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Information Division

NUCLEAR FACILITY DECOMMISSIONING

AND

SITE REMEDIAL ACTIONS

A SELECTED BIBLIOGRAPHY
VOL. 1

- Facility Decommissioning
- Uranium Mill Tailings Cleanup
- Contaminated Site Restoration
- Criteria and Standards

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Ecological Sciences Information Center
Information Center Complex

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OAK RIDGE NATIONAL LABORATORY
Oak Ridge, Tennessee 37830
operated by
UNION CARBIDE CORPORATION
for the
DEPARTMENT OF ENERGY

Contents

HIGHLIGHTS

This bibliography of 633 references represents the first in a series to be produced by the Remedial Actions Program Information Center (RAPIC) containing scientific, technical, economic, and regulatory information concerning the decommissioning of nuclear facilities. Major chapters selected for this bibliography are Facility Decommissioning, Uranium Mill Tailings Cleanup, Contaminated Site Restoration, and Criteria and Standards. The references within each chapter are arranged alphabetically by leading author, corporate affiliation, or title of the document. When the author is not given, the corporate affiliation appears first. If these two levels of authorship are not given, the title of the document is used as the identifying level. Indexes are provided for (1) author(s), (2) keywords, (3) title, (4) technology development, and (5) publication description. An appendix of 123 entries lists recently acquired references relevant to decommissioning of nuclear facilities. These references are also arranged according to one of the four subject categories and followed by author, title, and publication description indexes.

The bibliography was compiled from a specialized data base established and maintained by RAPIC to provide information support for the Department of Energy's Remedial Actions Program, under the cosponsorship of its three major components: Surplus Facilities Management Program, Uranium Mill Tailings Remedial Actions Program, and Formerly Utilized Sites Remedial Actions Program. RAPIC is part of the Ecological Sciences Information Center within the Information Center Complex at Oak Ridge National Laboratory.

INTRODUCTION

The staff of the Ecological Sciences Information Center (ESIC) provides technical support to the Department of Energy (DOE) Remedial Actions Program under the cosponsorship of the program's three major constituents:

- Surplus Facilities Management Program
  - Lead Field Office—DOE Richland Operations
  - Lead Contractor—UNC Nuclear Industries, Office of Surplus Facilities Management (OSFM)
- Uranium Mill Tailings Remedial Actions Program
  - Lead Field Office—DOE Albuquerque Operations Office
- Formerly Utilized Sites Remedial Actions Program
  - Lead Field Office—DOE Oak Ridge Operations Office

In this capacity, ESIC operates the Remedial Actions Program Information Center (RAPIC). Functionally, RAPIC is a part of ESIC, which is part of the Information Center Complex, Information Division, located at Oak Ridge National Laboratory. Administratively, ESIC's communications with the Remedial Actions Program and financial support from the program are coordinated through the Surplus Facilities Management Program's Office of Surplus Facilities Management, Richland, Washington.

RAPIC is designed to serve as a central clearinghouse for current and background information concerning scientific, technological, regulatory, and socioeconomic aspects of radioactively contaminated facility/site remedial actions. This includes both domestic and foreign publications. For both government and commercial industry, these remedial actions encompass such activities as:

- Performing characterization surveys of radioactively contaminated facilities/sites.
- Conducting ongoing security and surveillance programs.
- Performing preventive maintenance actions to ensure containment of radioactivity while awaiting permanent disposition action.
- Assessing environmental and engineering aspects of proposed disposition alternatives.
- Drafting detailed disposition plans and procedures.
- Removing contamination and restoring facilities/site for unlimited and limited new uses.
- Reclaiming valuable materials for industrial or nuclear fuel cycle uses.

This bibliography represents the first in a series to be generated by RAPIC. It contains 633 references, with an appendix of 123 citations of recently acquired documents. Subsequent volumes, incorporating newly identified items of relevance, will be issued approximately on an annual basis. A working draft of this document was prepared in September 1979 to serve as information support to the American Nuclear Society meeting on Decontamination and Decommissioning of Nuclear Facilities held in Sun Valley, Idaho, September 12-16, 1979. The contents of this publication are stored in a computer-retrievable data file which undergoes continual updating. It is preferred that researchers use this bibliography as their "first-line" reference tool; however, the data file can be accessed through RAPIC for more current literature listings.

Contents of Bibliography

The subject matter of this bibliography is presented in four chapters: Facility Decommissioning, Uranium Mill Tailings Cleanup, Contaminated Site Restoration, and Criteria and Standards. Due to the size and diversity of the first chapter, Facility Decommissioning, it was necessary to further divide it into the following subheadings: Field Studies, Theoretical Studies, Experimental Studies, and Economic Studies. Papers entered in the subheading Field Studies deal with the actual decommissioning of nuclear facilities, which include power plants and fuel cycle and research facilities in the United States and abroad. The remedial actions described are either in progress or completed. Specific methods, equipment and instrumentation used, and experiences gained during the decommissioning process are emphasized. Reviews, planning studies, guidelines and recommendations, radiological assessment, safety aspects, and waste management are major topics of the subheading Theoretical Studies. Citations entered in the subheading Experimental Studies deal primarily with decontamination techniques in various stages of development. The Economic Studies subheading covers such topics as decommissioning funding and cost recovery, cost-benefit analysis, and optimization of costs versus radiation exposures.

The chapter on Uranium Mill Tailings Cleanup emphasizes work on the radiological impact of tailings and on alternatives for their management. The chapter on Contaminated Site Restoration contains radiological survey and monitoring reports of formerly contaminated sites, which include part of a series of publications on the Formerly Utilized MED/AEC Sites Remedial Actions Program. The chapter Criteria and Standards deals with existing guidelines and regulations, evaluation of acceptable criteria for the release of nuclear facilities, and the development of future standards on a national as well as international level.

An appendix is included which lists recently acquired references relevant to decommissioning of nuclear facilities. These references are also arranged in four chapters and followed by author, title, and publication description indexes. The entries of the appendix will be fully cited in Volume 2 of this publication.

Citation Form

The references within each chapter are arranged alphabetically by leading author, corporate affiliation, or title of the document. When the author is not given, the corporate affiliation will appear first. If these two levels of authorship are not given, the title of the document is used as the identifying level. The following indexes are provided to aid the reader in locating references of interest: (1) author(s), (2) keywords, (3) title, (4) technology development, and (5) publication description. A separate group of indexes on author, title, and publication description are provided in the appendix.

As a result of computer limitations in indicating superscripts and subscripts in the standard manner, certain conventions have been established in this bibliography:

1. X sub t (X being a variable) means X_t or X subscript t.
2. In chemical compounds and elements, NaIO3 (for example) means $NaIO_3$.
3. 10(E+3) or X(E-3) (E denoting exponent) means 10^3 or X^{-3}.
4. For units of measurement, such as centimeters, meters, and feet, X3 means X^3.

Services

The Ecological Sciences Information Center provides a number of specialized services to governmental, industrial, academic, and foreign requesters. These services include indentifying, acquiring, organizing, indexing, abstracting, processing, storing, and maintaining information. Customized literature searches, as well as copies of specific published documents referenced in the bibliography, are provided upon submission of requests. Annotated and indexed bibliographies are published whenever a particular need is shown. Specialized data bases can also be created if a specific subject area has not previously been covered.

ESIC provides service to a large population of researchers involved in the environmental concerns of energy technology. These services are made available at no charge to the project's sponsoring agency or agencies and to their contractors. Requests received from other researchers and decision makers will be assessed a minimum fee of $30, which covers the charges for most services. The fees will be charged through the National Technical Information Service in Springfield, Virginia. All inquiries for information services should be addressed to:

Remedial Actions Program Information Center
Oak Ridge National Laboratory
P. O. Box X, Building 2001
Oak Ridge, Tennessee 37830
Phone: 615/574-7764 or FTS 624-7764

Acknowledgments

Staff of the Office of Surplus Facilities Management (OSFM), UNC Nuclear Industries, closely guided the project and contributed many of the publications referenced in this bibliography. Staff members of the Information Sciences and Operations Department, Information Center Complex, were responsible for the computer production of this document.

SAMPLE REFERENCE

This is an example of the format for the descriptive fields used in this bibliography:

1—Chapter Heading
2—Record Number
(Sequential Number of Reference)
3—Author(s)
4—Corporate Affiliation
5—Document Title
6—Publication Description
7—Publication Date
8—Abstract
9—Abstractor's Initials
10—Comments
11—Keywords

[1]FACILITY DECOMMISSIONING THEORETICAL STUDIES

[2]‹1129›

[3]Gustafson, P. D. and J. H. Opelka.[4] Argonne National Laboratory, Argonne, IL

[5]Study of Decommissioning Accelerators and Fusion Devices.

[6]DOE/EV-0042; Division of Environmental Control Technology Program-1978, (pp. 110-112), 259 pp.[7](June 1979)

[8]The objective of this study is to prepare a document describing the general technical and environmental effects of the decommissioning of particle accelerators. High-energy acceleraors to be studied will include the Princeton-Penn Accelerator at the University of Pennsylvania, the Cambridge Electron Accelerator at Harvard University, and the old Cornell Electron Accelerator at Cornell University. In addition, other smaller accelerators, such as synchrocyclotrons, betatrons, linear accelerators, and electro-static accelerators that have been decommissioned will be investigated. Estimates of future use and anticipated scheduling of decommissionings will be ascertained and obvious technical, economic, and environmental implications associated with their future decommissioning will be noted. A plan for decommissioning a particle accelerator will be developed. The economic cost of decommissioning will be assessed. Costs will be determined by activity and by period. Activity costs will be estimated as fixed cost and as unit cost. The volume, composition, and radiation level of radioactive material that will require disposal at appropriate waste disposal sites will be estimated. Based on the known similarities of fusion devices and particle accelerators, technical, environmental, and economic problems associated with decommissioning fusion devices will be assessed. A plan for decommissioning representative fusion demonstration devices will be developed. (Auth)[9](JMF)

[10]The paper contains a chart showing expected progress of the study.

[11]DECOMMISSIONING; NUCLEAR FACILITIES; COSTS; ENVIRONMENT; WASTE VOLUME; WASTE DISPOSAL; WASTES, RADIOACTIVE

Chapter 1

FACILITY DECOMMISSIONING

- Field Studies
- Theoretical Studies
- Experimental Studies
- Economic Studies

FACILITY DECOMMISSIONING FIELD STUDIES

1
Bonus Dimantled. Reactor and Fuel-Processing Technology 12(3):293-295. (1969)

Discusses the procedure for dismantling Bonus Reactor and the necessary entombment structure, which should have a lifetime of 125 years. Control dose not to exceed 0.4 mr per hr at entombment surface. All contaminated portions of system to be placed in entombment or shipped off site for burial.

BONUS REACTOR; REACTORS, INTERNAL SUPERHEAT; PERSONNEL; EXPOSURE, OCCUPATIONAL; DECOMMISSIONING

2
Pioneer AEC Reactor Dismantled Safely. Electrical World 181(9): 41-42. (1974, May 1)

Briefly describes the planning and execution of the dismantling and demolition of an obsolete 22.5 MW reactor at Elk River, Minnesota. The safety measures necessary to contain residual radioactivity, and special plant and equipment to complete the dismantling of the reactor pressure vessel and other components are discussed.

REACTORS, BWR; DECOMMISSIONING; ELK RIVER REACTOR

3
Aerojet Nuclear Systems Company, Sacramento, CA

XE-Prime Engine Final Report. Volume 2. Assembly, Test, and Disassembly Operations. Report; 482 pp. (1970, April)

The XE-Prime engine was the first nuclear rocket engine to be tested with components in a flight-type, close-coupled arrangement. The general objective of the test series was to further extend nuclear rocket technology in preparation for a flight system and to operate the test facility under nuclear firing conditions. A description of assembly, test and disassembly operations is presented. (Auth)

XE-PRIME REACTOR; PERFORMANCE TESTING; CONSTRUCTION; REACTOR DISMANTLING

4
Aerojet-General Corporation, Jackass Flats, NV

NRX/EST Post Test Report. Report; 215 pp. (1966, May 5)

The NRX/EST disassembly operation was performed at the R-MAD Facility at NRDS. All subassemblies were dismantled for final observation. Routine hot cell operations have been completed; replication, annealing, and fatigue studies are in the final stages of completion at NRDS. Metallography and special examinations are being completed at CMB-14, LASL, New Mexico. The results noted during the post-test operations and the experience gained during the test series have confirmed the ability of the NRX/EST total system to operate at conditions of design point power for extended periods of time and have provided valuable data applicable to the design of future engine systems and reactor components. As in the previously tested NRX test assemblies, no damage related to full power testing was apparent in the non-fuel subsystems. The major test effect occurred in the core region where a portion of the fuel elements were damaged by surface and internal channel corrosion, pinholing, channel exposure, and melting. (Auth)

NRX-A4-EST REACTOR; INSPECTIONS; CORROSION; FUEL ELEMENTS; REACTOR DISMANTLING

5
Aerojet-General Corporation, Jackass Flats, NV

NRX-A3 Post Test Report. Supplement. Report; 63 pp. (1965, September 30)

Post test metallography of NRX-A3 fuel elements and certain other components was carried out in hot cells at LASL. (LTN)

NRX-A3 REACTOR; INSPECTIONS; FUEL ELEMENTS; METALLOGRAPHY; REACTOR COMPONENTS; REACTOR DISMANTLING

6

Aerojet-General Corporation, Jackass Flats, NV

NRX-A6 Post Test Report. Volume I: Disassembly. Report; 80 pp.

The NRX-A6 post test disassembly operations have been completed; post operative examinations are still in progress. The results noted during disassembly have confirmed the ability of the NRX-A6 Test Assembly to operate at design conditions for a period of 60 minutes. The condition of the fuel was generally excellent. There was very little corrosion in evidence. The NbC bores were generally intact. Some corrosion occurred on the peripheral elements located adjacent to thin filler strips. The uncoated fuel elements were bonded together at the midsection and had to be separated mechanically. A "cluster buster" was designed to break apart the bonded elements. This device operated satisfactorily and held total element breakage down to less than 20%. The integrity of the bond between the element keys and the elements had been lost prior to disassembly. The reflector evidenced a large number of cracks, with the center ring appearing to have the most occurrences. All other components were basically intact. (Auth)

NRX-A6 REACTOR; INSPECTIONS; CORROSION; CRACKS; FUEL ELEMENTS; NEUTRON REFLECTORS; REACTOR DISMANTLING

7

Aerojet-General Corporation, Sacramento, CA

KIWI-B-4A Disassembly and Post-Mortem Photographs. Report; 226 pp.

Post-mortem photographs of KIWI-B4A, without text, are shown, emphasizing the fuel element damage which occurred during the test and the damage which the ejected fragments did to the nozzle coolant tubes. (LTN)

KIWI-B4A REACTOR; INSPECTIONS; PERFORMANCE TESTING; REACTOR DISMANTLING

8

Aerojet-General Nucleonics, San Ramon, CA

Army Gas-Cooled Reactor Systems Program. Interim Report, ML-1 Reactor Disassembly-Inspection Program. Report; 62 pp. (1965, December)

The findings of the second series of diagnostic experiments did not alter the earlier conclusion that disassembly of the pressure vessel was necessary to understand the nature of the leak path(s) in the pressure vessel. However, the detection of a leak above the tube sheet indicated that it would be desirable to perform certain disassembly and inspection steps prior to parting the lower plenum. As a consequence, the program for disassembly and inspection of the pressure vessel was revised; this program is described.

ML-1 REACTOR; PRESSURE VESSELS; REACTOR DISMANTLING

9

Agostinelli, A., S. Martini, B. Migliorati, L. Pizzi, G. Servo, and E. hapetti Ente Nazionale per l'Energia Elettrica, Rome, Italy; Fiat, Turin, Italy; Sorin, Vercelli, Italy

Partial Dismantling of the Avogadro RS-1 Reactor. IAEA-SM-234/5; Decommissioning of Nuclear Facilities, Proceedings of an International Symposium, Vienna, Austria, November 13-17, 1978. International Atomic Energy Agency, (pp. 477-492), 694 pp. (IAEA-SM-234/5). (1979)

The Avogadro RS-1 reactor was a water-moderated and -cooled pool reactor of the MTR (materials testing reactor) type that operated from 1959 to 1971 at different thermal power levels, rising to a maximum of 7 MW(th) towards the end of that period. The partial dismantling operations on the reactor were designed to make the pool acessible with a view to later conversion into a temporary store for irradiated fuel elements from ENEL (Italian National Electricity Company) nuclear power plants. The dismantling operations began in July 1977 and were virtually completed by September 1978, following various interruptions caused by organizational problems. The work was carried out on the basis of programs and procedures approved in advance by the CNEN (Italian National Nuclear Energy Committee), under the constant supervision of the Sorin and Fiat health physics services. Before dismantling, some of the components of the reactor systems were put into service. When the underwater exposure rate had been measured to determine the most suitable method of moving and chopping components for insertion into shielded containers, the components were dismantled and cut up into sections less than one meter in size. The work was carried out for the most part under water, either by means of a hydraulic chopper controlled from the side of the pool, or by divers who carried out the mechanical disassembly and cutting with arc welders in the pool itself. The containers holding the dismantled components were transferred to a store set up in a suitable area of the Sorin concern. At the end of the operations the pool was emptied and its inside surface decontaminated until the values obtained were such that access without any restriction from the health physics standpoint could be permitted. The dismantling process, carried out without any particularly sophisticated devices, proceeded smoothly and gave rise to no unforeseen difficulties. The whole-body dose absorbed by occupationally exposed personnel was 0.0175 man sievert, and the individual radiation doses lay well below the maximum permissible levels. (Auth)

AVOGADRO RS-1 REACTOR; REACTORS, MATERIAL TESTING; DISMANTLING; REACTOR COMPONENTS; CUTTING; EXPOSURE, OCCUPATIONAL; PERSONNEL; RADIATION DOSE

10

Arnett, L.M. Savannah River Laboratory, Aiken, SC

The Heavy Water Components Test Reactor Systems, Fuel Failure Detection, and Standby Condition. DP-1049; CONF-650602; American Nuclear Society Meeting, Gatlinburg, TN, June 21-24, 1965, (20 pp.). (1965)

Fuel was stored at another facility, the primary system filled with nitrogen so the magnetite coating will remain unaltered. Rotating equipment was left at ambient. Containment air is recirculated, and incoming air heated to maintain a 50% humidity. Although cracked thermal insulation allows rainwater to contact the steel containment shell, no serious strength impairment is expected for 3 - 5 years.

