exposures and all personnel directly involved with operations will wear dosimeters.

Bioremoval of Metals

E. W. Wilde and J. Radway

Laboratory experiments revealed that filter media composed of algae embedded in foam sequestered a given metal more efficiently from a single metal standard solution than from D-Area coal pile runoff basin (D-CPRB) water where the metal was present at the same concentration as the standard. To investigate reasons for these results, experiments are planned to treat D-CPRB water (pretreated to reduce iron and aluminum content) and a mixture of metal standards containing aluminum, beryllium, cadmium, cobalt, chromium, copper, iron, nickel, and zinc at levels similar to that of the wastewater. Single-metal solutions of nickel and zinc will also be tested as a comparison to the mixtures and to the previous experiment. The experiment is expected to show whether the problem relates to competition between metal ions or to some feature of the chemical environment (such as organic content) specific to the actual runoff. Only pH 5 will be used this time, since metal removal is generally superior at this pH. Similarly, based on the previous experiment, we have selected granulated foam rather than plugs. The mini-columns will be modified to reduce the initial rapid flow rate observed previously, increasing average contact time of metal ions with the algal biomass. This is expected to improve metal removal percentages. Additionally, the experiment will compare performance by three algal strains (phaeodactylum, chlorella, and cyanidium).

Sanitary Landfill Groundwater Bioremediation Optimization Test

T. C. Hazen, K. H. Lombard, M. M. Franck, D. Altman, C. J. Berry, and F. A. Washburn

Well installation and environmental sampling for the Sanitary Landfill Optimization Test Demonstration is back in full swing. The well installation at the vinyl chloride and chlorobenzene site (Site 2) is complete and the well development process is continuing on schedule. Fourteen piezometer clusters were installed with two vadose zones and one water monitoring point in each cluster. Three 50-ft stainless steel air and nutrient injection wells and one centralized air extraction well were also installed. Work began on the trichloroethylene site (Site 1) with well installation and soil sampling for site characterization, microbiology,

and VOC/inorganic analyses proceeding on schedule. Sampling and analyses of the groundwater will begin next week upon completion of the well development process. Procurement of the system components is on schedule and the installation and start up of the test equipment will begin in early April 1995.

Offgas Treatment Technology Testing of Flameless Thermal Oxidation

T. R. Jarosch and J. S. Haselow

HAZWRAP (Martin Marietta Energy Systems) of Oak Ridge, TN requested that SRS provide our site, services, and expertise in conducting a demonstration of an emerging technology for treating air streams containing chlorinated volatile organic compounds. The technology demonstration being proposed involves a flameless thermal oxidation (FTO) technique developed and patented by Thermatrix Inc. (San Jose, CA). The design employs a controlled, high-temperature (800–1000°C) inert-ceramic packed-bed reactor to thermally oxidize the organics. Fabrication of the 5 scfm test unit is complete and the unit is scheduled for delivery the week of March 13, 1995. Work is complete at the test site (AMH-4) for installation and service connections to the test unit. The demonstration will involve a one- to two-week period of testing at different flow rates, temperatures, and concentrations, followed by an extended one to three weeks of continuous operation at an optimal condition.

Permeable Barriers Work Group - M. A. Phifer

An Environmental Protection Agency Remediation Technologies Development Forum (RTDF) for Permeable Barriers Work Group is being formed with representatives of industry, government, government contractors, and academia. The purpose of the group is to pool expertise and resources to advance permeable barrier technologies more quickly and economically. M. A. Phifer of the ESS Groundwater Group is a member of this group and is participating in its formation and organization.

Rapid Bioassessment - M. Paller

Scientists from SRS, the South Carolina Department of Natural Resources, and the University of South Carolina met to discuss efforts at SRS to develop biotic assessment methods for determining stream integrity. As a result of interest expressed at this meeting, a workshop was scheduled in April 1995 to exchange information and chart directions for future research. Representatives from the South Carolina Department of Natural Resources and SRS will attend the meetings and give presentations.

HOPS DataDelve Demonstration J. Bowers

A demonstration of DataDelve/HOPS was given to the Risk-Based Standards Working Group. This complex-wide group, headed by J. Bascietto (DOE/HQ), included SRTC's demonstration as a part of their site tour. Representatives from Hanford, Idaho National Engineering Laboratory, Rocky Flats Plant, EG&G Mound Laboratory, Los Alamos National Laboratory, SRS, and the Environmental Protection Agency attended.