REACTORS, HEAVY WATER; REACTORS, PRESSURE TUBE; REACTORS, PWR; CONTAINMENT; DECOMMISSIONING; REACTORS, HWCTR

11

Atlantic Richfield Hanford Company, Richland, WA

Decommissioning of Division of Military Application Equipment at Richland Operations Office for Period Ending December 31, 1975. ARH-R-215-2Q; 7 pp. (1976, January 19)

Decommissioning of the Division of Military Application equipment (DMA) facilities is estimated at 88 percent complete and on schedule. The transfer of twelve transuranic boxes to 20-year retrievable storage was completed this quarter. These boxes contained nine major glove boxes, two conveyor sections, and miscellaneous filter boxes and related duct work. Two other glove boxes, HC-23CTR and HC-43M-1 have been removed from the main conveyor and connected with temporary ventilation. HC-43M-1 was the last machining glove box to be removed and was found to contain an estimated 630 grams of plutonium, which will necessitate an operational cleanout. The total volume of material transferred to the DMA trench this quarter was 15,915 cubic feet, with a residual plutonium content of 2,299 grams. The total fiscal year 1976 cost through the second quarter was $514,305. (Auth)(RAF)

DECOMMISSIONING; EQUIPMENT; WASTES, TRANSURANIC; BOXES; VENTS; WASTE STORAGE; RETRIEVABILITY; GLOVE BOXES; FILTERS; PLUTONIUM; COSTS; WORK SCHEDULE; DISPLACEMENT

12

Atlantic Richfield Hanford Company, Richland, WA

Decommissioning of Division of Military Application Equipment at Richland Operations Office for Period Ending September 30, 1975. ARH-R-215-1Q; 17 pp. (1975, October 20)

Decommissioning of the Division of Military Application equipment (DMA) facilities is estimated at 75 percent complete and on schedule. The transfer of eight transuranic boxes to 20-year retrievable storage was completed this quarter. These boxes contained three major glove boxes, nine conveyor sections, and miscellaneous filter boxes and related duct work. In addition, four other C-line glove boxes, along with miscellaneous duct level equipment have been removed and boxed for transfer to transuranic storage, scheduled for mid-October. The latter glove boxes removed included HC-30DB which was released for transuranic storage following the cleanout and recovery of approximately 2.2 kilograms of plutonium. Equipment removal from both the A-line and inspection area now has been completed. The total fiscal year 1976 cost through the second quarter was $245,155, and included approximately $56,000 for the balance of the fiberglass reinforced polyester (FRP) plywood storage box order completed during July. (Auth)(RAF)

DECOMMISSIONING; WORK SCHEDULE; WASTES, TRANSURANIC; BOXES; WASTE STORAGE; RETRIEVABILITY; GLOVE BOXES; EQUIPMENT; FILTERS; VENTS; DISPLACEMENT; RECOVERY; COSTS; PLUTONIUM

13
Atlantic Richfield Hanford Company, Richland, WA

Decommissioning of Division of Military Application Equipment at Richland Operations Office. ARH-R-170-4Q; 7 pp. (1975, July 21)

Decommissioning of the Division of Military Application equipment (DMA) facilities is estimated at 65 percent complete compared to 60 percent forecast at the start of the program in April 1974. The transfer of 12 transuranic boxes to 20-year retrievable storage this quarter brings the total to date to 26, and includes all of the inspection area glove boxes and conveyor sections, four A-line and two C-line glove boxes, along with all auxiliary hydraulic equipment pumps, and piping serving the three areas. Removal of additional A-line and C-line conveyor sections, one glove box, and relocation of two other glove boxes has been authorized. Albuquerque Operations Office and the A-line portion of work currently is estimated at 40 percent complete. The removal of the one high plutonium-containing glove box, HC-40DB has been delayed for additional sodium iodide (NaI) gamma counting following Z-Plant operations cleanout and recovery of over 1,900 grams of plutonium. The fiscal year 1975 cost was $1,080,000 as estimated, and includes $11,585 in accrued costs for fiberglass reinforced polyester (FRP) plywood boxes delivered but not billed at month-end (Auth)(RAF)

DECOMMISSIONING; WORK SCHEDULE; WASTES, TRANSURANIC; BOXES; WASTE STORAGE; RETRIEVABILITY; GLOVE BOXES; EQUIPMENT; PUMPS; PIPES; DISPLACEMENT; PLUTONIUM; RECOVERY; RADIATION, GAMMA; PLUTONIUM; RADIATION DETECTORS; COSTS

14
Atlantic Richfield Hanford Company, Richland, WA

Decommissioning of Division of Military Application Equipment at Richland Operations Office for Period Ending March 31, 1975. ARH-R-170-3Q; 16 pp. (1975, April 21)

Decommissioning of the Division of Military Application equipment (DMA) facilities is estimated at 40 percent complete compared to 45 percent forecast at the start of the program. Transfer of six inspection area glove boxes, 12 conveyor sections, and one A-line glove box to 20-year retrievable storage has been completed. Counting of the A-line glove boxes for plutonium content using a portable sodium iodide (NaI) gamma detector is continuing ahead of schedule. The removal of one of the C-line glove boxes, HC-40DB, was postponed until the indicated plutonium content of about one to two kilograms has been verified and cleanup completed to satisfy the 500 gram disposal limit mutually concurred on between ERDA-RL and ARHCO. Removal of appurtenances and services from the A-line and C-line fabrication glove boxes is estimated at 90 percent complete. The fiscal year 1975 cost through March 30, 1975 cost through March 30, 1975 was $711,178. Compiled with the $118,307 expended in fiscal year 1974, the total DMA cost through the third quarter of fiscal year 1975 was $829,485. (Auth)(RAF)

DECOMMISSIONING; GLOVE BOXES; WORK SCHEDULE; RETRIEVABILITY; WASTE STORAGE; PLUTONIUM; WASTES, TRANSURANIC; RADIATION DETECTORS; DISPLACEMENT; BOXES; EQUIPMENT; COSTS

15
Atlantic Richfield Hanford Company, Richland, WA

Decommissioning of Division of Military Application Equipment at Richland Operations Office for Period Ending March 31, 1976. ARH-R-215-3Q; 5 pp. (1976, April 22)

Decommissioning of the Division of Military Application equipment (DMA) facilities is 98 percent complete and currently six weeks behind original schedule. The transfer of nine transuranic boxes to 20-year retrievable storage was completed this quarter. These boxes contained five major glove boxes, six C-line conveyor sections, and miscellaneous filter boxes and related ventilation duct work. One glove box, HI-62G, containing the Sheffield gauge and the last section of the C-line conveyor could not be loaded out and boxed the last week of March as scheduled because of high winds. Loadout of these two items in early April will complete the removal of all major DMA equipment. The total volume of material transferred to the DMA trench this quarter was 15,750 cubic feet with a residual plutonium content of 974 grams. The total fiscal year 1976 cost through the third quarter was $769,569. (Auth)(RAF)

DECOMMISSIONING; WORK SCHEDULE; BOXES; WASTES, TRANSURANIC; WASTE STORAGE; RETRIEVABILITY; GLOVE BOXES; FILTERS; VENTS; DISPLACEMENT; WASTE VOLUME; COSTS; RESIDUAL ACTIVITY; PLUTONIUM

16

Atomics International, Canoga Park, CA

Final Status Report. AI-AEC-MEMO-23794 (R .); DOCKET 115-3; 229 pp. (1969, September 30)

Describes the condition of the remaining structures following dismantling and decontamination of the facility, and evaluates the status of those structures to ensure compliance with deactivation criteria. The design lifetime of the isolation structure is 100 years.

HALLAM REACTOR; LICENSE STATUS; REACTORS, LMCR; DECOMMISSIONING; SAFETY; OPERATING EXPERIENCE

17

Atomics International, Canoga Park, CA

Report on Retirement of Hallam Nuclear Power Facility. AI-AEC-12709; 200 pp. (1970, May 15)

This report describes the plant and summarizes the operational history of the facility. Details of the retirement are given, such as removal of equipment, handling of fuel, coolant, and contaminated equipment, recovery of usable equipment and securing and isolation of equipment left at the site. Cost of the retirement program is summarized.

FUEL HANDLING; HALLAM REACTOR; REACTORS, LMCR; SODIUM; OPERATING EXPERIENCE; SAFETY; DECOMMISSIONING; EQUIPMENT

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Bacca, J.P., R.L. Brookshier, J.C. Courtney, K.R. Ferguson, M.F. Huebner, and J.P. Madison Argonne National Laboratory, Idaho Falls, ID

Decontamination and Refurbishment of the Hot Fuel Examination Facility South (HFEF/S) Argon Cell. CONF-790923; Decontamination and Decommissioning of Nuclear Facility, Proceedings of an American Nuclear Society Conference, Sun Valley, ID, September 16-20, 1979. (17 pp.) (CONF-790923). (1979, September 16)

The refurbishment of Argonne National Laboratory's argon cell in the Hot-Fuel Examination Facility necessiated a decontamination phase. Remote removal of in-cell equipment, and remote decontamination are completed, and contact decontamination is about 25% complete. From smears collected, plutonium averaged 0.2% of the uranium within the cell and was important in planning decontamination operations. Also, significant long-lived fission products in the samples were Sr 90 - Y 90 and Cs 137 - Ba 137m. Trace quantities of Sb 126, Cs 134, Ce 144, and Eu 155 have also been detected. The calculated Sr 90 concentration was 0.02 Ci/g uranium; the concentration measured in a number of samples averaged 0.06 Ci/g. Cesium 137 concentration was more variable than the Sr 90, measuring from 0.005 to 0.05 Ci/g uranium. During remote decontamination procedures, dry methods consisted of blowing compressed air over the equipment before removal and remote brushing into a pan or vacuuming in accessible areas. The quantity of material was limited to a safe weight of 2.5 kg, at a time. Then a wet method, using a foam type agent on the floor, was utilized with wet vacuuming. Contact decontamination was preceded by strict administrative procedures for contamination control and personnel safety. Special breathing hoods were implemented with HEPA-filters approved for use in radioactive mists and fumes as a safety measure should the air supply be interrupted. Several layers of protective clothing and three pairs of thermoluminescent dosimeter (TLD 600) chips along with self-reading pocket dosimeters are utilized. Also, temporary rooms were constructed inside and outside the argon cell entrance to control contamination and air flow. Actual contact decontamination began in September, 1978. Wet methods were limited because of potential damage to some in-cell systems. Initial procedures consisted of sweeping and vacuuming in areas inaccessible to remote operations. The floor of the cell was then scrubbed with various cleaners. A water-based latex strippable coating was tested on wall and floor areas, but was inefficient. A high-pressure water spraying system using a shrouded spray was also tested and found very effective. At the end of contact decontamination in the first quadrant of the cell, marked by the high-pressure spraying, the penetrating radiation in the center of the work zone was about 30 mr/hr and the non-penetrating radiation in contact with the walls averaged 40 mr/hr. However, meeting Argonne's exposure-control guides of 1000 mrem penetrating radiation and 4000 mrem penetrating plus non-penetrating, per quarter year may necessitate repeating contact decontamination procedures and/or beginning procedures on the roof of the cell. (JMF)

The document contains drawings of the facility. A graph showing diminishing non-penetrating and penetrating radiation with time during contact decontamination is given.

HOT CELLS; CESIUM; CONTAINMENT; CONTAMINATION; DECONTAMINATION; DETERGENTS; DOSE RATE; DOSIMETERS; EQUIPMENT; FILTERS; FISSION PRODUCTS; FUEL CYCLES; INSTRUMENTS; INSTRUMENTATION; INHALATION; ISOTOPE RATIOS; ISOTOPES; MEASUREMENTS; NUCLEAR FACILITIES; MONITORING; PARTICLES; PARTICLES, AIRBORNE; PLUTONIUM; PLUTONIUM; PERSONNEL; RADIOACTIVITY; RADIOACTIVE DECAY; RADIATION, GAMMA; RADIATION SOURCES; RADIATION HAZARDS; RADIATION DOSE; RADIATION DETECTORS; RADIONUCLIDE MIGRATION; SAMPLES; SAMPLING; SHIELDING; STRONTIUM; SURFACE CONTAMINATION; URANIUM; TRANSURANICS; WASHING; WASTE DISPOSAL; WASTE MANAGEMENT; WASTE VOLUME; WASTES, HIGH-LEVEL; WASTES, INTERMEDIATE-LEVEL; WASTES, RADIOACTIVE; WASTES, TRANSURANIC; YTTRIUM

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Barrett, T.R., and D. Thom. United Kingdom Atomic Energy Authority, Dounreay Nuclear Power Development Establishment, Thurso, Caithness, United Kingdom

Decommissioning and Reconstruction of the Fast Reactor Fuel Reprocessing Plant, Dounreay. IAEA-SM-234/19; Decommissioning of Nuclear Facilities, Proceedings of an International Symposium, Vienna, Austria, November 13-17, 1978. International Atomic Energy Agency, Vienna. (pp. 539-559), 694 pp. (IAEA-SM-234/9), (1979)

The conversion of the Fast Reactor Irradiated Fuel Reprocessing Plant (FR) at Dounreay from its original function of servicing the Dounreay Experimental Fast Reactor 15 MWe fuel cycle to that of reprocessing fuel from the Dounreay Prototype Fast Reactor 250 MWe led to an extensive modification exercise. This necessitated entry into, decontamination, and rebuilding of the greater part of the plant; many areas were in effect decommissioned and then new facilities constructed on the same location. In cell plant conditions at the beginning of the exercise ranged down from radiation areas at above 1000 R/h gamma, and contamination levels 500 R/h beta-gamma and 1000 counts/s alpha. This exercise consequently proved to be the largest of its kind undertaken to date in the United Kingdom, and demonstrated the ability to decommission active plant facilities. It also generated much valuable experience and led to the demonstration of novel techniques in this field. The FR reprocessing plant was designed and built in the late '50s to reprocess the irradiated driver core fuel from the DFR reactor, and also to handle the breeder fuel elements prior to their transfer to the Windscale thermal reactor fuel reprocessing plant. It was decided in 1971/72 to modify the DFR reprocessing plants for the reprocessing of the PFR mixed oxide fuel. In order to achieve these modifications it was necessary to effect personnel entry into all sections of the active plant other than the DFR fuel disassembly cave and the DFR fuel dissolver cell. Several different types of cell were entered; namely - HA (beta-gamma) fuel breakdown caves, HA dissolver cells, and both HA and LA extraction cells. The conditions varied from total in cave or cell contamination to cells containing mainly internally contaminated vessels. The radiological hazards embraced variously high gamma radiation levels and high plutonium contamination levels. The extent of the work varied from complete cell strip out - and in some cases demolition - to limited relocation and addition of process equipment. The above features, taken together, determined the objective adopted, either: (i) conversion to a contamination-free working area, or (ii) acceptance of limited contamination and radiation levels and working in air line suits. (Auth)

NUCLEAR FACILITIES; FUEL REPROCESSING PLANTS; DFR REACTOR; DECONTAMINATION; DECOMMISSIONING; RADIATION, GAMMA; ALPHA PARTICLES; BETA PARTICLES; EXPOSURE, OCCUPATIONAL; PERSONNEL; PLUTONIUM; RADIATION HAZARDS; DEMOLITION; DISPLACEMENT; EQUIPMENT

20
Basham, S.J., Jr., and K.D. Kok Battelle-Columbus Laboratories, Columbus, OH

Research Reactor Dismantling: A Case History. Transactions of the American Nuclear Society 22:636-637. (1975, November)

BATTELLE RESEARCH REACTOR; COSTS; REACTOR DISMANTLING; REVIEWS

21
Bass, B.G., and E.C. Holman Walter Reed Army Institute of Research; Atcor, Inc.

The Walter Reed Research Reactor Dismantling Project. Transactions of the American Nuclear Society 15(2):897; CONF-721110 American Nuclear Society Winter Meeting, Washington, DC, November 12-17, 1972. (1972)

The principal problems encountered were the fuel removal and shipment, recombiner removal, core removal, and biological shield demolition. Two specially designed containers were used to ship the fuel and rinse solution. These containers were approved by DOT for transporting the fuel. The recombiner water and decon solutions were solidified in vermiculite and shipped in shielded stainless-steel drums.

REACTORS, RESEARCH; DECOMMISSIONING; OPERATING EXPERIENCE

22
Bayer, K.C., and K.W. King Nevada Operations Office, Las Vegas, NV

Tatum Salt Dome Test Site, Lamar County, Mississippi. Site Status Report at Decommissioning, June 30, 1972. Report; 68 pp. (1972, July)

GEOLOGIC DEPOSITS; GEOLOGY; GROUND WATER; HYDROLOGY; EXPLOSIONS, NUCLEAR; RADIATION MONITORING; RADIOACTIVITY; SALTS; TOPOGRAPHY; VELA PROJECT; LOGGING, WELL; SEISMOLOGY

23
Beall, S.E. Oak Ridge National Laboratory, Oak Ridge, TN

Experiences in the Decommissioning and Dismantling of Three Oak Ridge National Laboratory Experimental Reactors. CONF-650602; American Nuclear Society Meeting, Gatlinburg, TN, June 20-24, 1965. (4 pp.). (1965)

The Reactor Division of ORNL has permanently shut down three experimental reactors- the Homogeneous Reactor Experiment (HRE-1), which was a 1-MW reactor fueled with UO2SO4 in H2O; the HRE-2, which was similar but larger and more advanced; and the Aircraft Reactor Experiment (ARE), which was a 1-MW reactor fueled with molten UF4 in NaF and ZrF4. These reactors presented special decommissioning problems because they were fluid-fuel reactors in which fission products normally circulated outside the reactor core.

REACTORS, CIRCULATING FUEL; CONTAINMENT; DECONTAMINATION; CONTAMINATION, SURFACE; DECOMMISSIONING; PRESSURE VESSELS; FILTERS

24
Beckers, R.M., R. Blumberg, and C.H. Wodtke Oak Ridge National Laboratory, Oak Ridge, TN

The Remotely Operated Plasma Torch - A Tool for Nuclear Reactor Dismantling. CONF-731105; Winter Meeting of the American Society of Mechanical Engineers, Detroit, MI, November 11, 1973, (28 pp.). (1973)

The Elk River reactor facility is being dismantled in order to return the site to unrestricted use. The highly radioactive components - the reactor internals, the pressure vessel, and the outer thermal shield - have been cut up and shipped to a burial ground. Approximately 10,000 Ci of radioactive metal was removed without significant release of activity and without any overexposure to personnel. The dismantling was accomplished with a remotely operated plasma torch system. The design of the system, the results obtained, and evaluation of this technology are given.

REACTORS, BWR; DECOMMISSIONING; EQUIPMENT; DESIGN; EQUIPMENT; ELK RIVER REACTOR

25
Birely, W.C., and J.C. Schmidt

Decommissioning Peach Bottom Unit 1. CONF-790923; Decontamination and Decommissioning of Nuclear Facilities, Proceedings of a Conference, Sun Valley, ID, September 16-20, 1979. Session III-B, (pp. 3-5), 90 pp. (CONF-790923). (1979)

Peach Bottom 1, the first high temperature gas-cooled reactor (HTGR) to operate in the world and owned by Philadelphia Electric Co., has been mothballed since February, 1978 with decommissioning work performed intermittently over a three-year period. The work has been done in three separate phases by a combination of Philadelphia Electric Company and Catalytic, Inc. forces. The reactor vessel and primary system remain in place. Openings in the primary system made during a primary system sampling program were welded closed. The missile beams were replaced over the reactor vessel access ports and the crane was deactivated to prevent access to the vessel. Fuel handling equipment was deactivated and secured in place on the refueling floor. Access to high radiation areas was closed with multiple barricades bolted or welded. Access to clean inspection areas was provided through locked gates or doors as required by the decommissioning plan. Provision was made for visual inspection of the accessible areas, including low points such as the subpile room and the containment sump. All penetrations to the containment were cut and capped. A ventilation port with an absolute filter was installed in the equipment hatch for atmospheric pressure equalization of the containment vessel and as a check for airborne radioactivity. The fission product delay beds and their associated filters were removed. The purge condensibles trap was the most radioactive of these vessels, and the only component removed with appreciable contact radiation - 30 R/hour. It was removed following a preplan course of action to minimize radiation exposure. The spent fuel pool was drained and decontaminated. The fuel racks were cut and disposed of as radioactive waste. Other fuel handling equipment was deactivated, and the fuel transfer chute was removed and sealed with a blank flange. The spool piece removed from the transfer tube was highly contaminated. The fuel pool cooling system was removed and a lock exclusion area was established for the fuel pool building. The liquid waste area was decommissioned by removing all equipment except some sections of embedded piping. All accessible spaces within the exclusion areas have radiation levels less than 1.0 mR/hr and contamination meets limits for decommissioned facilities. In areas outside the exclusion zone the radiation levels are less than 0.01 mR/hr, and contamination is not present. (Auth)(JMF)

This paper is only an abstract of the actual paper which is to be published later.

DECONTAMINATION; DECOMMISSIONING; WASHING; NUCLEAR FACILITIES; REACTORS, HTGR; RADIATION DETECTORS; RADIATION SOURCES; MONITORING; CONTAINMENT; CONTAMINATION; RADIOACTIVITY; WASTES, TRANSURANIC; WASTES, RADIOACTIVE; WASTES, LIQUID; WASTES, SOLID; EXPOSURE, OCCUPATIONAL; DOSIMETERS; FUEL ELEMENTS; SPENT FUELS

26
Bishoff, J.R., and R.J. Hudson EG and G Idaho, Inc., Idaho Falls, ID

Early Waste Retrieval Final Report. TREE-1321; 24 pp. (1979, August)

The Early Waste Retrieval Project began operations in FY 1976 to investigate methods, risks, and hazards associated with the retrieval of 65000 cu m of transuranic contaminated waste in below grade storage at the Idaho National Engineering Laboratory. The retrieval facilities consisted of an Air Support Weather Shield and a movable Operating Area Confinement. Retrieval operations were conducted in the Operating Area Confinement to prevent contamination spread to the environment. The Air Support Weather Shield provided weather protection for the Operating Area Confinement and all associated retrieval equipment. Retrieval personnel wore full anti-contamination clothing and a totally enclosed bubble suit that incorporated a fresh air supply.

Waste retrieved included drums, loose waste, and contaminated soil. Approximately 67% of the drums retrieved were severely breached. Free liquid leaked from about 6% of the drums, and 5% were externally alpha-contaminated. Although alpha-contamination levels often exceeded 2X10(E+6) cpm, available equipment and established operating and safety procedures protected personnel and prevented any release of contamination into the environment. Under the Early Waste Retrieval project, the following studies and tests relating to buried waste retrieval were conducted: a transuranic isotope migration study was performed in support of the Progammatic Environmental Impact Statement for the Long-Term Management of the Defense Transuranic Waste at the Idaho National Engineering Laboratory; strip curtains were tested and used successfully for contamination control; a waste compactor was purchased and used to compact loose and self-generated waste into 208-l drums; and dust and airborne contamination control tests were performed using soil binders and fabric material. The total cost of the Early Waste Retrieval Project was $1,202,705. (Auth)(RAF)

RETRIEVABILITY; HAZARD ANALYSIS; WASTES, TRANSURANIC; DRUMS; SOILS; ALPHA PARTICLES; SAFETY; PACKAGING; LEACHING; INSTRUMENTATION; EXCAVATION; EXPOSURE, OCCUPATIONAL; DUSTS; COSTS; RADIONUCLIDE MIGRATION

27

Bjeldanes, M.N. Northern States Power Company

Pathfinder Converted from Nuclear to Natural Gas. Transactions of the American Nuclear Society 12(Suppl.):52. (1969, October)

Eight months required to dismantle, decontaminate, or dispose of, and convert plant to nonnuclear facility. Nearby 30 tons of pipe and equipment buried as radioactive waste. Reactor containment building sealed off and licensed under 10CFR Part 50. Plant back in operation at 60 MWe by end of June 1969, with no significant radiation in plant. Direct discharge from plant under unidentified limits of Part 20.

DECONTAMINATION; PATHFINDER REACTOR; REACTORS, INTERNAL SUPERHEAT; WASTE DISPOSAL; BURIAL; REACTORS, POWER; DECOMMISSIONING

28

Blumberg, R. Oak Ridge National Laboratory, Oak Ridge, TN

Technology for Dismantling Large Radioactive Structural Components. CONF-750822; Decontamination and Decommissioning of ERDA Facilities, Proceedings of a Conference Idaho Falls, ID, August 19-21, 1975, (12 pp.)(CONF-750822). (1975)

The dismantling of the ERR (Elk River Reactor) was completed successfully and safely in September, 1974. This 58 MW(T), boiling water reactor was removed down to its foundations, and all of the radioactive material was shipped in suitable containers to licensed burial grounds. The most difficult and the unique part of this effort was the cutting up and removal of the radioactive structural parts, namely the inner thermal shield, the pressure vessel, and the outer thermal shield. The tools and techniques for this operation were designed, developed, and fabricated at the Oak Ridge National Laboratory. This development provides the nuclear industry with a viable alternative to entombment and surveillance for decommissiong reactors. This paper describes the technology used, and comments on its application to larger, more radioactive systems.

REACTORS, BWR; RADIATION PROTECTION; DECOMMISSIONING; TOOLS, CUTTING; CUTTING; REACTOR COMPONENTS; OPERATING EXPERIENCE; REACTOR DISMANTLING; REACTOR COMPONENTS; RADIATION MONITORING

29

Blumfield, C.W., and J.S. Forrest (Ed.) United Kingdom Atomic Energy Authority Reactor Group, Dounreay Experimental Reactor Establishment, Dounreay, United Kingdom

Dounreay Project. Meeting on the Breeder Reactor, Strathclyde, United Kingdom, March 25, 1977 (pp. 21-36). (1977)

The paper briefly refers to the history of the Dounreay Experimental Reactor Establishment and the 18 years of safe operation of the Dounreay Experimental Liquid-Metal-Cooled Fast Reactor (DFR). Reference is also made to the successful commissioning of the 250 MWe prototype fast reactor (PFR). This long history of the use of fast reactor technology has shown that although fast reactors are different in concept to thermal reactors they are as easily operated, if not more so. The experience gained from the scientific research into materials suitable for fast reactors has provided a comprehensive library of information for the design of the next phase of fast reactors. Fuel assemblies have been operated at full power with flow restricted to produce coolant boiling conditions. These have shown that the high heat fluxes of fast reactors are adequately tamed by the liquid metal coolant. Experience in commissioning the PFR has enabled the designers of the demonstration commercial fast reactor to progressively deal with important issues. In particular, the boiler design, which was always considered to be difficult technological issue, has evolved to eliminate the small water leaks that have occurred in the PFR boilers. This will be tested in the PFR well in advance of its use in the demonstration commercial fast reactor. Reprocessing of the PFR fuel at Dounreay will commence in about a year's time. This has involved reconstructing a plant which was used for reprocessing of DFR fuel. The decommissioning of the plant to the colloquial green field state allowed the modifications to be carried out expeditiously. The new plant has been designed on the knowledge produced in experiments to determine the most efficient and safe method of separation and waste management.

DOUNREAY FAST REACTOR; FUEL ASSEMBLIES; MATERIALS TESTING; PERFORMANCE; PLANNING; REACTOR COMMISSIONING; REACTOR OPERATION; REPROCESSING; RESEARCH PROGRAMS

30

Boardman, T.J., and T.A. Paulett Atomics International, Canoga Park, CA

Hallam Nuclear Power Facility Retirement Disposition of Sodium. Report; 132 pp. (1968, September 30)

The removal of all bulk sodium from the HNPF site and the chemical reaction of residual sodium in the system are described. A list of all activity specifications and operating procedures covering the tasks at each phase of the operation is provided. The plans, performance, and results of the procedures are described. (DG)

REACTOR DECOMMISSIONING; SODIUM; CHEMICAL REACTIONS; DECONTAMINATION; PRIMARY COOLANT CIRCUITS; REACTOR DISMANTLING; SPECIFICATIONS; SURFACE CLEANING; TRANSPORTATION; WASTE DISPOSAL; DISPLACEMENT; HALLAM REACTOR

31

Bond, A.L. Nevada Operations Office, Las Vegas, NV

Safety Analysis Report for Tory 2-C Fuel Recovery. Report, 73 pp. (1975, September 12)

The following activities are examined: (1) transfer by rail of the reactor from the present storage location in the reactor maintenance, assembly and disassembly (R-MAD) building to the engine maintenance, assembly and disassembly (E-MAD) building, a distance of approximately five miles; (2) the disassembly of the Tory 2-C Assembly to permit removal of the reactor core in the E-MAD building; (3) the disassembly of the reactor core into individual fuel tubes, also referred to as fuel rods; and (4) the packaging of the tubes for shipment to the Idaho National Engineering Laboratory (INEL). Included are descriptions of organizational responsibilities, facilities and equipment, operations, radiological safety, nuclear safety, industrial hygiene, industrial safety, accident evaluation, and emergency plan. (GRA)

TORY-2C REACTOR; REACTOR DISMANTLING; FUEL ELEMENTS; PLANNING; SAFETY

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Breen, W., and T.P. Hillmer

Experience in Decontamination of Radwaste Evaporators at Commonwealth Edison's Zion Generating Station. CONF-790923; Decontamination and Decommissioning of Nuclear Facilities, Proceedings of a Conference, Sun Valley, ID, September 16-20, 1979. Session II-A, (pp. 7-9) 90 pp. (CONF-790923). (1979)

In 1978 Zion Nuclear Generating Station created an engineering group to handle radwaste probitems from its two unit, 1100 megawatt Westinghouse fourloop pressurized water reactor. In November, 1978, a chemical cleaning was scheduled for both the Aqua Chem 12GPM and the Westinghouse 15GPM radwaste evaporators. After the use of portable demineralizers to process radwaste had been proven, the means to shut down the evaporators with enough time to perform the needed maintenance was realized. Both evaporators were flushed with demineralized water on numerous occasions with little success in dose rate reduction. A solvent was apparently needed. Scale samples were obtained from rasking rings in the gas stripping column and the steam tube bundle of the Westinghouse evaporator. Chemical analyses were performed by Dow Nuclear Services. Dow recommended a dilute solution of a strong acid with an inhibitor to remove the scale. Dow had tried unsuccessfully to clean the specimens with EDTA, NSI, organic and several inorganic acids. During the cleaning chemistry samples were taken at 30-minute intervals for the first four hours of solvent contact, then taken every two hours for the remainder of the chemical cleaning operation. The samples indicated the amount of radioactivity being removed and the amount of corrosion taking place. The dose reduction on the Westinghouse evaporator showed a decontamination factor of 6.25 on contact reading on the evaporator shell and a 38.9% reduction in general area room dose rates. The Aqua Chem evaporator cleaning resulted in a decontamination factor of 1.7 on contact readings. This was far less than hoped for and the estimated personnel exposure for the maintenance work was still unacceptable. A new plan was developed whereby flushes were made with heated demineralized water with a controlled pH. By this procedure the decontamination factor was increased to 7.8 on contact readings. The dose rates still pose a problem, therefore, the current plans are to make repairs in segments so that man-rem will be spread over several quarters of exposure reporting. In conclusion, it was apparent that the inter-departmental cooperation played a major role in the development of the decontamination procedures for radwaste equipment and that other utilities could use coordinated approach similar problems in decontamination. (Auth) (JMF)

This paper is only an abstract of the actual paper which is to be published later.

DECONTAMINATION; WASHING; NUCLEAR FACILITIES; REACTORS, PWR; EVAPORATORS; DEMINERALIZATION; DOSE RATE; SOLVENTS; ACIDS; CONTAMINATION; DEPOSITION; RADIOACTIVE MINERALS; ACIDS, ORGANIC; CHELATES; CORROSION; EXPOSURE, OCCUPATIONAL

33

Broothaerts, J., [illegible], L. Greens, and W. Hild Eurochemic, Mol, Belgium

Experience Gained with the Decontamination of a Shut-Down Reprocessing Plant. IAEA-SM-234/39; Decommissioning of Nuclear Facilities. Proceedings of an International Symposium, Vienna, Austria, November 13-17, 1978. International Atomic Energy Agency. Vienna. (pp. 493-516), 694 pp. (IAEA-SM-234/39) (1979)

At the end of 1974, the Eurochemic Company decided to stop its reprocessing activities, after having processed some 200 tons of greatly varying irradiated fuel elements. After the shutdown of the reprocessing plant, a decontamination program was drawn up and carried out in view of reducing radiation and contamination levels so far as to allow direct access of personnel to the process cells, either for dismantling, or for modification of the process equipment in view of possible further operation. A description of the experience gained and of the main results obtained in carrying out this decontamination program is given. In the first phase, the plant equipment was rinsed with typical Purex-type solutions allowing collection or detection of fissile material unaccounted for. The second phase of the decontamination was carried out in view of further reducing the radiation to a level allowing direct access of personnel to the process cells, for inspection of the equipment, and preparative work in view of direct cleaning of the cells and their equipment. Rather mild decontamination chemicals were used in order to restrict the risk of corrosion. In all, more than 140 kCi of radionuclides were removed and concentrated in some 70 cu m of liquid waste concentrates. Finally, a description of the successful dismantling of the plutonium tail-end unit of the reprocessing plant is given. (Auth)

NUCLEAR FACILITIES; DECONTAMINATION; EQUIPMENT; CHEMICALS; DISPLACEMENT; RADIONUCLIDES; SEPARATION PROCESSES; WASTES, LIQUID; DISMANTLING; CLEANING; FUEL REPROCESSING PLANTS

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Broothaerts, J., E. Detilleux, L. Geens, W. Hild, R. Reynders, J. Baumann, O. Berners, H. Modreker, W. Bretag, W. Pfeifer, and R. Strohmenger Eurochemic, Mol, Belgium; Kraftanlagen AG, Heidelberg, German Federal Republic; Transnuklear G.m.b.H., Hanau, German Federal Republic

Industrial Experience Gained in the Decontamination and Partial Dismantling of a Shut-Down Reprocessing Plant. IAEA-SM-234/40; Decommissioning of Nuclear Facilities, Proceedings of an International Symposium, Vienna, Austria, November 13-17, 1978. International Atomic Energy Agency, Vienna. (pp. 575-595), 694 pp. (IAEA-SM-234/40). (1979)

At the end of the chemical rinsing and decontamination of the shut-down reprocessing plant a detailed program was undertaken for further decontamination and intervention, serving as a basis for either modification of the plant in view of its eventful restart or for complete dismantling of the installation. This paper gives a presentation of some of the essential work executed and the results obtained during the first phase of this program, as for instance the partial or total dismantling of process equipment like dissolvers and a multipurpose evaporatory. Operations executed for the decontamination of various process cells and a storage pond for high-level solid wastes, after emptying and repacking of its contents are described. The procedure applied for the evacuation from 18 vessels of some 10 cu m of boron glass Raschig rings used as heterogeneous neutron poison is presented together with the conditioning of these rings into waste packages suited for sea disposal. In addition, the compaction and cutting-up of activated fuel element structures and other disused material, stored under water, the segregation and the conditioning of the resulting scrap are reported. Furthermore the works executed for the decontamination and dismantling of the analytical laboratory of the reprocessing plant are presented. (Auth)

DECONTAMINATION; DISMANTLING; NUCLEAR FACILITIES; FUEL REPROCESSING PLANTS; EQUIPMENT; WASTE STORAGE; WASTES, SOLID; WASTES, HIGH-LEVEL; SEA DISPOSAL; COMPACTION; FUEL ELEMENTS; CUTTING; SCRAP; EQUIPMENT, LABORATORY

35

Buschmann, W.

Dismantling of Inactive Nuclear Power Plants with Pressurized Water Reactor. Kerntechnik 20(4):185-89. (1978, April)

The end of reactor operation must be expected after 30 or 40 years. After final shutdown of the reactor, it would be possible to dismantle the reactor partially or completely. This article shows how radiation exposure and costs can be determined in relation to the various possibilities for treating shutdown nuclear power plants. In addition, disposal of radioactive plant sections is discussed briefly.

NUCLEAR POWER PLANTS; DECOMMISSIONING; PERSONNEL; EXPOSURE, OCCUPATIONAL; COSTS; WASTE DISPOSAL

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Catalytic, Incorporated, Philadelphia, PA; General Atomic Company, San Diego, CA

Removal of Primary Circuit Components from the Peach Bottom High-Temperature Gas-Cooled Reactor. GA-A14369; 151 pp. (1977, April)

Subsequent to shutdown of the Peach Bottom high-temperature gas-cooled reactor for decommissioning, steam generator and primary circuit ducting samples were removed for subsequent evaluation and design methods verification. Component removal site work commenced with establishment of restricted access areas and installation of controlled atmosphere tents to retain relative humidity at less than 30 percent. A mock-up room was established to test and develop the tooling and train operators under simulated working conditions. Primary circuit ducting samples were removed by trepanning, and steam generator access was achieved by a combination of arc gouging and grinding. Steam generator tubing and other samples were removed by internal cutting and side grinding. The special tooling used was developed by Power Cutting, Inc., under subcontract to Catalytic, Inc. Throughout the component removal phase, strict health physics, safety, and quality assurance programs were implemented.

CUTTING; GRINDING; PEACH BOTTOM-1 REACTOR; PRIMARY COOLANT CIRCUITS; REACTOR DISMANTLING; SAMPLING; GENERATORS, STEAM

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Cerchione, J.D., F.D. McGinnis, R.E. Rice, and C.B. Doe Argonne National Laboratory, Argonne, IL

Reactor Deactivation, EBR-1 and Borax-5. Transactions of the American Nuclear Society 8(1):114-115. (1965, May)

The deactivation procedure is routine except for radioactive fuel and reactor components. EBR-1 fuel was reprocessed or buried, and reactor vessel filled with argon. EBR-1 can be reactivated with a new fuel core. Borax 5 boiler fuel was removed to storage - the superheater fuel, rods, etc., left in the reactor vessel, and water drained. Additional shielding blocks reduced radiation levels to less than 1 r/hr. Borax 5 could easily be reactivated.

BORAX-5 REACTOR; DECONTAMINATION; FUEL ELEMENTS; STORAGE; DECOMMISSIONING; EBR-1 REACTOR; EBR-2 REACTOR

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Christensen, E.L., R. Garde, and A.M. Valentine Idaho Operations Office, Idaho Falls, ID; Aerojet Nuclear Company, Idaho Falls, ID; Los Alamos Scientific Laboratory, Los Alamos, NM

Demolition of Building 12, an Old Plutonium Filter Facility. CONF-750827; Decontamination and Decommissioning of ERDA Facilities, Idaho Falls, ID, August 19-25, 1975, (pp. 303-324). (1975, September)

FILTERS; DECOMMISSIONING; NUCLEAR FACILITIES; PLUTONIUM; WASTE MANAGEMENT

39

Combs, A.B., W.P. Davis, J.M. Garner, and J.R. Geichman Mound Facility, Miamisburg, OH

A Summary Review of Mound Facility's Experience in Decontamination of Concrete. Concrete Decontamination Workshop, Seattle, WA May 28-29, 1980, (12 pp.). (1980, May)

Mound Facility has effectively decontaminated and/or decommissioned four major facilities since 1949 and is currently in the process of partially decontaminating two more facilities. In addition, many minor areas have been decontaminated and/or decommissioned. Many of these projects involved the decontamination of concrete surfaces. Most of the current concrete decontamination work involves surfaces that are contaminated with plutonium 238. Approximately 60,000 sq ft of concrete floors will have to be decontaminated in Mound's current Decontamination and Decommissioning (D and D) Project. Although most of these surfaces are partially protected by a barrier (tile or paint), contaminated water and acid have penetrated these barriers. Floor decontamination techniques are as follows: gross decontamination of room; removal of tile floor barrier; monitoring of floor contamination; removal of higher contamination spots; installation of temporary floor contamination barrier; final decontamination of room; decontamination of remaining floor contamination; final monitoring of floor; and resurfacing of floor. The initial cleaning of the floor involves standard water and detergent. Acids are not used in cleaning as they tend to drive the contamination deeper into the concrete surface. Next, the floor tile is manually removed inside a temporary enclosure under negative and filtered ventilation. Finally, layers of contaminated concrete are mechanically removed inside the ventilated enclosure. The suspected depth and surface area of contamination determines the type of mechanical tool used. Several generic methods of concrete decontamination can be utilized: Chemical - water, detergent, acids, paint remover, strippable paint, etc.; rotary - sanders, grinders, scarifiers, etc.; and impact - pressure washers (hydrolasers), particle blasters, scabbers, needlers, spallers, paving and rock breakers, ram hoes, etc. The particular method used depends on factors such as surface and area involved, depth of contamination, cost and availability of equipment, safety and radiological control, and waste generated. (Auth)(RAF)

DECONTAMINATION; CONCRETES; PLUTONIUM 238; METHODS; WATER; DETERGENTS; WASHING; TOOLS

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Courtright, W.C. Los Alamos Scientific Laboratory, Los Alamos, NM

Safety Problems with Abandoned Explosive Facilities. LA-DC-10923; CONF-690993; 11th Annual Meeting of Armed Services Explosives Safety Board, Memphis, TN, September 9, 1969. 45 pp. (1969)

Procedures were developed for the safe removal of explosive and radioactive contaminated materials structures and drains from abandoned sites, including explosives processing and service buildings with a goal to return the entire area to its natural state and to permit public access. The safety problems encountered in the cleanup and their solutions are applicable to modification and maintenance work in operating explosive facilities. (GRA)

BUILDINGS; DECOMMISSIONING; EXPLOSIVES, CHEMICAL; WASTE DISPOSAL; RECLAMATION, LAND; DECONTAMINATION; SAFETY

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Cox, E.J., and R. Garde Los Alamos Scientific Laboratory, Health Physics Group H-1, Los Alamos, NM

Decontamination of Concrete Surfaces at the Los Alamos Scientific Laboratory. Concrete Decontamination Workshop, Seattle, WA, May 28-29, 1980, (15 pp.). (1980, May)

For the past two years the Los Alamos Scientific Laboratory (LASL) has been engaged in decontaminating its former plutonium facility. The facility was in use for over 30 years for plutonium operations varying from dry metalurgical processes to wet (solution) recovery processes. To date approximately 3400 square meters of floor surface have been decontaminated to permit reuse for nonplutonium work. Approximately 330 square meters of concrete surfaces required scarifying the contamination after all other attempts such as detergents and acid solutions had proven ineffective. The uses of hand-held and floor type pneumatic scarifiers are described as well as an inexpensive but effective contamination containment chamber built at Los Alamos for use with the hand-held model. Contamination control, waste handling, manpower requirements, and cost are documented for the techiques used at LASL. (Auth)(RAF)

DECONTAMINATION; CONCRETES; METHODS; WASTE MANAGEMENT; COSTS

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Cox, E.J., R. Garde, and A.M. Valentine Los Alamos Scientific Laboratory, Los Alamos, NM

Disposition of TA-33-21, A Plutonium Contaminated Experimental Facility. LA-UR-75-1419; 44 pp. (1975, June 21)

The disposition of TA-33-21, a plutonium experimental facility, was begun in 1960 with preliminary decontamination efforts and ended in 1975 with health physics, waste management, and environmental aspects being completed. Most internal surfaces of the building and surfaces of experimental equipment items became contaminated on April 13, 1960, following an accidental release of approximately 300 milligrams of Pu 239 oxide powder from an experimental apparatus in the process section of the main building. Following the accident, decontamination efforts were begun to allow personnel occupancy and beneficial use of the building. The general sequence was as follows: (1) Removal of most material and equipment items from the process room. (2) Removal of material and equipment from the other rooms. (3) Scrubbing of surfaces in the process room. (4) Sealing of duct openings and outside door form process room and removal of all remaining movable items from process room. (5) Final scrubbing of rooms and equipment surfaces. Later, as a result of program redirection, the facility became an excess contaminated facility awaiting final desposition, and was put through final decontamination procedures in October, 1974. Before final decontamination, survey results of July, 1972, showed a recontamination of various levels in different areas of the facility. These are given in the body of the report. The following decontamination efforts were initiated to reduce the potential for plutonium dispersal during subsequent demolition phases: (1) Removal of gloveboxes, equipment items and miscellaneous materials remaining in the building. (2) Removal of some contaminated air ducts and fixtures. (3) Resealing of duct openings. (4) Scrubbing of floors and bench tops. Removal of the distribution system began with excavation at the ends most distant from the common junction. The north-south lateral of the distribution system was found to be contaminated to levels of approximately 80 pCi/gm gross alpha for approximately 10 m of trench. Approximately 2.5 cubic meters of contaminated soil from this trench and all of the clay pipe were sent to the contaminated waste burial ground and buried as nonretrievable waste. (Auth)(JMF)

The report contains many diagrams and photographs of different parts and aspects of the facility to be decontaminated. Charts giving radiation levels in the different areas are included.