New Assays for Petroleum— Contaminated Soil T. C. Hazen, K. H. Lombard, M. M. Franck, J. Heffner and W. Groce

SRTC and the Environmental Protection Department began testing new immunoassays for total petroleum hydrocarbons (TPH). These assays cost \$20 per sample and can be completed in the field in less than one hour. The conventional TPH assay currently required by South Carolina Department of Health and Environmental Control is by gas chromatography and a freon extraction; this process costs \$200 per sample, takes seven days to complete, and generates hazardous waste. Adopting these immunoassays for routine TPH field screening could save SRS millions of dollars in assay costs and hazardous waste management. Two of the companies that make these test kits will be collaborating on the project.

Environmental Restoration TNX Groundwater - R. L. Nichols, M. A. Phifer, F. C. Sappington, B. E. Pemberton, C. P. May, C. R. Betivas, M. A. Keenan, D. W. Williams, J. M. Mowers

The TNX groundwater is contaminated with chlorinated volatile organic compounds (CVOC). The Record of Decision (ROD) to address this contamination states that the 500 ppb trichloroethylene (TCE) plume will be hydraulically contained and treated. Recovery wells at the edge of the 500 ppb TCE contaminant plume and an associated air stripper will be installed to accomplish this. Environmental Restoration (ER) requested that the Environmental Science Section install a test recovery well and perform a pump test on the test well to obtain design parameters for a full-scale recovery well system. The following occurred in association with the TNX test recovery well and pump test:

- Aquifer parameters determined from the constant rate pump test, the recovery test, and well loss data from the step pump test were transmitted to SGS and ER to expedite modeling and design of the recovery well system.
- The test report is being prepared.
- Samples of the activated carbon were collected and analyzed for RCRA TCLP hazardous waste characteristics. The results indicate that the used carbon is not a hazardous waste. TCE had the highest concentration at 0.053 mg/L, and the regulatory limit for TCE is 0.500 mg/L. Plans are being made for the carbon unit vendor to take the used carbon and regenerate it for reuse.
- A revised Work Authorization Document was received from ER for an additional \$72 million in funding required to cover the additional scope associated with discharge water treatment and additional regulatory requirements.

Design of TNX Recirculation Well R. L. Nichols, R. M. White, J. Kupar

The TNX Groundwater Interim Record of Decision (IROD) calls for the installation of a hybrid groundwater remediation system consisting of conventional pump and treat wells and an innovative vertical recirculation well. SRTC is the design and technical agency for the recirculation well. A design review is complete and comments are being incorporated into the drawings. The drawings will be entered into Document Control after updating. Equipment specifications are being prepared to procure the equipment for testing the well. Our intent is to procure equipment that could be left in place as the permanent system after tests are complete.

Detailed Three-dimensional Flow and Contaminant Transport Modeling of the Old Burial Ground - M. Harris, P. Thayer, A. Smits, J. Haselow, G. Flach, W. Jones, L. Hamm

Development of a detailed, three-dimensional contaminant transport model of the Old Burial Ground continues. Recently, a FACT code input deck for flow and tritium transport from the Old Burial Ground was constructed and some initial computer simulations were performed. FACT code performance was robust during these initial simulations, so subsequent numerical difficulties are not expected. The model is expected to provide significant insight into past and future tritium discharge to Fourmile Branch and be a valuable tool to evaluate potential remediation approaches, such as capping the Old Burial Ground.

Detritiation Technologies Review
B. Looney and K. Jerome

A program to evaluate the status of current and emerging aqueous detritiation methods and to develop a practical assessment of potential viability will be conducted to support Environmental Restoration (ER) efforts in remediating the F- and H-Area Groundwater Plume. The statement of scope for the SCUREF contract was submitted to procurement and the request for proposal was forwarded to the universities. V. Van Brunt, of USC, responded to the request for proposal. A review of Van Brunt's proposal was completed on March 10, 1995 and transmitted to the buyer. ER is asking us to hold off on placing the contract until a

decision can be made by ER management as to whether to continue funding this study.