DECONTAMINATION; DECOMMISSIONING; ENVIRONMENT; NUCLEAR FACILITIES; PLUTONIUM; RADIATION HAZARDS; RADIOACTIVITY; RADIONUCLIDES; TRANSURANICS

43
Cox, J.A. Oak Ridge National Laboratory, Oak Ridge, TN

Problems of Mothballing the ORNL Graphite Reactor. Transactions of the American Nuclear Society 8(1):115-116. (1965, May)

Openings in the shield were sealed, and fuel slugs left in reactor with a slight exhaust air flow to hold a negative pressure. Heating the inleaking air keeps the fuel clad to 50 C to prevent condensation and corrosion. The annual cost is $3000, and fuel reprocessing would not pay. Spare control rods were inserted and the normal control rods welded in place. Demolition costs would be excessive - filling internal voids with grout is estimated at $70,000, and decontamination of exhaust duct and filter house at $30,000.

DECONTAMINATION; ECONOMICS; DECOMMISSIONING; REACTORS, GCR TYPE

44
Cunnane, J.C., and W.R. Stagg

Coolant Chemistry Control During Pressurized Water Reactor Shutdown-Cooldown. CONF-790923; Decontamination and Decommissioning of Nuclear Facilities, Proceedings of a Conference, Sun Valley, ID, September 16-20, 1979. Session V-A, (pp. 7-9), 90 pp. (CONF-790923). (1979)

One way to control the occupational radiation exposure which is associated with the shutdown radiation fields in pressurized water reactors (PWRs) is to control the buildup of the radiation source in those areas of the plant which require inspection, repair and maintenance operations. For modern PWRs, which operate with very low failed fuel levels, this reduces to controlling the buildup of activated corrosion products. Studies which have followed the radionuclide concentration in the primary coolant throughout various phases of plant operation have shown that the total amount of activity which passes through the steam generators during the shutdown-cooldown sequence is comparable to the amount which passes through during a normal cycle. Hence, it was realized that chemistry control during this period is potentially very important. The increase in the radionuclide content of the primary coolant during the shutdown-cooldown sequence can be explained by the solubility changes which accompany the cooldown-boration and subsequent oxygenation. The oxygenation component can be controlled by maintaining reducing conditions in the primary coolant and the cooldown-boration component can be controlled to a lesser degree by appropriate pH control. Based on these results, redox and pH control programs were developed and tested during recent PWR refueling shutdowns. The program which was designed to demonstrate control of the oxygenation component was implemented during the Oconee, Unit 2 end-of-cycle (EOC) 3 refueling shutdown. Reducing conditions were maintained in the primary coolant by maintaining the hydrogen overpressure on the letdown storage tank until the reactor coolant temperature was about 250 F. At this point, a hydrazine addition program was initiated and continued until the steam generators were drained under a nitrogen blanket. Reducing conditions were effectively maintained up to the point at which the steam generators were drained. The oxygenation component of the solubilization was suppressed, as intended, until after the steam generators were drained. It has been demonstrated that the dissolution of the activated corrosion product oxides can be controlled, to some degree at least, during the shutdown-cooldown sequence for PWRs. This will be very important in controlling the source of the problem shutdown radiation fields if future work shows that there is a significant contribution to the buildup of these fields during the plant shutdown sequence. (Auth)(JMF)

This paper is only an abstract of the actual paper which is to be published later.

RADIATION HAZARDS; REACTORS, PWR; MAINTENANCE; EXPOSURE, OCCUPATIONAL; COOLANTS; RADIONUCLIDES; COBALT; CHEMISTRY

45
Davis, B.J. Idaho Operations Office, Idaho Falls, ID; Aerojet Nuclear Company, Idaho Falls, ID; Chicago Operations Office, Argonne, IL

Elk River Reactor Dismantling. pp. 83-118. (1975, September)

CUTTING; TOOLS, CUTTING; ELK RIVER REACTOR; MECHANICAL STRUCTURES; RADIATION DOSE; REACTOR DISMANTLING

46
Detilleux, E. U.S. Energy Research and Development Administration, Washington, DC; Oak Ridge National Laboratory, Oak Ridge, TN; Eurochemic, Mol, Belgium

Status of the Decommissioning Program of the Eurochemic Reprocessing Plant. International Symposium on Management of Waste from the LWR Fuel Cycle, Denver, CO, July 11, 1976 (pp. 413-425). (1976)

Reprocessing operations at the Eurochemic Demonstration Plant stopped in December 1974, after 8 years of operation. Immediately thereafter, cleaning and decontamination were begun as the first phase of the decommissioning program. The facility and reprocessing program are described to indicate the magnitude of the problem, and the requirements of the local authorities are reviewed. The technical decommissioning program consists of several phases: (1) plant cleaning and rinsing, (2) establishment of the final fissile-material balance, (3) plant decontamination for access to process equipment, (4) equipment dismantling, and (5) conditioning and storage of newly generated wastes. The two first phases have been completed, and the third one is nearing completion. Some dismantling has been performed, including the plutonium dioxide production unit. Waste-conditioning and surface-storage facilities have been built to meet the dismantling requirements. Since reprocessing may be resumed in the future, decontamination has been performed with "smooth" reagents to limit corrosion and dismantling has been limited to subfacilities.

DECOMMISSIONING; DECONTAMINATION; WASTE STORAGE; CLEANING

47
Douglas, R.E. Atomics International, Canoga Park, CA

Effects of Water Leakage into Tanks Containing Sodium. NAA-SR-MEMO-12239; 14 pp. (1966, November 10)

One method for disposing of the Hallam primary sodium is to bury the storage tanks without prior reaction of the sodium. A test was performed to determine the effects of ground water leakage into the tanks through pinholes or cracks. A half quart can was submerged and various sized holes drilled. Results indicate that the sodium-water reaction would take place at a self-regulating rate, and no excessive internal pressure increase or explosive condition would be created in the tanks under conditions similar to those imposed for the test.

EXPLOSIONS, NUCLEAR; REACTORS, GRAPHITE MODERATED; HALLAM REACTOR; REACTORS, LMCR; WATER; CHEMICAL REACTIONS; SODIUM; WASTE DISPOSAL; DECOMMISSIONING; BURIAL

48
Driesner, A.R. Los Alamos Scientific Laboratory, Los Alamos, NM

Summary of Disassembly and Post-Mortem Visual Observations of the Kiwi-B4e-301 Reactor. Report, 37 pp. (1965, April 16)

The KIWI-B4E-301 reactor was tested approximately 8 minutes at full power (maximum average fuel element temperature approximately 2100 °C) on August 28, 1964. The reactor was restarted on September 10, 1964, and run at full power for 2-1/2 minutes. Test results and disassembly procedures are presented. (Auth)

KIWI-B4E REACTOR; PERFORMANCE TESTING; FUEL ELEMENTS; INSPECTIONS; REACTOR CORES; REACTOR DISMANTLING; REACTOR OPERATION; THERMAL STRESSES

49
Eickelpasch, N., and M. Ladch

In-Situ Decontamination of Parts of the Primary Loop at the Gundremmingen Nuclear Power Plant. CONF-790923; Decontamination and Decommissioning of Nuclear Facilities, Proceedings of a Conference, Sun Valley, ID, September 16-20, 1979. Session III-A, (pp. 6-8), 90 pp. (CONF-790923). (1979)

Decontamination and shielding were needed for the Gundremmingen boiling water reactor when extensive welding and testing works were necessary on the steam generator and the primary loops. The Gundremmingen nuclear power plant was installed in 1966, and in 1977, after more than 10 years of operation, needed the repair work. However, highly radioactive corrosion products inside the system caused radiation levels of some 800 mR/h at the welding area and more than 15 R/h inside the primary system. For that reason, decontamination and shielding were needed. A local hard decontamination was selected because it supplies higher decont-factors than soft decontamination, that means less radiation exposure for extensive welding work (more than 100 hours); the know how was available; and the risk of damaging primary pump gaskets or heat exchanger tubes by corrosion attack can be excluded. A modified APAC method developed by KWU was used. Before application the solutions were exposed to abundant tests, to ensure that selective corrosion attack on the stainless steel 304, especially on sensitized fields, is avoided. The APAC method consists of alkaline permanganate solution, applied for 2 hours at 90 deg C; rinsing with cold water; a treatment with ammoniated citric acid - oxalic acid EDTA solution for 6 hours at 90 deg C; and rinsing with water. The solutions were pumped and heated in a circuit. Due to the experience, the following provisions proved to be necessary for obtaining good results: (1) The solutions had to be stirred violently. (2) The removal of the oxide layer had to be supported by abrasive aids, soft rubber balls, e.g., which were running with the solutions. (3) Mechanical cleaning after decontamination with high pressure water jet, if possible. As decontamination is performed "in situ", attention was to be paid to some more items: (1) The parts that became decontaminated had to be sealed effectively to prevent leakage. (2) The installation of the sealing equipment in the high radiation field had to be exercised with inactive prototypes. (3) The monitoring of the decontamination had to be done by television. (4) After decontamination, a shielding was installed to reduce the radiation level that was brought about by the undecontaminated components. (Auth)(JMF)

This paper is only an abstract of the actual paper which is to be published later. The document contains figures showing radiation levels before and after decontamination.

DECONTAMINATION; WASHING; NUCLEAR FACILITIES; REACTORS, BWR; RADIOACTIVE MINERALS; RADIATION SOURCES; CORROSION; SHIELDING; ACIDS, ORGANIC; ACIDS; BASES; WATER; DEMINERALIZATION; MONITORING

50

Elder, M. Los Alamos Scientific Laboratory, Los Alamos, NM

Phoebus-1A. Preliminary Report. 137 pp. (1965, September 25)

The Phoebus-1A full power test was conducted on June 25, 1965, at the Nuclear Rocket Development Station, Jackass Flats, Nevada. The reactor was held at full design power and temperature for approximately 10 minutes and 30 seconds before an unexpected loss of coolant resulted in core support overheating and subsequent ejection of core parts through the nozzle. Peak power achieved during the hold was 1090 Mw at a maximum fuel element exit temperature of 4460 R. Corresponding values for the Kiwi-B-4E test were 809 Mw and 4040 R. The reactor contained several optional design modifications aimed at reducing corrosion. The primary objective of the test series was to operate the reactor at full power and temperature for sufficient cumulative time (10 minutes) to provide a comparison of these modifications by post-mortem inspection and analysis. Test results are presented. (Auth)

PHOEBUS-1A REACTOR; PERFORMANCE TESTING; CONTROL SYSTEMS; NOZZLES; REACTIVITY; REACTOR CORES; REACTOR DISMANTLING; REACTOR KINETICS; REACTOR OPERATION; TEMPERATURE, VERY HIGH

51

Farinelli, U., D. Lavrencic, I. Gastaldi, and T. Candelieri CNEN, Rome, Italy; University of Rome, Rome, Italy; CNEN-CRN, Trisaia, Italy

Some Experience and Study on Decommissioning Performed in Italy. IAEA-SM-234/6; Decommissioning of Nuclear Facilities, Proceedings of an International Symposium, Vienna, Austria, November 13-17, 1978. International Atomic Energy Agency, (pp. 141-176). 694 pp. (IAEA-SM-234/6). (1979)

The general outlook on decommissioning problems is summarized; nuclear reactors and nuclear fuel cycle plants decommissioned at various stages in the world are reviewed. Italian experience on decommissioning is to date limited to the 7 MW research reactor Avogadro, shut down in 1972, and the ISPRA-1 of the Joint Research Centre Establishment, Ispra, now in the stage of mothballing. Experience on nuclear power plant

decommmissioning problems was obtained during removal of the thermal shield from the Trino Vercellese PWR. Experience relevant to decommissioning problems in the future may derive from decontamination procedures applied in situ following the accident at the ITREC reprocessing pilot plant and from decontamination operations preceding replacement of the tube nest of the high level waste (HLW) evaporator and a number of steam-ejectors. Calculation of the activity inventory of the Garigliano BWR after a hypothetical 30 years of operation was performed. The end-of-life activation of the pressure vessel and biological shield at the time of reactor shut-down is illustrated. (Auth)

REACTOR DECOMMISSIONING; REACTORS, RESEARCH; AVOGADRO RS-1 REACTOR; ISPRA-1 REACTOR; TRINO VERCELLESE REACTOR; GARIGLIANO REACTOR; NUCLEAR POWER PLANTS; THERMAL SHIELDS; DISPLACEMENT; DECONTAMINATION; ACCIDENTS; WASTES, HIGH-LEVEL; EVAPORATORS; CALCULATIONS; INVENTORIES; PRESSURE VESSELS; BIOLOGICAL SHIELDS; REACTORS, BWR; REACTORS, PWR

52

Folkers, C.L., S.G. Homann, A.S. Nicolosi, S.L. Hanel, and W.C. King Lawrence Livermore Laboratory, Livermore, CA

Decommissioning a Tritium Glove-Box Facility. UCRL-82381; 15 pp.; CONF-790923; Decontamination and Decommissioning of Nuclear Facilities, Proceedings of an American Nuclear Society Conference, Sun Valley, ID, September 16-20, 1979, (15 pp.) (CONF-790923, UCRL-82381). (1979, August 8)

A glove-box facility at Lawrence Livermore Laboratory, which had been used for the synthesis and processing of metal tritides (and deuterides and hydrides), including compounds of Li, U, Ti, Zr, and Ce was decontaminated and decommissioned. Gram quantities of tritium had been processed by crushing, grinding, sieving, and weighing. Due to the inability of the mocular-sieve bed, used to store tritium contaminated water, to handle large additions of water, wet decontamination procedures were limited. Mineral oil and kerosene were used to remove "loose" contamination before using water and water based detergents. Also, waterbased detergents would react with less stable particulates, giving excessive tritium gas and thereby increase worker exposures. Further protection of personnel was accomplished by maintaining a positive air flow away from the worker area, the wearing of protective clothing, and continuous monitoring for airborne tritium. Also, daily urine samples were taken during heavy work loads and at least weekly at other times. The typical range of tritium concentration was 1 to 5 uCi/l, and the highest value was 8 uCi/l. The maximum worker exposure was 110 mrem, and the total integrated dose for all workers was 420 mrem for the 6-month period to date. Special swipe techniques using cotton swabs were utilized in monitoring the progress inside the glove box. An inexpensive in-situ packed-bed dryer was also developed for use inside the glove box to adsorb water contaminated by tritium. Using these procedures, tritium contamination inside the glove box was reduced by six orders of magnitude to a level of about 10 to 100 dps/sq cm. (JMF)

Photographs of the facility are given. A table of equipment contamination inside the facility is given. A table of acceptable contamination levels for equipment to be reused is given. A graph showing reduced contamination as procedures continued is given.

AEROSOLS; CONTAINMENT; CONTAMINATION; DECOMMISSIONING; DECONTAMINATION; EVAPORATORS; FILTERS; GLOVE BOXES; HOT LABS; INSTRUMENTS; LITHIUM COMPOUNDS; MOISTURE; MOISTURE CONTENT; PERSONNEL; RADIATION DETECTORS; RADIATION HAZARDS; RADIONUCLIDE MIGRATION; SAMPLING; WASHING; WASTES, LOW-LEVEL; WASTES, RADIOACTIVE; WATER

53

Francioni, W.M., U. Frick, P. Riner, G. Megaritis, and H. Conrad Eidgenoessisches Institut Fuer Reaktorforschung, Wuerenlingen, Switzerland

Reconstruction of the Reactor Diorit 1. Report; 120 pp. (1973, September)

The DIORIT 1 reactor was disassembled after 10 years of operation and rebuilt with a new reactor vessel. The preparations made for the disassembly and criteria to be used in the removal, transport, and storage of the reactor components are outlined in detail. The disassembly itself is described fully. The preparations made for the rebuilding operation are discussed. The financial cost of the operation is given. The radiation monitoring carried out throughout the entire operation is discussed. (JSR)

CONSTRUCTION; DIORIT REACTOR; PRESSURE VESSELS; RADIATION MONITORING; REACTOR COMPONENTS; REACTOR DISMANTLING; MAINTENANCE

54
Franklin, J.P. U.S. ARMY

Removal of the PM-2A Nuclear Power Plant from Camp Century. Transactions of the American Nuclear Society 8(1):117-118. (1965, May)

Camp Century snow conditions were deteriorating badly, so the camp was placed in seasonal operation in 1963 and PM2A removed in 1964. Even though the fuel was discharged, the reactor skid was unexpectedly radioactive and needed expedient shielding. The entire area was decontaminated to Danish specifications. The carbon-steel reactor vessel was approaching NDT operating complications and will be used for tests. The power-generation equipment was stored.

DECONTAMINATION; DECOMMISSIONING; REACTORS, MILITARY; PRESSURE VESSELS

55
General Electric Company

Status of Deactivated Vallecitos Boiling Water Reactor. DOCKET 50-18; Letter to P.A. Morris, DRL; 5 pp. (1966; 1969, April)

Facility remained static, as in Report 3. Routine surveys and inspections were made. Reactor-vessel water level remained constant. Generating system was removed. Condenser subsystem and parts of turbine subsystem were shipped to burial site. Other parts salvaged. Building to be converted into filter-media testing [illegible]. Control room was converted into a customers radiochemistry training lab by rewiring the active VBWR access alarms and controls into control panel of evesr.

REACTORS, BWR; VALLECITOS BOILING WATER REACTOR; BUILDINGS; MODIFICATIONS; DECOMMISSIONING; GENERATORS, STEAM; CONTROL ROOMS

56
General Electric Company, Pleasanton, CA

Annual Report No. 6, Vallecitos Boiling Water Reactor (Deactivated). DOCKET 50-18; Letter-General Electric Company to AEC Division of Reactor Licensing; 6 pp. (1971, February 20)

The facility remained essentially in a static condition, as described in Annual Report No. 5. Entry into the containment building was made for routine radiation surveys, a check of general conditions throughout the building to verify the unchanged condition of the facility and for the removal of a 450 horsepower motor from the basement. Radiation levels are slightly lower than those reported a year ago. The reactor vessel water was monitored and remained essentially constant.

REACTORS, BWR; VALLECITOS BOILING WATER REACTOR; DECOMMISSIONING; REACTOR OPERATION; DOCUMENTATION

57
General Electric Company, San Jose, CA

Operating Experience for Sixth Six-Month Period, Esada - Vallecitos Experimental Superheat Reactor. DOCKET 50-183; 24 pp. (1967, May 13)

There were thirteen reactor scrams during the period. Six were flux-flow-temperature subdivided, one spurious while setting bias, one valve malfunctioned, two operator error, two turbine trip. There was one from high water level, one from low pressure, one from high radiation in steam and four from instrument malfunction. Emergency cooling was repaired on eight scrams. Plant deactivation started.

FAILURES; EQUIPMENT; SCRAM; REACTORS, INTERNAL SUPERHEAT; INSTRUMENTS; CLADDING; DECOMMISSIONING; REACTOR OPERATION; DECONTAMINATION; VALLECITOS EXPERIMENTAL SUPERHEAT REACTOR

58
Giraudel, B., and [illegible]. Langlois CEA, Institut de protection et de surete nucleaire, Fontenay-aux-Roses, France

Experience Relevant to Safety Obtained from Reactor Decommissioning Operations in the French Atomic Energy Commission. IAEA-SM-234/34; Decommissioning of Nuclear Facilities, Proceedings of an International Symposium, Vienna, Austria, November 13-17, 1978. International Atomic Energy Agency, Vienna, (pp.89-104), 694 pp. (IAEA-SM-234/34). (1979)

From among the nuclear facilities constructed in France the authors cite eight large reactors, ranging from critical assemblies to power reactors, that have been finally shutdown since 1965. A brief account is given of the way in which the various operations were carried out after the final control rod drop, a distinction being drawn between the shut-down proper and the containment and dismantling work. A description is also given, from the technical and regulatory standpoint, of the final stage attained, and mention is made of French safety arrangements and of the part played by the safety services during decommissioning operations. Among the lessons derived from French experience, the authors mention the completion of operations without any serious safety problems, and with guarantees for the protection of personnel and the population as a whole, by conventional techniques; the advantage of planning decommissioning operations from the very beginning of construction of the facilities; and the importance of filing descriptive documents. In view of the experience gained, the French Atomic Energy Commission has devised internal procedures for facilitating the application of regulations governing the shut-down and decommissioning phases, which are aimed at preserving surveillance procedures similar to those in force during normal operation. (Auth)

REACTOR DECOMMISSIONING; REACTOR SHUTDOWN; DISMANTLING; CONTAINMENT; SAFETY; PERSONNEL; PLANNING; DOCUMENTATION; REGULATIONS, INTERNATIONAL

59

Graves, A.W., G.P. Streechon, and D.A. Phillips Atomics International, Canoga Park, CA

Submerged Cutting of Reactor Components and Vessels. American Nuclear Society Winter Meeting, San Francisco, CA, November 27, 1977; Transactions of the American Nuclear Society 27:760-761. (1977)

TOOLS, CUTTING; REACTOR DISMANTLING; REACTORS, SRE

60

Guymon, R.H. Oak Ridge National Laboratory, Oak Ridge, TN

MSRE Procedures for the Period Between Examination and Ultimate Disposal. ORNL-TM-3253; 41 pp. (1971, February 10)

Describes the condition of the MSRE and specifies procedures to be followed after the postoperation examinations and before the ultimate disposal of the fissile and radioactive material in the reactor. The fuel salt will be kept frozen in the sealed drain tanks, within secondary containment whose only opening is through filters to a stack. Surveillance will consist of remote monitoring and daily visits by X-10 personnel. Personnel access will be controlled by the security fence around the reactor building. The MSRE procedures specify remedial actions for abnormal conditions. Also specified are procedures and responsibilities for maintenance, modifications, and removal of surplus equipment.

MAINTENANCE; REACTORS, MOLTEN SALT; REACTORS, MSRE; WASTE DISPOSAL; MODIFICATIONS; DECOMMISSIONING; RADIATION MONITORING

61

Harmer, D.E., and J.L. White

Results to Date of the Dresden 1 Chemical Cleaning. CONF-790923; Decontamination and Decommissioning of Nuclear Facilities, Proceedings of a Conference, Sun Valley, ID, September 16-20, 1979. Session III-A, (p. 2), 90 pp. (CONF-790923). (1979)

After more than 18 years of commercial operation, Dresden 1 has been shut down for various ISI activities and retrofitting tasks, and a complete chemical cleaning of the internal primary system to remove radioactive deposits from pipe and equipment. The orginal objectives of the program included: (1) Reduce radiation levels to improve plant accesibility. (2) Ensure continued safe and efficient operation. (3) Develop and prove techniques applicable to other reactors. (4) Encourage vendor, manufacturer and consultant participation. Laboratory tests of the NS-1 solvent on samples of actual Dresden 1 internal surfaces have given radiation reduction in excess of 99%. A field result close to this efficiency is anticipated. Plans for this decontamination cleaning have been progressing since 1973. The cleaning solvent has been selected and tested. Process details and procedures have a completion date of April, 1979. Construction activities went forward in two areas: New piping and equipment connections in the containment sphere, and an entirely new building to process the spent cleaning solvent and rinses. Photographs and drawings of these facilities will be shown. The actual chemical cleaning of Dresden 1 is scheduled during the second half of 1979. This date represents a moderate amount of slippage from the earlier target date. The new schedule, and results of the cleaning operations to date, are to be included in this report. (Auth)(JMF)

This paper is only an abstract of the actual paper which is to be published later.

DECONTAMINATION; WASHING; NUCLEAR FACILITIES; DEPOSITION; RADIOACTIVE MINERALS; RADIOACTIVITY

62
Harris, W.R., B.R. Kokenge, and G.C. Marsh Albuquerque Operations Office, Albuquerque, NM; Sandia Laboratories, Albuquerque, NM

Decommissioning of the Special Metallurgical Building at Mound Laboratory. pp. 825-854. (1974, July)

BUILDINGS; DECOMMISSIONING; DECONTAMINATION; FILTERS; GLOVE BOXES; PLUTONIUM 238; DISPLACEMENT

63
Heine, W.F., A.W. Graves, and B.F. Ureda Atomics International, Canoga Park, CA

Decommissioning of the Sodium Reactor Experiment. Transactions of the American Nuclear Society 26:435-436. (1977, June)

REACTOR DECOMMISSIONING; REACTOR DISMANTLING; REACTORS, SRE

34
Herre, F. Gesellschaft zur Wiederaufarbeitung von Kernbrennstoffen, Leopoldshafen, German Federal Republic

Nuclear Fuel Elements and their Reprocessing, Waste Removal, and Shut-Down of Nuclear Installations. pp. 180-186. (1973)

DECOMMISSIONING; NUCLEAR FACILITIES; WASTE DISPOSAL; REPROCESSING; SPENT FUELS

65
Huntsman, L.K., and R.H. Meservey EG and G Idaho, Inc., Idaho Falls, ID

Sodium Removal from Hallam Reactor Components. TREE-1368; 51 pp. (1979, August)

The Hallam Nuclear Power Facility at Lincoln, Nebraska contained the experimental reactor used to test the feasibility of sodium coolant. Since their shipment to the Idaho National Engineering Laboratory in 1968, the Hallam Reactor components had been stored in inert nitrogen to prevent the sodium in the components from reacting with moisture in the air. The procedures used to react the sodium in the components, decontamination steps, and problems during D and D are discussed. Components selected for D and D were 5 intermediate heat exchangers, 3 primary pumps, 3 steam generator evaporators, and 3 super heaters. The wetted gaseous nitrogen (GN2) process was used for sodium removal. Wetted GN2 reacts with a Na producing gaseous hydrogen (GH2) and a strong caustic. A system was designed to incorporate this process in such a way that the Hallam components themselves served as reactor vessels. Since some of the components were radioactively contaminated, while others were not, two variations of the processing system were designed. Some of the project conculsions are: the wet nitrogen process performed well reacting all sodium except for small amounts located in small confined spaces. By exercising proper precautions, the process can be made controllable and safe. Handling and neutralizing large amounts of strong caustic should be expected and provided for. All operations personnel must be fully trained, provided with the proper tools and equipment, and must conduct the operation using detailed operating procedures. The processing system should be constructed using welded joints. Caustic carryover throughout the system is a problem, and great care must be exercised to prevent contamination spread if radioactive materials are being processed. (RAF)

HALLAM REACTOR; SODIUM; COOLANTS; REACTOR COMPONENTS; DECONTAMINATION; SEPARATION PROCESSES; HEAT EX-

CHANGERS; PUMPS; GENERATORS, STEAM; SUPERHEATERS; NITROGEN; HYDROGEN; OXYGEN; CAUSTIC; HAZARD ANALYSIS

66
IIT Research Institute, Chicago, IL

Safety Procedures and Hazards of Decommissioned ARR (L-54) Reactor. DOCKET 50-1; Letter to D.J. Skovholt from R.B. Moler and R.E. Zelac; 4 pp. (1968, March 6)

The risk of pressure buildup due to radiolytic production of H2 and O2, and subsequent precipitation of UO2 by H2O2, are not credible since (1) recombination rate of 2H2 and O2 was observed to be same as production rate during operation, and (2) even if all UO2 precipitated, reactor would remain subcritical. Emergency procedures available before operation ceased are still suitable now for plausible incidents such as fire or explosion and involve arrangements with Chicago Fire Dept., AEC radiological assistance team, campus security force, and health physics.

CHEMICAL REACTIONS; FIRES; REACTORS, HOMOGENEOUS; HAZARD ANALYSIS; REACTORS, RESEARCH; EMERGENCY PROCEDURES; PRECIPITATION, CHEMICAL; URANIUM DIOXIDE; RADIOLYSIS; GASES; DECOMMISSIONING; PRESSURE, INTERNAL; EXPLOSIONS, NUCLEAR

67
Iriarte, M., and J.H. Fragoso Puerto Rico Water Resources Authority

Decommissioning of Bonus Nuclear Superheat Power Station Transactions of the American Nuclear Society 12:53. (1969, October)

Parts of the facility were decontaminated when possible and restored to original location if not placed in the entombment cylinder within the containment building. Decontaminated site to be used as an exhibition center for five yea Spent fuel sent to be processed. Piping decontaminated with 10 v/o HCL or 15 v/o H3PO4. Ultrasonic cleaning used for some components. Complete decommissioning to be completed by Jan. 1970. Entombment to be effective for 140 years.

BONUS REACTOR; DECONTAMINATION; REACTORS, INTERNAL SUPERHEAT; REACTORS, POWER; DECOMMISSIONING; FUEL REPROCESSING; RADIATION MONITORING

68
Johnson, H.E. Atlantic Richfield Hanford Company, Richland, WA

Work Plan for Removal of Division of Military Application Equipment, 234-5 Z Building. Report; 18 pp. (1974, April 26)

The work plan for removal and burial of fabrication equipment used for the fabrication of plutonium weapon components from 1949 to 1965 is outlined. (JSR)

DECOMMISSIONING; NUCLEAR FACILITIES; PLANNING; WASTE DISPOSAL; BURIAL

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Johnson, J.E., and D.J. Bradford Idaho National Engineering Laboratory, Idaho Chemical Programs, Idaho Falls, ID

Decontamination of the Waste Calcining Facility - A Historical Review. ICP-1173; 27 pp. (1978, December)

This document covers decontamination of the Idaho Waste Calcining Facility during its fifteen-year history of converting high-level liquid radioactive wastes to granular solids. Topics covered include the general decontamination approach as it has evolved, monitoring the progress of decontamination, waste generation, and special problems and techniques. (Auth)

DECONTAMINATION; NUCLEAR FACILITIES; WASTES, RADIOACTIVE; CALCINATION; WASTES, HIGH-LEVEL; WASTES, LIQUID; EQUIPMENT; DISPLACEMENT; WASTE STORAGE; SEPARATION PROCESSES; RESIDUAL ACTIVITY; METALS; SURFACE CLEANING; CORROSION; CONTAINERS; CHEMICALS

70
Keaten, R. W., D.A. Mannas, and W.H. Olson Atomics International, Division of NAA

Evaluation of Long-Term Operation on Sodium Reactor Experiment Sodium Systems.

CONF-650710; American Nuclear Society Conference on Reactor Operating Experience. July 28-29, 1965, Jackson Lake Lodge, WY. (pp. 32-33). (1965)

General condition after 9 years is good, shown by examination of dismantled primary and secondary system. Erosion was minimal, a hard metallic layer (0.001 inch) was found in secondary cold leg. Heat exchanger ok, despite many 200 degree F shocks. Inoperable check valve was due to deposits in unnecessarily small clearances. Some carbon plugs in heat exchanger had been dissolved by high temperature operation leaving only 10% of tubes plugged.

REACTORS, GRAPHITE MODERATED; REACTORS, LMCR; SODIUM; OPERATING EXPERIENCE; REACTORS, SRE; CHEMISTRY, COOLANT; DECOMMISSIONING; HEAT EXCHANGERS; COOLING SYSTEMS, MAIN

71

Kendall, E.W. Idaho Operations Office, Idaho Falls, ID; Aerojet Nuclear Company, Idaho Falls, ID

Decontamination and Decommissioning Experience at Experimental Breeder Reactor No. 1. pp. 253-274. (1975, September)

DECONTAMINATION; EBR-1 REACTOR; LIQUID METALS; POTASSIUM ALLOYS; REACTOR DECOMMISSIONING; REACTOR DISMANTLING; REACTOR SITES; SODIUM ALLOYS; SURFACE CLEANING; DISPLACEMENT

72

Kendall, E.W., and D.K. Wang Aerojet Nuclear Company, Idaho National Engineering Laboratory, Idaho Falls, ID

Decontamination and Decommissioning of the EBR-1 Complex Final Report. ANCR-1242; 390 pp. (1975, July)

In 1966, the Experimental Breeder Reactor No. 1 (EBR-1) was designated a Registered National Historic Monument, and it was planned to transfer custody of the facility to the National Park Service (NPS) after decontamination and decommissioning. The complex located in the southwestern portion of the Idaho National Engineering Laboratory (INEL) consists of the Experimental Breeder Reactor Building (EBR-601), the Zero Power Reactor Building (RTF-601), the Argonne Fast Source Reactor (AFSR) Shielding, and the contaminated NaK (eutectic solution of sodium and potassium) Storage Pit. The D and D Program scope of work included: extraction of 5500 gallons of NaK coolant contained in the EBR-I reactor primary and secondary coolant loops; conversion of NaK to solid caustic for drummed waste disposal in the INEL Radioactive Waste Management Complex (RWMC); decontamination of all NaK and/or radioactive contaminated portions of the complex; demolition and removal of portions which could not be decontaminated to safe levels; isolation of areas which could not be removed or decontaminated to safe levels; decontamination and removal of the ZPR-3 reactor; demolition of the AFSR shielding; and removal of contaminated NaK in the NaK storage pit. The total progam plan is based on an expenditure of $325,000 in FY 74 and $415,000 in FY 75. The environmental impact from construction activities will be minimal. Materials potentially hazardous to the environment are presently being stored at the EBR-1 complex. These materials will be removed and processed to produce a more stable product which can be stored at the NRTS Burial Ground. The program was initiated in October 1973 and all D and D effort was satisfactorily completed by June 13, 1975. (Auth)(JMF)

The document contains numerous drawings, tables, graphs, photographs, and diagrams of the facility to be decontaminated and decommissioned.

DECONTAMINATION; DECOMMISSIONING; NUCLEAR FACILITIES; WASHING; REACTORS, BREEDER; COOLANTS; WASTE DISPOSAL; WASTES, RADIOACTIVE; ENVIRONMENT; COSTS

73

Kirk, W.L. Los Alamos Scientific Laboratory, Los Alamos, NM

Nuclear Furnace-1 Test Report. LA-5189-MS; 112 pp. (1973, March)

Results from the highly successful tests of the Nuclear Furnace-I reactor are reported. The reactor, its instrumentation, and the test facility are described; and a chronology of the Experimental Plans which constituted the test series is given. Concl[illegible]sions reached from the analysis of the test data are outlined together with the observations made during disassembly and postmortem inspection of the reactor components. Results of experiments on the effluent cleanup system are also discussed. (Auth)

REACTORS, NUCLEAR FURNACE; PERFORMANCE TESTING; DESIGN; FUEL ELEMENTS; WASTES, GASEOUS; PERFORMANCE; WASTES, RADIOACTIVE; REACTOR CORES; REACTOR DISMANTLING; REACTORS, SPACE POWER

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Kittinger, W.D., and G.W. Meyers

Decommissioning the Sodium Reactor Experiment, a Status Report. CONF-790923; Decontamination and Decommissioning of Nuclear Facilities, Proceedings of a Conference, Sun Valley, ID, September 16-20, 1979. Session IV-B, (pp. 6-8), 90 pp. (CONF-790923). (1979)

The dismantling of the Sodium Reactor Experiment (SRE) is approaching the final phases toward completion, and, depending upon funding, the decommissioning will be completed in FY 1980 or FY 1981. This project is the major effort in a program by Atomics International to decommission eight nuclear facilities at the Santa Susana Field Laboratory near Los Angeles. The Program is funded by the Department of Energy. The goal in decommissioning each of these facilities is to achieve unrestricted use status. In chronological sequence, the major tasks that were performed earlier included: (1) Safe removal of radioactively contaminated sodium; cleaning of sodium from the reactor vessel, piping, and components; and the reaction of sodium heels and residues with alcohol. The reaction with alcohol and absorption in diatomaceous earth produced a product acceptable for burial at a licensed site. Approximately 2,500 pounds of sodium were removed from components. (2) Safe and controlled removal of systems or items disposed intact without size or weight reduction. (3) Removal of reactor vessel internals such as cooling piping, clamps, bellows, and grid plate by cutting remotely and underwater with either shaped-charge explosives and/or plasma torch techniques. (4) Remote, underwater removal of the activated and contaminated concentric structures of the reactor vessel. In the more recent period, progress has been made in removing contaminated and activated concrete structures and surfaces, the reactor vessel cavity liner, and contaminated soil. Excavations are necessary in some locations to 40 feet deep. An early engineering analysis had shown it was most cost effective to retain the total SRE building superstructure for reasons including the need for contamination containment and weather protection. Although engineering and planning of a general nature had occurred in the early phases for excavation and demolition, it was found necessary to engage in a much more detailed engineering effort preceding the actual performance: (1) Design of a sharing system that protected personnel and allowed the building and supporting services to remain in place. (2) Design of excavation and demolition approaches to encompass unpredictables in volumes of contaminated concrete and soil. (3) Sampling, analyses and engineering studies to determine methods for removing only significantly activated portions of the biological shield. (4) Design of alternate approaches as changes from construction drawings were encountered. (5) On-going analyses of cost versus benefits in decisions to decontaminate surfaces and items to decrease waste volumes or to accomplish gross removal. An Environmental Impact Assessment study also was recently made in order to give more detailed examination of the potential impacts of the residual activity guidelines employed. The currently remaining activities in the SRE decommissioning project include finish work on many of the excavation, decontamination, and demolition items previously listed. The total SRE dismantling project is estimated to cost $13 million, a portion of which funded development work on tooling, techniques, and operating parameters. (Auth)(-TMF)

This paper is only an abstract of the actual paper which is to be published later.

DECONTAMINATION; WASHING; DECOMMISSIONING; NUCLEAR FACILITIES; URANIUM; SODIUM; MONITORING; CONCRETES; CONTAMINATION; SHIELDING; EXPOSURE, OCCUPATIONAL; SAMPLING; COST BENEFIT ANALYSIS; COSTS; ENVIRONMENT; ENVIRONMENTAL IMPACT STATEMENTS; REACTORS, SRE

75

Kohler, E.J., K.P. Steward, and J.V. Iacono General Atomic Company, San Diego, CA

Peach Bottom High-Temperature Gas-Cooled Reactor Decommissioning and Component Removal. GA-A14297; 37 pp. (1977, July)

Peach Bottom 1 was the first prototype in the United States. The 40 MWe plant operated from June 1967-October 1974 with an overall NSSS availability of 88%, when it was shut down for decommissioning which permitted selective component removal. Decommissioning involved: shipment off-site of all fuel and source materials for storage and eventual reprocessing; removal from the containment of liquids, pressurized gases, and flammable materials; decontamination and retirement of major equipment; removal and burial of fission product traps, delay beds, and contaminated materials; complete closure of the primary system; and release of control room, laboratories, etc. for unrestricted use.

PEACH BOTTOM-1 REACTOR; REACTORS, HTGR; DECOMMISSIONING; DECONTAMINATION; WASTE DISPOSAL; REACTOR COMPONENTS

76
Kohler, E.J., K.P. Steward, and J.V. Iacono Gulf General Atomic Company, San Diego, CA

Peach Bottom HTGR Decommissioning and Component Removal. American Nuclear Society Meeting, Chattanooga, TN, August 8, 1977, 42 pp. (1977, July)

The prime objective of the Peach Bottom end-of-life program was to validate specific HTGR design codes and predictions by comparison of actual and predicted physics, thermal, fission product, and materials behavior in Peach Bottom. Three consecutive phases of the program provide input to the HTGR design methods verifications: (1) nondestructive fuel and circuit gamma scanning; (2) removal of steam generator and primary circuit components; and (3) laboratory examinations of removed components. Component removal site work commenced with establishment of restricted access areas and installation of controlled atmosphere tents to retain relative humidity at 30%. A mock-up room was established to test and develop the tooling and to train operators under simulated working conditions. Primary circuit ducting samples were removed by trepanning, and steam generator access was achieved by a combination of arc gouging and grinding. Tubing samples were removed using internal cutters and external grinding. Throughout the component removal phase, strict health physics, safety, and quality assurance programs were implemented. A total of 148 samples of primary circuit ducting and steam generator tubing were removed with no significant health physics or safety incidents. Additionally, component removal served to provide access for determination of cesium plateout distribution by gamma scanning inside the ducts and for macroexamination of the steam generator from both the water and helium sides. Evaluations are continuing and indicate excellent performance of the steam generator and other materials, together with close correlation of observed and predicted fission product plateout distributions. It is concluded that such a program of end-of-life research, when appropriately coordinated with decommissioning activities, can significantly advance nuclear plant and fuel technology development.