Reactor Canal Groundwater Investigation -

C. B. Fliermans, F. A. Washburn, K. M. Jerome, C. P. May, and M. C. Whitford, J. Cardoso-Neto

Since the initial operation of the production reactors, cooling water was discharged from the reactors through unlined cooling ponds and lakes. These unlined canals and ponds are most apparent at P, R, and C Reactors. The discharges of 45°C at a ΔT , established unique microbial habitats within the canal system. Previous investigations demonstrated that the microbial communities sequestered isotopes and metals at concentrations of several orders of magnitude above the concentrations found in the effluent discharges. Previous studies have not, however, investigated the fate of tritium on the groundwater. In an effort to determine the impact of the reactor effluent on the groundwater, well points will be installed and groundwater samples will be collected and analyzed. Preliminary documentation, such as National Environmental Policy Act and Site Use and Site Clearance, have either been approved or are routing for approval. South Carolina Department of Health and Environmental Control has toured the proposed drilling sites and the comments received were minor with no impact to the existing schedule. Current internal issues concerning the Federal Facilities Agreement are under discussion. Drilling activities are planned for April 1995.

Data Quality Objectives Workshops
J. Gladden

Representatives from ESS participated in an inter-site workshop on Data Quality Objectives for Ecological Risk Assessment. The workshop was organized by the DOE-HQ EH-412, Risk-Based Standards Working Group. Representatives from DOE-HQ, DOE-SR, WSRC, most DOE laboratories, and the Environmental Protection Agency attended. Following the two-day workshop, a site tour was conducted and included a demonstration of DataDelve and a discussion of the Ecology Data Atlas.

Old F-Area Seepage Basin Soil Remediation - V. H. Dukes, S. M. Serkiz, and J. L. Siler

The Old F-Area Seepage Basin is an inactive, unlined basin north of Building 221-F. This basin, which can be described as a wet-weather pond, was used to process various waste waters, such as evaporator overheads and contaminated cooling water.

The binder screening samples (12 total) were mixed and poured. These are scheduled to cure for 30 days at which time the samples will then be crushed and leached per the TCLP protocol. These leachings will occur at the end of this month and early April. The solutions will be analyzed via ICP-MS, along with a variety of analytical techniques, to determine which three binder mixtures merit further study.

The longer-term (30 days or greater) samples for the curing time studies were mixed and poured. These samples will be crushed and leached, similar to the binder studies discussed above. The samples will be leached from April to July.

F/H Groundwater - Contaminant Adsorption - W. N. Johnson, S. M. Serkiz

On March 24, S. Serkiz and B. Johnson, WSRC, met with Dr. S. Clark, SREL, and Dr. D. Dzombak, Carnegie Mellon University, to discuss the application of contaminant sorption models to field and laboratory data for the F- and H-Seepage Basin groundwater studies.

Dr. Dzombak, co-author of Surface Complexation Modeling: Hydrous Ferric Oxide, agreed with the modeling approach being taken for this project. He suggested that, for modeling at this site, the mass action approach with competitive proton binding would be most appropriate.

Additionally, he suggested that if these data were to be applied to other sites with a different groundwater chemistry, the model fitting parameters derived from electrostatic models (e.g., constant capacitance or triple-layer models) would be most appropriate.

WASTE MANAGEMENT

Shrinkage Compensating Concrete - C. A. Langton

Shrinkage Compensating Concrete (SCC) has been evaluated for use at SRS. SCC is widely used in industry for rapid construction of slabs and walls, and where low permeability structures are required. SCC achieves low permeability by eliminating shrinkage cracks and by reducing/eliminating the need for water stops or construction joints in structural units. SRTC developed a mix and both laboratory and field prepared samples have been tested for compressive strength and restrained expansion. Cost savings are expected as some reinforcement and most if not all of the construction joints/water stops can be eliminated. The developed mix has been recommended for field testing on actual slabs at SRS.

Proposed Site Treatment Plan R. H. Hsu, L. Williams

The Proposed Site Treatment Plan (PSTP) is being submitted to DOE-SR on schedule. This plan proposes treatments for each of the seventy plus mixed waste streams at SRS. SRTC has had considerable involvement in preparing this plan over the last year and a half. Most recently, SRTC has been heavily involved in revising the TRU waste sections and in preparing a description of emerging technologies.

Filter Programs: Equipment Upgrades - D. J. McCabe, C. A. Nash, R. A. Peterson, B. W. Walker

The goal of the Caves Unit Filter project is to have a small crossflow filtration unit ready to test ITP feed by the end of May. The design of Bob Younkens has been approved by the ITP and Late Wash customers. The major procured items (i.e., low shear pump, pump motor, filter) are in hand. Completion of construction is scheduled for the last week in March. This

will be followed by non-radioactive tests in the Mockup Cell.