PEACH BOTTOM-1 REACTOR; PRIMARY COOLANT CIRCUITS; REACTOR COMPONENTS; REACTOR DECOMMISSIONING; REACTOR DISMANTLING; REACTOR SHUTDOWN; GENERATORS, STEAM

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Koning, C. Netherlands Energy Research Foundation, Petten, The Netherlands

The Decontamination of Large Components at ECN. IAEA-SM-234/7; Decommissioning of Nuclear Facilities, Proceedings of an International Symposium, Vienna, Austria, November 13-17, 1978. International Atomic Energy Agency, (pp. 517-527), 694 pp. (IAEA-SM-234/7). (1979)

A description of the decontamination facility at ECN, Petten, is given. The layout of the low-level decontamination and the in-cell decontamination of high-level contaminated objects is explained. The results of the recent decontamination of large components, such as boxes used for handling of active materials, and reactor pool equipment, are presented. (Auth)

DECONTAMINATION, EQUIPMENT; BOXES; REACTOR COMPONENTS

78
Kratzer, W.K.

Decontamination of the Hanford N-Reactor in Support of Continued Operation. CONF-790923; Decontamination and Decommissioning of Nuclear Facilities, Proceedings of a Conference, Sun Valley, ID, September 16-20, 1979. Session II-A, (pp. 6-7), 90 pp. (CONF-790923). (1979)

The purpose of decontamination activities at N-Reactor is to reduce the radiation fields in locations where work is required to support plant operation. Decontamination decisions are based on cost-benefit analyses and on maintaining personnel exposure as low as practicable. For example, during the 1978 summer outage, decontamination saved 187 rem equivalent to about $500,000.00. Decontaminations at N-Reactor can be categorized as on-reactor, applied to components or systems in place, and off-reactor, applied to components removed from the reactor for decontamination, repair, and reinstallation. On-reactor decontaminations at N-Reactor include: (1) Reactor coolant system decontamination. (2) Steam generators. (3) Reactor coolant system bypass loop. (4) External surfaces of reactor system piping. (5) Spent fuel storage basin. Off-reactor component decontaminations include: (1) Graphite cooling system heat exchangers. (2) Reactor valves. (3) Pressure tube caps. (Auth)(JMF)

This paper is only an abstract of the actual paper which is to be published later.

DECONTAMINATION; WASHING; NUCLEAR FACILITIES; COST BENEFIT ANALYSIS; EXPOSURE, OCCUPATIONAL; MAINTENANCE

79

Lacy, C.S., and B. Montford

Decontamination Experience in Ontario Hydro. CONF-790923; Decontamination and Decommissioning of Nuclear Facilities, Proceedings of a Conference, Sun Valley, ID, September 16-20, 1979. Session II-A, (p. 6), 90 pp. (CONF-790923). (1979)

The Atomic Energy of Canada Limited and Ontario Hydro have developed capabilities so that the whole range of components in the circuits of the CANDU reactor can be decontaminated. Since 1975, the staff of the Nuclear Generation Division of Ontario Hydro have used these capabilities and decontaminated: (1) the complete reactor/heat transport circuit at the Douglas Point Nuclear Generating Station to remove activated corrosion products; (2) a Pickering Nuclear Generating Station Fueling machine - this had become badly contaminated by irradiated fuel debris; (3) two Incoloy-800 bleed coolers at the Brude Nuclear Generating Station - these heat exchangers were contaminated by fission products. The bleed coolers were decontaminated sequentially by the CAN-DECON process followed by the alkaline permanganate-citrox process. (Auth)(JMF)

This paper is only an abstract of the actual paper which is to be published later.

DECONTAMINATION; WASHING; NUCLEAR FACILITIES; CONTAMINATION; DEPOSITION; RADIOACTIVE MINERALS

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Logie, J.W.

Three Reactor Vessel Replacements at Chalk River. CONF-790923; Decontamination and Decommissioning of Nuclear Facilities, Proceedings of a Conference, Sun Valley, ID, September 16-20, 1979. Session IV-B, (p. 6), 90 pp. (CONF-790923). (1979)

Since 1947, when Canada's first research reactor, NRX, went critical, ORNL has been faced with the task of partially dismantling nuclear research reactors three times. In each case, twice for NRX and once for NRU, the objects was the replacement of the calandria or vessel. Planning and techniques have improved in quality and ease of application from the hectic days during the first NRX calandria change in 1952, to the relatively effortless NRU vessel change in 1972. Of the many dismantling lessons learned, three stand out: (1) Careful, detailed planning with time for intensive review and practice on full-scale mock-ups. (2) Procedures designed to minimize radiation dose to personnel. (3) Design of special tooling to carry out dismantling operations effectively and safely. We have gained enough confidence in our ability to deal with dismantling operations that power reactor dismantling is viewed without undue pessimism. That is not to say that power reactors hold fewer difficult problems for dismantling teams than do our vessels for us. We are well aware of the much larger radiation fields associated with power reactor components, and the much greater volumes of radioactive material that future teams will have to consider. The application of techniques already at hand, the introduction of methods now being worked out, and the design of future reactors to ease radiation problems, will overcome many of the difficulties we can foresee. (Auth)(JMF)

This paper is only an abstract of the actual paper which is to be published later.

DECOMMISSIONING; DECONTAMINATION; WASHING; NUCLEAR FACILITIES; REACTORS; EXPOSURE, OCCUPATIONAL; FIELD STUDIES

81

MacMillan, D.P., and A.R. Driesner Los Alamos Scientific Laboratory, Los Alamos, NM

Post-Mortem Examination of Kiwi-A. Report; 115 pp. (1960, July)

A brief account is given of the disassembly of Kiwi-A, the first rocket reactor test device to be tested at Nevada Test Site on July 1, 1959. The results of examination of some recovered parts, particularly the fuel elements, are presented. Some of the "graphite whims" supporting the fuel elements were found to be cracked. Rupture of the closure plate was verified. The consequent by-pass of propellant resulted in much higher fuel element temperatures than planned with consequent severe corrosion of the hotter fuel elements. Fuel plates were examined radiographically and autoradiographically, dimensional and weight changes were measured, and photographs were taken. From these data together with studies of graphite corrosion as a function of temperature in an electrically heated furnace, the temperature from point to point in the reactor was deduced and an estimate made of propellant by-pass. (Auth)

KIWI-A REACTOR; FUEL ELEMENTS; INSPECTIONS; PERFORMANCE TESTING; REACTOR CORES; REACTOR DISMANTLING; REACTOR OPERATION

82

Manion, W.J., J.W. Jones, and R.W. Pullman Gulf United Nuclear Fuels Corporation; United Power Association, Elk River, MN

Dismantling the Elk River Boiling Water Reactor. 45 pp. (1972)

Dismantling of the Elk River Reactor requires the extensive use of remotely operated tooling. The paper primarily deals with the removal of the vessel internals, pressure vessel and biological shield since they are the only activities which require the use of remote tooling. All remote tooling for the Elk River Reactor dismantling project was designed, fabricated and tested at Oak Ridge National Laboratory. The tooling for reactor dismantling operations includes mechanical and flame cutting equipment. The flame cutting selected for the work is the plasma arc technique which develops temperatures greater than 24000 K. This high temperature permits single pass cutting of the thickness of metal involved, i.e., up to three inches. Because of high radiation levels, positioning and translation of the torch over the work is done automatically. Plasma cutting will be performed underwater and in-air. In-air cutting of radioactive components will produce large quantities of contaminated smoke. Therefore, the volume containing the material to be cut is isolated in a contamination control envelope which is exhausted through high efficiency filters by a high capacity blower. (Auth)(RAF)

REACTOR DISMANTLING; ELK RIVER REACTOR; REACTORS, BWR; REACTOR COMPONENTS; BIOLOGICAL SHIELDS; REMOTE HANDLING; TOOLS, CUTTING; CUTTING, PLASMA; FILTERS, HEPA; RELEASES, AIRBORNE; CONTAMINATION; AIR

83

McConnon, D. United Power Association, Elk River, MN

Operational Health Physics During Dismantling of the Elk River Reactor. Paper No. 37; 18th Annual Health Physics Society Meeting, Miami Beach, FLA, June 17, 1973, (CONF-730603). (1973)

The Elk River Reactor (ERR), a 58 MW(Th) boiling water reactor, was operated for four years and shut down in 1968 for economic reasons. The facility is now being dismantled such that the reactor site will be returned to approximately the condition that existed prior to installation of the reactor with all vestiges of the reactor plant (except for subgrade foundations) having been removed and disposed of. This is the first time that decommissioning of a power reactor has involved complete removal and disposal of large radioactive structures, rather than in-place entombment. Removal operations and radiological conditions during dismantling of the highly radioactive portions of the reactor are described.

DECONTAMINATION; ECONOMICS; HEALTH PHYSICS; REACTOR OPERATION; REGULATIONS; WASTE DISPOSAL; WASTES, SOLID; PERSONNEL; EXPOSURE, OCCUPATIONAL; RADIOACTIVITY; DECOMMISSIONING; REMOTE HANDLING; OPERATING EXPERIENCE; ELK RIVER REACTOR; PROCEDURES

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McConnon, D., and J.F. Nemec Albuquerque Operations Office, Albuquerque, NM; Sandia Laboratories, Albuquerque, NM

Experiences in Decontamination/Decommissioning of the Elk River Reactor. pp. 785-824. (1974, April 1)

DECONTAMINATION; ELK RIVER REACTOR; PERSONNEL; RADIATION DOSE; REACTOR DECOMMISSIONING; REACTOR DISMANTLING; REACTOR SHUTDOWN; REACTOR SITES

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McKenzie, J.L., and B.A. Wilson Armed Forces Radiobiology Research Institute, Bethesda, MD

Decommissioning of the Air Force Nuclear Engineering Center (1970-1971). pp. 72-76. (1974)

REACTORS, NETR; REACTOR DECOMMISSIONING; REACTOR DISMANTLING; REVIEWS

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Meservey, R.H.

OMRE and Hallam Decontamination and Decommissioning Projects at the Idaho National Engineering Laboratory. CONF-790923; Decontamination and Decommissioning of Nuclear Facilities, Proceedings of a Conference, Sun Valley, ID, September 16-20, 1979. Session IV-B, (pp. 4-5), 90 pp. (CONF-790923). (1979)

A brief history of decontamination and decommissioning (D and D) experience at the Idaho National Engineering Laboratory will be presented as a introduction to the status of current projects. The Hallam Project involved the removal of the low-level (less than 15 mR/hr) contaminated sodium from a number of major reactor components in the sodium cooled reactor that operated at the Hallam Nuclear Power Facility. Following dismantling of the reactor, the components were stored for several years under a protective purge of nitrogen gas. The objective of the Hallam D and D project was to react the sodium remaining in the components and convert it to a stable form of caustic solution. The caustic was then neutralized with acid and water and recirculated through the component to allow adequate time for complete reaction of the sodium. A system which generated humid nitrogen for reacting the sodium was designed and built. This, with the rest of the processing system, provided control of the steam/sodium reaction, neutralization and draining of caustic, flushing with water, and filtering off-gases from the process. Performance of the sodium processing system was good although some sodium remained in certain components. The project was completed in one year at a cost of about $450,000. Three disposal methods were involved: disposal of radioactively contaminated items, disposal of components which were not radioactively contaminated and free of sodium, and disposal of those noncontaminated items containing residual amounts of sodium. The Organic Moderated Reactor Experiment (OMRE) facility was designed to investigate and develop organic coolant technology and was operated at the INEL from 1957 to 1963. Following final reactor shutdown, the nuclear fuel and reactor vessel internals were removed and the organic coolant was drained from all systems. The facility remained in this deactivated condition until D and D was started in October 1977. Decommissioning of the OMRE facility involved removing the reactor and all support systems, buildings, roads, fences, etc. Although most contaminated areas in the OMRE facility had radiation fields of less than 1 mR/hr, the reactor vessel itself contained fields in excess of 350 R/hr. Actual costs for removing the OMRE facility and restoring the area to its natural state will be about $500,000. Development areas receiving emphasis during the coming year include: sodium and NaK processing, facility characterization, soil decontamination, and remote cutting and handling techniques. (Auth)(JMF)

This paper is only an abstract of the actual paper which is to be published later.

DECONTAMINATION; WASHING; DECOMMISSIONING; COSTS; SODIUM; CONTAMINATION; WASTE MANAGEMENT; REACTORS; WASTES, LIQUID; HOLDING PONDS; ORGANIC COMPOUNDS; ASBESTOS; REACTORS, BWR; EVAPORATION; HALLAM REACTOR; REACTORS, ORGANIC MODERATED

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Meservey, R.H. EG and G Idaho, Inc., Idaho Falls, ID

Decontamination and Decommissioning Projects at the Idaho National Engineering Laboratory. IAEA-SM-234/27; Decommissioning of Nuclear Facilities, Proceedings of an International Symposium, Vienna, Austria, November 13-17, 1978. International Atomic Energy Agency, Vienna, (pp. 561-574), 694 pp. (IAEA-SM-234/27). (1979)

A discussion of decontamination and decommissioning (D and D) work which is being conducted at the Idaho National Engineering Laboratory (INEL) is presented. This work includes the generation of a detailed long range plan for D/D of contaminated facilities at the INEL. The plan comprises criteria, alternatives, priorities, and program development and management requirements for the INEL D/D program. Details pertaining to the dismantling of the Organic Moderated Reactor Experiment facility are presented. These details include a description of the reactor facility, a discussion of the disassembly experience, cost and schedule data, and a summary of the current status of the project. A second project involving the removal of sodium from reactor components is also discussed. Sodium remaining in major components (heat exchangers, pumps, air eliminators, etc.) of the Hallam reactor was processed to convert it to a stable form. This D/D effort required that a processing system be designed and built, that the sodium remaining in the reactor components be processed, and that the components be cleaned. Technical results of this project are discussed as well as related budget and schedule information. A brief summary of current planning efforts and of preparations which are being made for new D D projects is also presented. (Auth)

DECONTAMINATION; DECOMMISSIONING; NUCLEAR FACILITIES; REACTORS, ORGANIC COOLED; COSTS; DISPLACEMENT; SODIUM; REACTOR COMPONENTS; HALLAM REACTOR; DISMANTLING; PLANNING; PROGRAMS

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Meyer, D.D. Los Alamos Scientific Laboratory, Los Alamos, NM

Demolition of an Alpha-Contaminated Building. TID-7517 (Part 1); Sanitary Engineering Aspects of the Atomic Energy Industry, Proceedings of a Seminar, Cincinnati, Ohio, December 6-9, 1975, (pp. 212-222), 609 pp. (TID-7517, Part 1). (1955, December)

The successful demolition of a building, containing plutonium dust, at the Los Alamos Scientific Laboratory is discussed. Building D was the building dismantled and it had 48,000 sq feet. The structure housed the purification and fabrication facilities of plutonium for weapons. To keep the dust down the walls were wallboarded and the floors were painted a number of times during life of the building. One time, while work was being done on the building a worker stepped through the ceiling and the dust contaminated the lab below to levels of 400 d/m/sq M. Anyone working in the building had to wear respirators and protective clothing because of the contaminated dust. In addition, the air outside was monitored to protect the surrounding laboratories and adjacent housing project. Demolition began on March 29, 1954 and ended on June 23, 1954. Burial was chosen for disposal due to the large quantity of noncombustible material. It was calculated that the dismantled building and contents would occupy a net volume of 8,000 cu yards. Work proceeded from the low-contamination area to the high-contamination areas. Sections, 8 by 10 feet, were cut, lifted by crane and sprayed with paint along the edges. The material was cocooned by covering with cheese-cloth and sprayed with paint once it was on the trucks. As a final precaution the load was covered with a canvas. Once the truck was unloaded it was washed at the burial site. A thousand trips were made during the demolition. Before the sawing began the room was rinsed with water from a fire hose and the liquid effluent was collected and sent to the waste disposal plant. Monitoring showed the effluent to be at least 100 times the normal activity. The building was successfully dismantled without having the workmen accumulate a body burden or creating an airborne hazard to the people in the surrounding community. Such a process takes careful planning and close supervision. During the demolition the average airborne alpha activity was: in D building, 34; outside building, 1; 300 to 500 feet away, 1; community area (100 to 7500 ft), 1; and truck escort vehicle, 8 d/m/cu M. (NDV)

ALPHA PARTICLES; BURIAL; DECOMMISSIONING; DECONTAMINATION; DUSTS; HAZARD ANALYSIS; INHALATION; MONITORING; PLUTONIUM COMPOUNDS; WASTE DISPOSAL; WASTES, RADIOACTIVE; WASTES, SOLID; EXPOSURE, OCCUPATIONAL

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Meyers, G.W., and W.D. Kittinger Rockwell International, Atomics International Division, Energy Systems Group

Progress Report on Dismantling of the Sodium Reactor Experiment. IAEA-SM-234/20; Decommissioning of Nuclear Facilities. Proceedings of an International Symposium. Vienna, Austria. November 13-17, 1978. International Atomic Energy Agency. Vienna. (pp. 435-438). 694 pp. (IAEA-SM-234/20). (1979)

The decommissioning of the Sodium Reactor Experiment (SRE) near Los Angeles, California is nearing completion. The reactor vessel and all contaminated support systems are being removed in order to return the building and site to unrestricted use. It was found cost effective to preserve the building throughout decommissioning. To date: fuel was removed and declad, tooling and technique development was completed, bulk sodium and sodium films and heels were removed, coolant piping was removed, in-vessel piping was removed by underwater remote explosive and plasma torch cutting, the reactor vessel assembly has been dissected by remote underwater plasma torch cutting, fuel and moderator handling machines were removed intact, and many of the contaminated support systems have been removed. The work has progressed successfully to meet contamination guidelines while maintaining radiation exposures to workers to as low as practicable levels. Noteworthy accomplishments were made in developing decommissioning tooling techniques and in demonstrating the capability to return a nuclear facility to unrestricted future use. To date, the decommissioning of the SRE has cost approximately $9 million of which approximately $1.5 million was spent on development, tooling modification and design, and training. Waste committed to burial at the licensed Nevada site to date is approximately 108,000 cu ft. The peak exposures have occurred during removal of the primary system and vessels; these are expected to reduce considerably during the later phases of the project. The actual decommissioning activities including packaging of waste have been accomplished with a task force of about 20 to 25 men at peak periods. No personnel has been exposed to greater than 3 rem over a one-year period. (RAF)

REACTOR DECOMMISSIONING; REACTORS, SRE; REACTOR VESSELS; DISPLACEMENT; TOOLS; SODIUM; PIPES; EXPLOSIVES; CUTTING; PLASMA TORCHES; REMOTE HANDLING; COSTS; EXPOSURE, OCCUPATIONAL; PERSONNEL

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Morgan, J.P. Puerto Rico Water Resources Authority

Application of Technical Specifications During Decommissioning. Letter to AEC, Drl; DOCKET 115-4. (1968, August)

All fuel has been removed from pressure vessel and stored. Poison injection system is out of service. The emergency condenser and shield cooling systems are in dry storage. Since the reactor is not capable of being made critical, areas of tech. specs. are no longer applicable. Interpretations have been made, and assurance that they can be implemented is required. In particular, 24-hr surveillance by operators is no longer needed, and, effective Aug. 18, the number of shifts will be reduced.

ADMINISTRATIVE CONTROL; BONUS REACTOR; REACTORS, INTERNAL SUPERHEAT; SPECIFICATIONS; DECOMMISSIONING; OPERATING EXPERIENCE

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Naval Research Laboratory, Washington, DC

Condition of the Naval Research Laboratory Reactor Facility Following Dismantling. Letter-Naval Research Laboratory to Division of Reactor Licensing (AEC); 2 pp. (1970, December 21)

Describes the condition of the remaining structure in accordance with Atomic Energy Commission regulations and your authorization to dismantle the reactor facility dated 29 July 1970.

REACTORS, RESEARCH; REGULATIONS, FEDERAL; BUILDINGS; DECOMMISSIONING; REACTOR DISMANTLING

92

Nelson, S.L. General Electric Company, Hanford Atomic Products, Richland, WA

Operational Procedures in Deactivation of the Hanford Production Reactors. Transactions of the American Nuclear Society 8(1):116-117. (1965, May)

100 DR was mothballed, while equipment in two others was abandoned or salvaged. Fuel was discharged, coolant removed, and reactor dried out. DR graphite temperatures reached equilibrium at ambient after six days, minimizing possibility of a stored-energy release. The reactors will likely remain exclusion areas for 100 years or longer.