Effect of Variations in Solution Composition on Combustibility of Slurries and Cesium Content in the Resulting Smoke M. J. Barnes

During In-Tank Precipitation (ITP) processing, liquid levels will rise and fall within Tank 48H. Slurry will coat the walls and possibly dry out. Dried slurry poses a combustion hazard. In addition to the scenario described, other combustion scenarios involving dried slurry include leaks in the filter cell or tank annulus. Recently, a question was posed whether additional constraints on chemical species should be included in the ITP Process Requirements to protect against these combustion hazards.

Investigation indicates no additional constraints on chemical species are recommended for Revision 4 of the ITP Process Requirements to protect against combustion hazards. Typical In-Tank Precipitation (ITP) slurries, with inorganic salt compositions ranging from that of unwashed (5.0M) to washed (0.3M) material have been tested and found safe with respect to drying rates, combustibility, and the cesium content in smoke produced by combustion of dried deposits. The phenomena has been further examined for slurries outside of this composition range. Existing documentation clearly shows that slurries with low inorganic salt content have a fast drying rate and high fuel content. However, these same deposits have a low cesium release due to their ability to burn efficiently. As a result, the cesium release is bounded by existing calculations and is inherently safe. On the opposite extreme of the concentration range, cesium release plateaus for slurries with a high inorganic salt content (e.g., greater than 5.0M). However, these same slurries have a much slower drying rate and lower fuel content. As a result, the cesium release is bounded by existing calculations and is inherently safe.

ESP Slurry Pump Modifications - M. J. Dalmaso, D. B. Stefanko

ESP plans to replace slurry pumps in Tank 51. Three pumps will be modified and tested at TNX before installation in Tank 51. IWT is responsible for coordinating the pump modifications, including preparing the test facility, revising the test procedure, and providing technical support during pump tests. Activities completed this reporting period include:

- Generated a draft pump modification schedule/logic, which was forwarded to ESP for review. This schedule will be incorporated into the ITP/ESP POW schedule.
- Pump modification guidelines were revised by IWT and HLWE. HLWE later issued the revised guidelines as a letter of instruction.
- Began facility checkout and calibration of instruments.
- Transported three pumps to TNX for modification.

The path forward is to complete the facility preparations and continue working with construction during pump modifications. Plans are to test the first pump by May.

Waste Management and Environmental Restoration - Alex Henderson

EES is continuing the design of the Annulus Camera System for High Level Waste. The camera package will now house a color camera and a motorized zoom lens allowing the camera to focus from 6 inches to infinity. The deployment system has been modified so that a flat, heavy-duty ribbon cable will be used to deploy the camera package. This will reduce the size of the deployment reel significantly.

EES has corrected the vendor design flaw on the Waste Tank Camera Tool deployment reel and has repaired resulting problems. The design flaw caused the cable reel drum to detach from the shaft leading to the breakage of the video signal wire inside the drum. All repairs are complete, and the system is operational.

Defense Waste Processing Facility - Alex Henderson

EES completed assembly of the Gas Chromatograph Sample Drying System for DWPF on March 5th. The Sample Drying System is currently being tested in Building 305-A, and the system will be installed in the field when the necessary paperwork is completed by DWPF.

EES has begun final design of the three Field Termination Cabinets for Late Wash, and EES drafting is currently working on the termination interconnection drawings. The bill of materials for procurement of cabinet accessories is being completed.

EES received the mechanical enclosures for the Late Wash Facility Benzene and Nitrite Analyzer systems and will begin modifications once Design Engineering completes the design changes to the enclosures. Procurement for all valves, electrical connectors, and cables has begun, and the electrical schematics for the analyzer enclosures are underway.

EES completed requisitions for the Infrared Camera System and image analysis computer for the Canister Level Detection job, and the requisitions are being routed for approvals. Other support equipment has been ordered, and EES is preparing a final purchase requisition for the image analysis and Distributed Control System interface software.

EES is continuing to develop design changes for the Analytical Cell upgrades. Stainless steel mirrors, which will be used to eliminate blind spots in the cells, are being procured and prototype mirror holders are being fabricated. Fabrication is complete or in progress for bailing devices for the hot plate stirrers, ultrasonic cleaner, drying oven, and capper/decapper. The bails will make it possible to lift heavy equipment with the overhead hoist for removal from the cells.

The final prototype of the penetration seal has been submitted to the shop for fabrication. The first generation design is currently being

Progress and Accomplishments

pressure tested to see if it will pass the leak rate requirements. EES has begun to review the design of several custom tools used in the cells to see if design improvements can be made to increase efficiency and decrease complexity.

GENERAL

Change Control Status - L. R. Chandler

The current status of the Baseline Change Proposal (BCP) packages developed by SRTC for the FY95 23 Site is: twenty-three Sitewide packages have been prepared; three are routing in SRTC for approval; two are awaiting DOE approval; eighteen have been approved by DOE; and twelve have been entered into the FY95 AOP electronic data base.

Reactor Support - Malcolm Kyle

EES will be demonstrating the remote flange removal and sampling technique for Reactor Purification Deionizer Sampling. The demonstration is for Reactor and HP personnel and is scheduled for the end of March.

EES completed a detailed estimate for design and fabrication of a vessel (per ASME code) to be used to transport spent deionizer resin. The estimate was delivered to the Site Packaging and Transportation Group.

EES is working on a Phase I Vacuum System to install in K-area. There are two main differences from the one currently in L-area. The first difference is that an electrically powered pump will be tested, and the second is a centralized hose routing that will allow quicker cleaning of the basin.

EES is developing a tool to streamline the process of unloading fuel coming into the RBOF facility. Design is 80% complete, and some of the components ordered earlier this month have started to arrive onsite. The end-effector currently being designed will be of a "quick-connect" variety to allow easy change-out of the grippers to accommodate any variety of fuel shapes.

EES has completed an internal review of the air-seal stoplog design. Prints are in the process of going out for bids. The air-seal design allows better sealing between the monitor basin and the rest of the disassembly basin. The improved

sealing allows for storage of the sludge in the monitor pin basin while purifying the water in the rest of the basin with deionizers.

Site Robotics Support - W. J. Lewis

EES completed development of an improved version of the torch deployment tool for use on the Elbow Cutting Pipe Crawler. A more powerful torch has been procured. A six-minute videotape highlighting the elbow removal demonstration in F-Area has been made, and actual elbow removal in the F-Area ventilation line is scheduled for April 11th.

EES has proposed a new type of Camera in a Drum (CID) video system for crane deployment in the Separation Canyons as a tool to investigate anomalies. The CID unit would be used to provide video views from vantage points down to the canyon floor with adjustable pan/tilt/zoom/lighting functions and would be controlled through the existing remote video controls. The new style canyon cranes, now installed in all canyons, are not compatible with the earlier CID units used during the late 1980's. The new system would maintain the sealed nature of the new cranes and be interchangeable to all canyons.

EES wrote a software program to interface a balance and calculate the oil content of a sample for the Analytical Development Section (ADS). ADS proposed a new scheme for determining the percentage of oil in a soil or liquid sample and requested EES assistance interfacing a Mettler balance to an IBM computer.

EES is continuing re-engineering work on the DWPF Borescope. One of the current borescope units was removed from routine service to evaluate its condition. It was found to have a heavily eroded area around the opening used for viewing and lens purging. The cause of the erosion is under study.

Robotics for D&D - W. I. Lewis

As part of the OTD Robotics for D&D program, EES is coordinating surveillance and maintenance risk and cost reduction evaluation methodologies. The request for proposal was

received by JBF Associates this week for phase II funding of the "DECIDE" software development. The writing of a production code software specification document will be the first task addressed with the continuation of funding under this contract.

EES met with principle investigators (PI's) from ORNL to discuss the OTD dismantlement scenario and how the EES program for remote dismantlement of highly radioactive equipment fits into the overall program. The other two PI's are developing large remote tools for cutting apart pipes and vessels while EES is developing remote tooling for smaller components. The EES-developed tooling will work well with the larger deployment systems for removing the tremendous amount of small pipe and tubing that exists in K-25 and K-27 at ORNL. EES is currently working out the details to take part in a joint demonstration of the equipment systems at ORNL.

Robotics for Mixed Waste Operations - W. I. Lewis

EES completed installation of the fixed portion of the inspection mast on the equipment frame of SWAMI (Stored Waste Autonomous Inspector). Removable legs and braces were added to support the frame and allow it to be detached from the vehicle. The inspection mast will house the camera and laser systems that allow SWAMI to read drum bar-codes and perform inspection of stored waste drums for dents, blisters, rust spots, and rust streaks.