WIGNER ENERGY; DECOMMISSIONING; REACTORS, PRODUCTION

93

Nemec, J.F. and K.G. Anderson Herbst Sons Construction Company

Demolition of Radioactive and Contaminated Concrete Structures by Use of Explosives. CONF-740608; American Nuclear Society Annual Meeting Philadelphia, PA. June 23-28, 1974. (13 pp.)(CONF-740608). (1974, April 15)

Techniques used to remove approximately 1550 cu yards of radioactive or contaminated concrete structures located within the Elk River Reactor (ERR) containment building are described. The concrete structure consisting of the ERR biological shield (B/S) and fuel element storage well (FESW) was approximately 45 feet high with a maximum thickness of 9 feet and was composed of 3500 psi (minimum) concrete reinforced with 9 rebar located at a depth of approximately 4 inches from all exposed surfaces on a 12-inch by 12-inch vertical and horizontal grid. Various explosives, drilling equipment and control techniques were tested to minimize the spread of radioactive contamination to clean reactor building structures and to control blastproduced debris, toxic fumes and vibrations. Control of vibrations was of major concern since the reactor building is located approximately 220 feet from an operating electrical generating facility. The demolition was accomplished in four major stages. Stage 1, which consisted of removing the B/S and FESW structures above elevation 938 ft provided basic information concerning dust, debris and toxic fume control requirements. Stage 2, which consisted of removing the B/S and FESW structure from elevation 938 ft to elevation 923 ft provided the data necessary to determine optimum explosive loading patterns and proof test the dust, debris and toxic fume control techniques. During stage 2, several methods of removing thin sections of concrete from exposed surfaces were tested. Stage 3 consisted of removing relatively highly radioactive concrete and reinforcing rods from the reactor cavity. Because contamination control was a prime consideration, the removal began inside the reactor cavity and proceeded outward. Stage 4 consisted of the removal of the remaining portion of the B/S and FESW. The entire job required the removal and packaging of approximately 1,550 cubic yards of concrete. Demolition commenced in late september, 1973 and was completed in april, 1974. 127 separate blasts were made ranging in size from 0.2 to 25 pounds per blast. A total of 1,200 pounds of explosives was used. (RAF)

ELK RIVER REACTOR; REACTORS, BWR; DEMOLITION; CONCRETES; DISPLACEMENT; METHODS; EXPLOSIVES; DRILLING; VIBRATIONS; BUILDINGS, CONTAINMENT; BIOLOGICAL SHIELDS; RADIATION MONITORING

94

Nemec, J.F., R.M. Beckers, and R. Blumberg United Power Association, Elk River, MN; Oak Ridge National Laboratory, Oak Ridge, TN

Radioactive Operations in the Dismantling of the Elk River Reactor. CONF-730611; 19th Annual Meeting of the American Nuclear Society, Chicago, IL, June 10-14, 1973. (54 pp.)(CONF-730611). (1973)

The method chosen for dismantling the Elk River Reactor (ERR) was to start inside the reactor pressure vessel and progress outwards as follows: the reactor internals, the inner thermal shield, the pressure vessel, the outer thermal shield, the biological shield and remaining reactor structures. The calculated radioactivity inventory at the ERR was 10,000 curies, of which 1200 curies were in the pressure vessel, and 8,700 curies were in the structural components inside the vessel. The hottest component was the core support plate which read approximately 8000 r/hr (contact) and which required 3-1/4 inches of steel and 8-1/4 inches of lead shielding for shipment by truck. To the extent necessary, the operations were done underwater. All of the internals were mechanically disassembled, transferred and loaded into shipping casks. A number of special long-handled tools were used for the difficult operations. These included a sheet metal nibbler, a series of hydraulically operated chisel and wedge tools and special lifting rigs. The inner thermal shield was a 1 inch thick by 81 inches diameter by 144 inches high cylinder, reading a maximum of 1300 r/h on contact and was sectioned into 26 segments. A plasma torch was mounted on a manipulator, which was supported by a work platform on top of the reactor vessel flange. The operation and manipulation of the torch was done from a control panel located outside a containment envelope which was set up to prevent the spread of contamination resulting from the underwater cutting operation. Accurate torch position control was required. A system of long-handled tools was provided to support the segments during the cutting process and to transfer and load them into shipping containers. The inner thermal shield was sectioned, transferred and shipped in a smooth operation with a minimum of personnel exposure and no release of contamination. The pressure vessel with a 3 inches thick cross-section, was cut in-air, using similar techniques and equipment. The outer thermal shield was cut into six sections for shipment. While the plasma torch method has been used by others, a considerable effort was required for this specific application. The methods used in this project proved to be safe, efficient and capable of preventing the spread or release of contamination. (Auth) (RAF)

ELK RIVER REACTOR; REACTORS, BWR; REACTOR DISMANTLING; METHODS; REACTOR COMPONENTS; THERMAL SHIELDS; BIOLOGICAL SHIELDS; PRESSURE VESSELS; INVENTORIES; SPECIFICATIONS; RADIOACTIVITY; CALCULATIONS; REMOTE HANDLING; TOOLS, CUTTING; CUTTING, PLASMA

95

NERVA Test Operations, Jackass Flats, NV

NRX-A3 Post Test Report. Report; 210 pp.

The NRX-A3 Disassembly operation was performed at the R-MAD Facility at NRDS. At the present time, routine hot cell operations have been completed; replication and fuel fatigue studies are in the final stages of completion. The results noted during the post-test operations have confirmed the ability of the NRX-A3 Test Assembly to operate at conditions of design point power for a pre-determined time and have provided valuable data applicable to the design of future NRX Reactors. No damage related to full power testing was apparent in the non-nuclear hardware, the core support assembly, the outer reflector assembly, and cluster hardware, except for support blocks where considerable corrosion had occurred in the tie rod holes. The fuel region components sustained minor damage. Some fuel elements within a cluster were fused together and, in some instances, fuel element clusters were fused together. Interstitial surface corrosion, pinholing, channel exposure and corrosion at the nozzle undercut area were the major types of surface effects noted on the fuel elements. The surface coated elements and the unfueled tips at the nozzle end of fuel elements were generally in good condition. The test car and related systems experienced no damage. To date, essentially all post-test inspections have been successfully performed as planned or approved by the Test Specification and Procedure Review Board and all post-test objectives are being satisfied. (Auth)

NXR-A3 REACTOR; INSPECTIONS; CORROSION; FUEL ELEMENTS; REACTOR DISMANTLING

96

NERVA Test Operations, Jackass Flats, NV

Nrx-A5 Post Test Report. Report, 186 pp. (1966)

Post test disassembly of the NRX-A5 Test Assembly was performed at the R-MAD facility at NRDS. As with previous test assemblies, no significant damage related to full power testing was apparent in the non-nuclear hardware or the outer reflector assembly. Damage was basically confined to the fueled region, with the following observations specifically noted: high weight loss from corrosion of fuel elements in the central core region; a large percentage of breakage of elements in the peripheral region of the core; and breakage of filler blocks, filler strips and tiles. The greatest damage to the test assembly occurred in the core region, centered around Cluster 5F5. It was theorized and later substantiated during post-operative examination that pieces of filler strips and/or filler blocks fell from the core periphery and became lodged between the core support plate and the cluster plate surfaces. As discussed and pictured in the cluster plate examination section, several cluster plates were found to have plugged holes. The material plugging these holes was analyzed and found to be carbonaceous. These pieces apparently blocked the coolant flow to a sufficient degree to produce overheating, resulting in severe corrosion to the fueled elements, center elements and support blocks in this area. (Auth)

NRX-A5 REACTOR; INSPECTIONS; CORROSION; FUEL ELEMENTS; REACTOR DISMANTLING

97

Nicholson, J.O. Atomics International, Canoga Park, CA

Demolition of the Heat-Transfer Systems at the Sodium Reactor Experiment (in Preparation for the Power Expansion Program). CONF-650710; American Nuclear Society Conference on Reactor Operating Experience, Jackson Lake Lodge, WY, July 28-29, 1965; Transactions of the American Nuclear Society 8(Suppl.):12-13. (1965)

Beta-gamma ratio increased from 8/1 to 15/1 after sodium removed from piping. Radioactive components were given treatment in butylcellosolve, rather than being steam cleaned following the oil bath, this to give slow reaction rate. Seven weeks and 16 men were used- maximum exposure was 1.8 rems.

REACTORS, GRAPHITE MODERATED; REACTORS, LMCR; REACTORS; MODIFICATIONS; DECOMMISSIONING; POWER UPRATING; REACTORS, SRE

98

Northern States Power Company

Six-Month Operating Report No. 6. DOCKET 50-130; 21 pp. (1969, June 19)

The plant is being converted from nuclear power to fossil fuel. Topics in this report include reactor reassembly, system modifications, chemistry and radiation experience, construction and major maintenance, personnel changes. Appendices - primary system decontamination, AEC correspondance, and safety analysis for plant modifications.

PATHFINDER REACTOR; REACTORS, INTERNAL SUPERHEAT; MODIFICATIONS; DECOMMISSIONING; OPERATING EXPERIENCE; FOSSIL-FUEL POWER PLANTS; FOSSIL FUELS; DOCUMENTATION

99

Northern States Power Company

Unusual Occurrence Report 21. ARC Air Cutting on Contaminated Stainless Steel Plate. NSP-6802(APP. II); DOCKET 50-130; 10 pp. (1968, November 19)

On July 3, arc cutting of a hole in the demister storage stand released enough surface contamination in 15 min for the welder to inhale 5% the Co 60 and 1% the Zn 65 body burden. While a radiation work permit was posted at the airlock door, radiation levels of 100 mr/hr from the stand were noted before commencing work. Later, smears showed about 500,000 dpm/smear. The welders nose smeared 3,600 dpm/smear. Work orders, reviewed by Asst. Plant Supt., are now required for all maintenance work outside the shop. Whole body counts used to back calculate airborne concentration as 32 mpc. Letter to plant personnel reviews well the airborne radioactivity problems faced in maintenance.

REACTORS, BWR; COBALT; INHALATION; PATHFINDER REACTOR; REACTORS, INTERNAL SUPERHEAT; WELDING; ZINC; WHOLE BODY COUNTERS; CONTAMINATION; RADIATION PROTECTION; ACCIDENTS; DECOMMISSIONING; ADMINISTRATIVE CONTROL; FAILURES; AIR; RADIOACTIVITY; EXPOSURE, OCCUPATIONAL

100

Parrott, J.R., Sr. Oak Ridge National Laboratory, Oak Ridge, TN

The Decontamination of Concrete Surfaces in Building 3019, Oak Ridge National Laboratory. Concrete Decontamination Workshop, Seattle, WA, May 28-29, 1980, (17 pp.). (1980, May)

Building 3019 at Oak Ridge National Laboratory was the first radiochemical processing pilot plant constructed in the United States. This facility has been used to demonstrate essentially all radiochemical separations processes being used today. The seven heavily shielded, remotely operated cells have been decommissioned and refitted many times. This has resulted in numerous programs involving decontamination of the concrete interiors of the cells. The entire building was contaminated with plutonium to transferable alpha levels varying from 50 to 10(E+8) dis/min/100 sq cm after a non-nuclear chemical explosion in 1959. This paper describes the efforts that took place over an 18-month period to return the facility to operation. (Auth)(RAF)

DECONTAMINATION; CONCRETES; PLUTONIUM; ALPHA PARTICLES; METHODS; FIELD STUDIES

101
Peterson, R.E., and R.L. Cubitt Los Alamos Scientific Laboratory, Los Alamos, NM

Operation of the Plutonium-Fueled Fast Reactor LAMPRE. LA-DC-8398; CONF-670413; American Nuclear Society National Topical Meeting on Fast Reactors, San Francisco, CA, April 10-13, 1967. (14 pp.). (1967)

Adequate coolant purity was maintained by hot traps so that the tantalum fuel container would not be corroded by oxygen in the sodium. Atmosphere nitrogen which diffused through pipe walls was controlled by flushing. Fission-product release into the loop had only minor effects on reactor operations, fuel handling, etc. Major part of core structure and coolant loop was disassembled after experiment, without difficulty. Pu contamination was less than expected, and although larger gas piping on vessel top contained detectable levels of Pu, bagging techniques were adequate.

REACTORS, FAST; FUEL HANDLING; OPERATING EXPERIENCE; CHEMISTRY, COOLANT; DECOMMISSIONING

102
Piqua Nuclear Power Facility

Piqua Nuclear Power Facility Final Report. DOCKET 115-2; 11 pp. (1569; 1979, February 4)

Seal welding of the ten reactor vessel penetration nozzles was completed by a certified welder on December 31, 1968. The vessel was closed and the leak test was completed on January 6, 1969. Sealing of the floor above the reactor vessel was completed on January 17, 1969, and the concrete traffic slab was completed on January 27, 1969. The level alarm system for the reactor building sump has been installed and tested for proper operation. The cathodic protection system has been modified and inspected by the installing contractor. All other work described in the dismantlement plan has been completed, with the exception of some painting which is not related to the safety of the plant.

REACTORS, ORGANIC COOLED; RADIATION SOURCES; RADIATION MONITORING; DECOMMISSIONINC; REACTOR OPERATION; DOCUMENTATION; PIQUA NUCLEAR POWER FACILITY

103
Polytechnic Institute of New York, Brooklyn, NY

AGN-201M Reactor Dismantled. Letter with Attachment to NRC Division of Operating Reactors; DOCKET 50-216; 6 pp. (1977, July 1)

Polytechnic Institute of New York has informed NRC that the dismantling of the AGN-201m Reactor has been performed according to an NRC order of 9-29-76. The reactor was located at the Univ. Heights Campus of Bronx Community College in Bronx, N.Y. A radiation survey taken on February 28, 1977, at the time of the shipment of the reactor from the site, which included an external radiation survey and wipe tests, indicated contamination levels indistinguishable from background.

REACTORS, TRAINING; COLLEGES AND UNIVERSITIES; DECOMMISSIONING; RADIATION MONITORING; LICENSE STATUS; REACTORS, AGN

104
Power Reactor Development Company, Detroit, MI

Retirement of the Enrico Fermi Atomic Power Plant. NP-20047; 340 pp. (1974, March)

Presents the details of the activities to retire the Fermi-1 power plant. Decommissioning was initiated November 27, 1972. The program was substantially completed by March of 1974. The total cost of the program including disposition of the primary sodium and blanket fuel is estimated at about $7,000,000.

ECONOMICS; ENRICO FERMI REACTOR; DECOMMISSIONING; REVIEWS; OPERATING EXPERIENCE; REACTORS, LMFBR; JACOBS

105
Power Reactor Development Company, Newport, MI

Retirement of the Enrico Fermi Atomic Power Plant, Supplement 1. NP-20047 (Suppl. 1); 120 pp. (1975, October)

Supplement 1 to Report NP-20047 describes the decommissioning activities performed by Power Reactor Development Company (PRDC) from

March 1974 through October 1975 relating to the retirement of the Enrico Fermi Atomic Power Plant (EFAPP or Fermi-1). The major decommissioning tasks undertaken and reported are the following: (1) Disposal of blanket subassemblies. (2) Disposal of radioactive sodium. (3) Removal and disposition of primary and auxiliary secondary system components. (4) Removal and disposal of miscellaneous contaminated equipment and materials. (5) Removal and disposition of radioactivity monitors. (6) Use of carbon dioxide gas (CO2) as a sodium passivating agent in decommissioning. (7) Closing and sealing contaminated areas. (8) Decontamination and painting of pools.

DECONTAMINATION; ENRICO FERMI REACTOR; SODIUM; CARBON DIOXIDE; WASTE DISPOSAL; DECOMMISSIONING; REACTORS, LMFBR; JACOBS

106

Prasad, A.N., and S.V. Kumar International Atomic Energy Agency, Vienna, Austria

Indian Experience in Fuel Reprocessing. International Conference on Nuclear Power and Its Fuel Cycles, Salzburg, Austria, May 2-13, 1977 (7 pp.). (1977)

Plant scale experience in fuel reprocessing in India was started with the successful design, execution and commissioning of the Trombay plant in 1964 to reprocess aluminum clad metallic uranium fuel from the 40 MW research reactor. The plant has helped in generating expertise and trained manpower for future reprocessing plants. With the Trombay experience, a larger plant of capacity 100 tons U/year to reprocess spent oxide fuels from the Tarapur (BWR) and Rajasthan (PHWR) power reactors has been built at Tarapur which is undergoing precommissioning trial runs. Some of the details of this plant are dealt with in this paper. In view of the highly corrosive chemical attack the equipment and piping are subjected to in a fuel reprocessing plant, some of them require replacement during their service if the plant life has to be extended. This calls for extensive decontamination for bringing the radiation levels low enough to establish direct access to such equipment. For making modifications in the plant to extend its life and also to enable expansion of capacity, the Trombay plant has been successfully decontaminated and partially decommissioned. Some aspects of the decontamination campaign are presented in this paper.

DECONTAMINATION; FUEL REPROCESSING PLANTS; NUCLEAR FUELS; REACTOR OPERATION; PLANNING; PUREX PROCESS; RAJASTHAN-1 REACTOR; REPROCESSING; SPENT FUELS; TARAPUR-1 REACTOR

107

Pryor, W.A. U.S. Department of Energy, Oak Ridge Operations Office, Oak Ridge, TN

Transport of Irradiated Fuel and Control Rods from a Decommissioned Power Reactor. IAEA/SM-178/20; CONF-731083; Experience from Operating and Fueling of Nuclear Power Plants. Proceedings of an International Atomic Energy Agency Symposium, Vienna, October 8-12, 1973. (19 pp.). (1973)

Presents an overview of operating experiences gained during recent years of commercial operation including three refuelings. The focus will be placed on problems which have resulted in reduction of the plant capacity factor and the solution to these problems. The reliability of nuclear units in terms of capacity or availability factors is becoming increasingly significant by reason of the high differential fuel costs experienced between fossil and nuclear fuels.

TRANSPORTATION; DECOMMISSIONING; CONTROL ELEMENTS; FUEL ELEMENTS

108

Puerto Rico Water Resources Authority

Boiling Nuclear Superheater Power Station Decommissioning Final Report. DOCKET 115-4; Decommissioning Final Report; 286 pp. (1970, September 1)

The dismantling and decontamination of the Bonus plant have been accomplished, with the exception of the burial of the time capsule and the placement of the plaques describing the facility. The remaining structures are described in detail and the post-decommissioning surveillance program is defined. The purpose of this summary is to simplify the reviewing of the present condition of the facility. It indicates the work performed, with comments on minor departures from the decommissioning plan previously submitted.

BONUS REACTOR; REACTORS, INTERNAL SUPERHEAT; WASTE STORAGE; RADIATION

PROTECTION; DECOMMISSIONING; QUALITY ASSURANCE; SAFETY EVALUATION

109
Puerto Rico Water Resources Authority, San Juan, Puerto Rico

Bonus Decommissioning Plan - Safety Analysis of Decommissioned Plant. WRA-B-69-1(Vol.2); DOCKET 115-4; 100 pp. (1969, May 16)

Concludes that the entombment system will prevent excessive radiation exposure to the source for 140 years during which time the major nuclide Co 60 will decay to 0.2 millirem/hour. A plaque will be affixed to the entombment prohibiting demolition of the structure. The piping and equipment external to entombment will not pose radiation hazard since dose levels meet requirements of an unrestricted area.

BONUS REACTOR; LICENSE STATUS; REACTORS, INTERNAL SUPERHEAT; RADIATION PROTECTION; DECOMMISSIONING; SAFETY; OPERATING EXPERIENCE

110
Puerto Rico Water Resources Authority, San Juan, Puerto Rico

Bonus Decommissioning Plan - Program Description. WRA-B-69(Vol.1); DOCKET 115-4; 89 pp. (1969, April 5)

Power operations ceased in July 1967. Report describes the current plant status, a description of the decommissioned plant, and a description of the decommissioning operations including decontamination and liquid waste disposal, disposition of source material, construction of entombment system and disposition of radioactive equipment. The safety aspects of decommissioning are also discussed.

BONUS REACTOR; LICENSE STATUS; REACTORS, INTERNAL SUPERHEAT; DECOMMISSIONING; OPERATING EXPERIENCE; SAFETY

111
Raile, M.N. Atlantic Richfield Hanford Company, Richland, WA

P-11 Facility Cleanup Summary Report. Report; 47 pp. (1974, December)

This document describes methods, techniques, and equipment employed at Hanford for the cleanup, dismantling, and decommissioning of plutonium-contaminated facilities. (Auth)

BUILDINGS; DECOMMISSIONING; PLUTONIUM; WASTE STORAGE; DECONTAMINATION; DEMOLITION; DISPLACEMENT

112
Raile, M.N. Atlantic Richfield Hanford Company, Richland, WA

Demolition and Removal of Plutonium-Contaminated Facilities at Hanford. ARH-SA-223; 39 pp. (1975, May)

This paper describes the successful demolition and cleanup of a plutonium-contaminated facility at the U.S. Energy Research and Development Administration Hanford Plant in Washington State. Several new materials, along with special techniques and equipment, were utilized for the containment and control of plutonium contamination during the course of the demolition work. The use of light-capacity fiberglassed plywood boxes for long-term (20-year, minimum) storage of the contaminated materials in underground transuranic waste trenches has led to the development, design and use of larger capacity modular fiberglassed plywood boxes that are replacing standard carbon steel boxes at less than one-third the cost, and without the potential for early failure from normal soil or atmospheric corrosion. (Auth)

BUILDINGS; CONTAMINATION; DECOMMISSIONING; DEMOLITION; HOT CELLS; PLUTONIUM; RADIATION MONITORING; RADIATION PROTECTION; WASTE STORAGE; WASTES, RADIOACTIVE; SOILS; WASTE DISPOSAL; DISPLACEMENT

113
Raile, M.N. Atlantic Richfield Hanford Company, Richland, WA

Decommissioning of Division of Military Application (DMA) Equipment at Hanford - Summary Report. ARH-ST-141; 41 pp. (1977, June)

Describes the successful decommissioning of plutonium-contaminated equipment used for weapon component fabrication and inspection at the U.S. Energy Research and Development Administration Hanford Plant in Washington State. Special materials, techniques, and equipment were employed during the course of the decommissioning program. Most significant was the development and design of large, double-wall fiber-glassed plywood boxes for long-term (20-years, minimum) retrievable storage of the contaminated equipment in underground transuranic waste trenches.