Underground Storage Tank - Integrated Demonstration - W. I. Lewis

EES met the Underground Storage Tank (UST) Integrated Demo Surveillance and Inspection Milestone #4 on schedule with the issue of the detailed design report on the Optical Alignment System (OAS). The OAS is an end effector device for the Light Duty Utility Arm (LDUA) robot now being designed for remediation of Hanford UST's. The OAS will be used as the initial tank entry device for the LDUA by serving as a final alignment check and entry progress gauge. The OAS has video line lasers and distance readout lasers to provide a variety of reference indications to the LDUA controller.

Office of Technology Development - Focus Areas - W. I. Lewis

EES is participating in the newly created Landfill Focus Area and the Transition, Decommissioning and Final Disposition (TD&D) Focus Area created under the Office of Technology Development (OTD). EES personnel were recently selected as the Retrieval Technical Task Leader for Landfill and as coordinator for TD&D site involvement. To this end, EES participated in Landfill Focus Area meetings at DOE-HQ and aided DOE SR in coordinating TD&D Focus Area meetings at SRS.

Alliance for the Advancement of Robotic Technology (AART) - W. I. Lewis

As part of nine DOE sites, EES represented SRTC in the AART meeting in Dallas. The group's vision and mission statements, Memorandum of Understanding, and core competencies were agreed upon, and work was started on an industrial outreach program and informal presentation to various DOE organizations and the G10/G19. AART will use the collective resources of its participants to develop advanced robotics technology to reduce cost, enhance safety, and improve the productivity and effectiveness of DOE, US industry, and other federal agencies.

ITEMS OF INTEREST

EES Robotic and Remote Systems Technologies were highlighted at the recent Technology Transfer Day at the Radisson in Augusta. Several commercial companies expressed interest in licenses of EES technology and further collaboration.

EES hosted approximately 50 individuals involved with AMTEX on a tour of the Robotics Laboratory.

EES presented "Radiation - What's Important" to the US Naval Academy as an invited lecture.

M. Paller "Inter-replicate Variance and Statistical Power of Electrofishing Data from Low-gradient Southeastern Streams," was acceptable for publication in the July 1995 issue of the North American Journal of Fisheries Management.

K. J. Hofstetter, "Continuous Aqueous Tritium Monitoring", submitted for publication in the March 18 edition of Fusion Technology.

K. J. Hofstetter, "Environmental Radiation Monitoring Technology: Capabilities and Needs," was published in Nuclear Instruments & Methods in Physics Research, A 353, (1994) 472-476.

K. J. Hofstetter and K. W. MacMurdo wrote, "Proposal to DOE/NN-20 'Field Tritium Detector' on March 15, 1995.

R. Brigmon of the Biotechnology Group gave a presentation on March 2, 1995 at the Groundwater Update meeting entitled, "Monoclonal Antibodies as Diagnostic Tools in Waste Water and Soil Treatment at the Sanitary Landfill."

T. Hazen gave the closing paper at the Third International Symposium on the Interface between Analytical Chemistry and Microbiology in Knoxville, TN. His paper was entitled, "Monitoring of in situ Biodegradations."

T. Hazen presented a special evening lecture at the Second Keystone Symposium on Environmental Biotechnology. His paper was entitled, "Advances in Bioremediation of Soil and Groundwater at U. S. Department of Energy Sites."

P. R. Cable and D. M. Beals presented, "Glow Discharge Device as a Complimentary Source for an ICP Mass Spectrometer," at the 1995 Pittsburgh Conference on March 5-10, 1995.

D. M. Beals and P. R. Cable presented, "Supercritical Fluid Extraction of Metals and Actinides from Solid Matrices," at the Pittsburgh Conference on March 5-10, 1995.

P. R. Cable was invited to present a paper for the Glow Discharge Symposium at the 22nd Conference of the Federation of Analytical Chemistry and Spectroscopy Societies (FACSS) on October 15-L20, 1995.

K. J. Hofstetter submitted, "Continuous Aqueous Tritium Monitoring", for presentation at the Fifth Topical Meeting on Tritium Technology in Fission, Fusion, and Isotopic Applications Conference in Lake Maggiore, Italy, May 28-June 3, 1995 (Published in Extended Book of Summaries, February 1995).

"Year-End Project Review on "Warhead Dismantlement/Special Nuclear Materials Control Program (RADMAPS)" was presented to DOE/NN-20 management, in Washington DC on March 8, 1995.

The Bioremediation Report 4(2):11. February 1995. Patent 5384048. Bioremediation of Contaminated Groundwater. Inventors: T. C. Hazen and C. B. Fliermans.