JACOBS; DECOMMISSIONING; PLUTONIUM; CONTAMINATION; RETRIEVABILITY; WASTE STORAGE; TRANSURANICS; BURIAL

114

Removille, J. Komm. Eur. Gem., Steinfort, Luxembourg

Dismantling of Hot Fuel Assemblies of Fast Breeder Reactors, with Particular Reference to Cooling Problems. Kerntechnik 16(2):82-86. (1974)

COOLANTS; SODIUM; REACTORS, BREEDER; REACTOR DISMANTLING; FUEL ASSEMBLIES

115

Rural Cooperative Power Association

RCPA Rejects Option to Buy Elk River Reactor. DOCKET 115-1; Letter-Rural Cooperative Power Association to AEC Division of Reactor Licensing; 3 pp. (1970, June 15)

On March 9, 1970, option to buy reactor was rejected. Reactor has been shut down since January 31, 1968. Operating authorization has been maintained in good standing. All reactor fuel elements, the neutron source, and all control rods have been removed to an off-site AEC location. The status of the plant systems and organization is outlined. After a final agreement on the disposal of the plant has been reached, requests will be made for reactivation of the reactor. All systems which are in operating condition will be tested as required by the present technical specifications.

REACTORS, BWR; LICENSE STATUS; SPECIFICATIONS; DECOMMISSIONING; SAFETY; ELK RIVER REACTOR; RADIATION MONITORING; INSTRUMENTS

116

Rural Cooperative Power Association

Temporary Waiver of Tech Specs to Permit Fuel Storage in Reactor. DOCKET 115-1; Letter-Rural Cooperative Power Assoc. to AEC Division of Reactor Licensing; 9 pp. (1969, June 9)

This would permit storing 20 fuel rods in the reactor to permit removal of temporary storage racks. No neutron source is available and emergency cooling spray is disconnected. Conservative calculations have been made and control rod drives are removed so rods which are in reactor cannot be inadvertently withdrawn. After removal of temporary racks, 28 fuel elements will be shipped off site and the pressure vessel emptied of fuel.

REACTORS, BWR; CRITICALITY; SAFETY; RADIATION SOURCES; FUEL ELEMENTS; STORAGE; SPECIFICATIONS; DECOMMISSIONING; COOLING SYSTEMS, EMERGENCY CORE; ELK RIVER REACTOR

117

Schaich, R.W. Oak Ridge National Laboratory, Oak Ridge, TN

Decommissioning of the Fission Product Development Laboratory at Holifield National Laboratory. Report; 23 pp. (1975)

The decontamination of the Fission Product Development Laboratory at Holifield National Laboratory was initiated in FY 1975 after 17 years of processing fission product waste streams to produce commercial quantities of Sr 90, Cs 137, Ce 144, and Pm 147. The objective of the decommissioning program is the removal of all radiation and contamination areas in the facility to a level which will be compatible with the environment in the foreseeable future. The initial phase of the decommissioning of the fission product development laboratory has been accomplished by reducing the radioactive content in the facility by a factor of 10(E+3). The intermediate phase of reducing the curie quantities of fission products by an additional factor of 10 will require considerable personnel exposure and direct contact type of operations. The final phase of shielding and sealing to acceptable levels of radiation and contamination can be accomplished with a minimum of personnel exposure. A substantial monetary investment will be required to allow a complete shutdown of the facility. (GRA)

HOT CELLS; DECOMMISSIONING; DECONTAMINATION; FISSION PRODUCTS

118
Scharf, R., and E. Roesner Babcock-Brown Boveri Reaktor GmbH, Mannheim, German Federal Republic

Removal of the Control Section of a Pressurized Water Reactor of the BBC/BBR Type. IAEA-SM-234/23; Decommissioning of Nuclear Facilities, Proceedings of an International Symposium, Vienna, Austria, November 13-17, 1978. International Atomic Energy Agency, (pp. 529-538), 694 pp. (IAEA-SM-234/23). (1979)

This paper deals with certain aspects for the decommissioning and total dismantling of a BBC/BBR nuclear power plant. The boundary conditions for this investigation are listed. The methods and aids - especially the plant model - are presented. By means of two examples the usage of the model is explained: removal of the steam generators and the reference components of the auxiliary systems. Finally, a schedule for the dismantling procedure, the overall masses, and possible techniques to be used for dismantling are presented. (Auth)

REACTORS, PWR; REACTOR DECOMMISSIONING; DISMANTLING; MODELS; REACTOR COMPONENTS; DISPLACEMENT

119
Schulte, H., E. Campbell, H. Ide, W. Moss, J. Lindsey, and R.L. Reithel Los Alamos Scientific Laboratory, Los Alamos, NM

Phoebus 1B Disassembly and Postmortem Results. LA-3829; 68 pp. (1968, September)

FUEL ELEMENTS; PERFORMANCE TESTING; PHOEBUS-1B REACTOR; WASTES, RADIOACTIVE; REACTOR CORES; REACTOR DISMANTLING; THERMOCOUPLES

120
Shrade, F. Aerojet-General Corporation, Sacramento, CA

Test Specification for the X-Engine Remote Assembly Design Aid (RADA). Report; 11 pp. (1966, May 10)

Specifications are given for testing remote handling equipment designed for repair, assembly, disassembly, etc. of the X-Engines. It will also be used for training operating crews in remote handling operations. (LTN)

NERVA REACTOR; REMOTE HANDLING; EQUIPMENT; CONSTRUCTION; INSPECTIONS; REACTOR DISMANTLING; SPECIFICATIONS; TESTING

121
Skanborg, P. Danish Atomic Energy Commission, Research Establishment, Risoe, Denmark

Farewell to a Reactor. Ingenioeren 2(6):20-21. (1976)

Denmark's second reactor, DR 2, whose first criticality took place the night of 18/19 December 1958 was shut down for the last time on 31 October 1975. It was a light-water moderated and cooled reactor of swimming-pool type with a thermal power of 5 MW, using 90% enriched uranium. The operation is described. The reactor and auxiliary equipment are now being put 'in store' - all fuel elements sent for reprocessing, the reactor tank and cooling circuits emptied, and a lead shielding placed over the tank opening. The rest of the equipment will remain in place.

DR-2 REACTOR; REACTOR DECOMMISSIONING; REACTOR OPERATION;

122
Smith, D.L. EG and G Idaho, Inc., Idaho Falls, ID

Final Report SPERT-4 Decontamination and Decommissioning. TREE-1373; 42 pp. (1979, August)

The Special Power Excursion Reactor Test (SPERT) Project was established as a part of AEC's reactor safety program in 1954. The

SPERT-4 facility was constructed in 1960 to broaden the safety program in the area of reactor stability investigations by providing a prototype for safety tests of swimming-pool-type reactors. The reactor went critical in 1961, operated during the sixties, and was placed on standby condition in 1970. The object of the D and D was to render as much of the building as possible available for unrestricted use consistent with the planned future use of the SPERT-4 facility. D and D consisted of removing, sectioning, and packaging for burial the two reactor pool tanks and all the contaminated components of the coolant system. Coolant system components included coolant pumps, heat exchanger valves, and piping. No attempt was made to remove any of the piping embedded in the basement floor or external to the SPERT-4 reactor building. All piping left in the basement floor was radiologically surveyed, isotopically analyzed, and sealed in place. Because potentially hazardous gases could be generated during the plasma-ore torch cutting of the stainless steel components, considerable effort was spent in sampling and analyzing airborne contaminants. Air samples were analyzed for metal particulate concentrations (Cr, Fe, Mn, Ni, Si, and Ni carbonyl) and for carbon monoxide. Based on the results of Ni carbonyl measurements, the cutting operations were stopped and the decision was made to require full-face, air-supplied respirators instead of the previously used half-masks. D and D estimated and actual cost comparisons are given. (RAF)

DECONTAMINATION; DECOMMISSIONING; DISMANTLING; BUILDINGS; SPERT-4 REACTOR; RADIATION MONITORING; COOLING SYSTEMS, REACTOR; ALPHA PARTICLES; BETA PARTICLES; RADIATION, GAMMA; MEASUREMENTS; CUTTING; PIPES; TANKS; WASTES, RADIOACTIVE; TRANSPORTATION; BURIAL; BOXES; WASTES, GASEOUS; METALS; CHROMIUM; IRON; MANGANESE; NICKEL; NICKEL CARBONYL; SILICON; CARBON MONOXIDE; COSTS; EXPOSURE, OCCUPATIONAL; PERSONNEL; RADIATION DOSE; HAZARD ANALYSIS

123

Smith, D.L. EG and G Idaho, Inc., Idaho Falls, ID

Explosive Demolition of Activated Concrete. Concrete Decontamination Workshop, Seattle, WA, May 28-29, 1980, (12 pp.). (1980, May)

This paper describes the removal of a radiologically contaminated concrete pad. This pad was removed during 1979 by operating personnel under the direction of the Waste Management Program of EG and G Idaho, Inc. The concrete pad was the foundation for the Organic Moderated Reactor Experiment (OMRE) reactor vessel located at the Idaho National Engineering Laboratory (INEL). The pad consisted of a cyclindrical concrete slab 15 ft in diameter, 2 ft thick, and reinforced with steel bar. It was poured directly onto basalt rocks approximately 20 ft below grade. The entire pad contained induced radioactivity and was therefore demolished, boxed, and buried rather than being decontaminated. The pad was demolished by explosive blasting. (Auth)

CONCRETES; DECONTAMINATION; DEMOLITION; EXPLOSIVES; FIELD STUDIES

124

Sutton, C.R., and N. Balai Argonne National Laboratory, Argonne, IL

Pre-Layup Inspection of EBWR Reactor Vessel. Transactions of the American Nuclear Society 11(2):648-49. (1968)

After discovering cracks in SS clad before the plutonium recycle irradiations, a surveillance program (results described) was begun. Conclusions - no significant metal loss by corrosion. No additional major cracking. No base SA-212B metal cracking. No significant deterioration of exposed SA-212B base metal.

REACTORS, BWR; EXPERIMENTAL BOILING WATER REACTOR; CORROSION; FAILURES; CLADDING; DECOMMISSIONING; FAULTS; PRESSURE VESSELS

125

Takashima, S. Science and Technology Agency, Tokyo, Japan

Decommissioning of the Reactor Facilities. Example of JRR-1 Reactor. Genshiryoku Kogyo 22(4):36-40. (1976, April)

Experiences from the decommissioning of the Japanese First Experimental Reactor, JRR-1 (a 50 kw water boiler type research reactor) are presented from regulatory and technical aspects. The first part briefly explains the structural outline and the roles of the research reactor. The second part reviews the legal procedures actually taken for the decommissioning of the reactor. The third part describes how each component was dismantled. It includes reactor itself, fuel handling and storage system, reactor cooling system, control and instrumentation system, reactor containment system, auxiliary system, and radio-activity monitoring system. As a whole, the original appearance of the reactor facility was left as a monument. A chart representing the actual progress of dismantling is also given. The fourth part explains the prescriptions for securing safety during the dismantling operations. The fifth part briefly describes how the remaining facility is now being controlled.

JRR-1 REACTOR; LEGAL ASPECTS; RADIATION PROTECTION; WASTE DISPOSAL; REACTOR DECOMMISSIONING; REACTOR DISMANTLING; SAFETY

126
The University of Wyoming, Laramie, WY

Rinsing of the Reactor Core at the University of Wyoming. Letter to AEC Directorate of Licensing; DOCKET 50-122; 2 pp. (1974, May 21)

After the removal of 29.5 liters of aqueous homogeneous uranyl sulfate fuel solution containing 1.145 kg of U 235, the core vessel was rinsed with 3 liters of distilled water. An additional 11 grams of U235 were recovered. The rinse will be shipped to NRTS for reclaiming instead of being buried as originally planned.

DECONTAMINATION; FUEL HANDLING; REACTORS, HOMOGENEOUS; LIQUID FUELS; REACTORS, RESEARCH; URANIUM; DECOMMISSIONING; COLLEGES AND UNIVERSITIES; RECOVERY; SULFATES

127
Togo, Y. Tokyo University, Faculty of Engineering, Tokyo, Japan

Some Problems of Nuclear Power Plant Dismantling. Genshiryoku Kogyo 22(4):9-14. (1976, April)

Part 1 of this report generally discusses the problems associated with the dismantling of nuclear plants. Various factors which determine reactor life span are discussed together with the ordinary life span of experimental and power reactors. *Some options to be taken after the end of* lives are also shortly considered. Examples of experimental and demonstration reactors that have reached the end of their lives are presented. The problems associated with the dismantling are summarized as follows: proper consideration for the dismantling should be made at the stage of design and construction; the regulatory activity level of radioactive solid wastes should be established; technological development for economical dismantling is needed. Part 2 reviews the records on the accident analysis and the dismantling of the SL-1 Reactor (Stationary Low Power Reactor-1). Whole program and each step of works are explained. Some recommendations from these experiences are summarized in the final part. (Auth)

PLANNING; RADIATION PROTECTION; REACTOR DECOMMISSIONING; REACTOR DISMANTLING; RECOMMENDATIONS; SL-1 REACTOR

128
Torikai, K., and T. Kinoshita Japan Atomic Energy Research Institute, Tokai Research Establishment, Tokai, Ibaraki, Japan

Decommissioning of Light Water Reactor. Genshiryoku Kogyo 22(4):29-35. (1976, April)

As a few examples of light water reactor dismantling, the cases of Elk River Reactor (ERR) and part dismantling of Japan Power Demonstration Reactor (JPDR) are reviewed. After a short description of the history of ERR, the processes of dismantling the reactor are explained. Referring to this example, the authors proposed a series of procedures for dismantling light water reactors. The use of plasma arc torches for cutting reactor structural components is recommended. As for JPDR, the processes of reactor reconstruction for doubling the power output are explained. The removal of the biological shield concrete is discussed in the first part, in which the importance of preventing the diffusion of radioactive dust and preventing its inhalation by operators is emphasized. The second part explains the dismantling of the upper core structures such as core spray sparger. The third part deals with the underwater cutting of core components such as poison curtain, control rods, and instrumented fuel assembly. Finally, some merits and demerits of underwater cutting are discussed based on the authors' experiences.

BIOLOGICAL SHIELDS; CUTTING; TOOLS, CUTTING; ELK RIVER REACTOR; JAPAN POWER DEMONSTRATION REACTOR; PRESSURE VESSELS; WASTE DISPOSAL; REACTOR COMPONENTS; REACTOR DECOMMISSIONING; REACTOR DISMANTLING; CONCRETES

129
U.S. Energy Research and Development Administration

US/USSR Seminar on Fast Breeder Reactor Construction and Operating Experience. ERDA-42(ENG); 262 pp. (1975, June 5)

Presents the text of 11 papers on the following subjects: status of LMFBR's in the U.S.; EBR-2 construction experience and initial performance; EBR-2 operating experience; Enrico Fermi construction experience; decommissioning of Enrico Fermi; SEFOR construction and operating experience; FFTF; and constructibility of the Clinch River Breeder Reactor.

ENRICO FERMI REACTOR; REACTOR OPERATION; SEFOR REACTOR; DECOMMISSIONING; REVIEWS; REACTORS, LMFBR; CONSTRUCTION; CLINCH RIVER BREEDER REACTOR; JACOBS; EBR-1 REACTOR; EBR-2 REACTOR; FAST FLUX TEST FACILITY REACTOR

130
U.S. Energy Research and Development Administration, Nevada Operations Office, Las Vegas, NV; Austral Oil Company, Incorporated, Houston, TX

Project Rulison. Well Plugging and Site Abandonment Plan. Report; 50 pp. (1976, May)

Project Rulison involved the use of a nuclear explosive to stimulate natural gas recovery from a deposit in Colorado. The 43 kt explosive was detonated at a depth of 8426 ft on Sept. 10, 1969. A re-entry well was drilled in July 1970 and production testing occurred during October 1970 to April 1971 at which time the well was shut-in. There are no further plans for using the well. Plans for the well plugging, radiological sampling decontamination procedures and site abandonment, including equipment removal, are described. (LCL)

DECOMMISSIONING; DECONTAMINATION; NATURAL GAS; WELLS; EXPLOSIONS, NUCLEAR; RULISON EVENT

131
United Nuclear Corporation, Research and Engineering Center, Elmsford, NY

BONUS Decommissioning Program Report. 203 pp. (1971, March)

This report is a detailed summary of the technical and administrative aspects of a reactor decommissioning program based on BONUS experience. The subject matter is presented in such a way as to be of general use to the nuclear industry for planning a reactor decommissioning program. The report includes: 1. An overall summary of the BONUS decommissioning program from the decision to decommission through the termination of the operating authorization. 2. A discussion of the factors involved in selection of the decommissioning approach including the end-product goals and the form of the end-product. 3. A review of the documentation required for obtaining approvals and for accomplishing the decommissioning program. 4. The assignment of responsibilities to the various organizations involved in the program. 5. A detailed description of all decommissioning activities including the schedule of accomplishment, and the problem that developed in both the planning and construction phases. 6. A list of specific recommendations pertinent to a decommissioning program, including changes in a plant design which would facilitate plant decommissioning. 7. A definite breakdown of program costs incurred in planning, design, and construction of the decommissioned facility. (RAF)

BONUS REACTOR; REACTOR DECOMMISSIONING; DOCUMENTATION; WORK SCHEDULE; COSTS; DECONTAMINATION; WASTES, LIQUID; DISPLACEMENT; NUCLEAR MATERIALS; EQUIPMENT; ENTOMBMENT; RADIOLOGICAL SURVEYS; RADIATION MONITORING; DESIGN; NUCLEAR FACILITIES; SPECIFICATIONS; DISMANTLING; TRANSPORTATION; PIPES; CONSTRUCTION; LICENSING; SAFETY EVALUATION; WASTES, RADIOACTIVE; COBALT 60; ZINC 65; COBALT 58; CESIUM 137; IRON 55; NICKEL 63; ACTIVATION PRODUCTS; DUSTS; INHALATION; INGESTION; CRUD; CASKS; CUTTING; TOOLS; ACCIDENTS; FIRES; HYDROGEN; CONCRETES; DRILLING; WELDING

132
United Power Association, Elk River, MN

Final Elk River Reactor Program Report. COO-651-93; 150 pp. (1974, November)

Describes in detail the dismantling program which was carried out in 3 phases: the planning phase, dismantling phase, and facility closeout. The total project cost was $5.73 million plus $418,000 for technical support.

REACTORS, BWR; DECOMMISSIONING; REVIEWS; JACOBS; ELK RIVER REACTOR

133
Ureda, B.F. Atomics International, Canoga Park, CA

Kinetic Experiment Water Boiler Facilities Decontamination and Disposition. Final Report. Report; 51 pp. (1976, February 25)

The decontamination and disposition of the KEWB facilities, Buildings 073, 643, 123, and 793, are complete. All of the facility equipment, including reactor enclosure, reactor vessel, fuel handling systems, controls, radioactive waste systems, exhaust systems, electrical services, and protective systems were removed from the site. Buildings 643, 123, and 793 were completely removed, including foundations. The floor and portions of the walls of Building 073 were covered over by final grading. Results of the radiological monitoring and the final survey are presented. 9 tables, 19 figures. (Auth)

DECONTAMINATION; RADIATION MONITORING; REACTOR DISMANTLING; KINETIC EXPERIMENT WATER BOILER

134
Valentine, A.M., and J.L. Warren Los Alamos Scientific Laboratory, Los Alamos, NM

Waste Management and Safety Considerations for Future LASL D and D Projects. Report; 21 pp. (1975, July)

Currently excess contaminated facilities at the Los Alamos Scientific Laboratory are described along with associated decontamination and decommissioning waste management and safety considerations. Waste management and safety considerations are also briefly described for the removal and disposal of plutonium contaminated gloveboxes and equipment items in the LASL plutonium facility since the facility will be decontaminated when current operations are transferred to a new facility and for both past and future upgrading of the exhaust air filter system in a chemistry metallurgy research facility. (GRA)

DECONTAMINATION; GLOVE BOXES; CONTAMINATION; EQUIPMENT, LABORATORY; PLUTONIUM; ISOTOPES; WASTE DISPOSAL; SAFETY; WASTE MANAGEMENT

135
Voigt, A.F., B.W. Link, R.G. Stress, D.L. Hull, and M.D. Voss Iowa State University, Ames Laboratory, Ames, IA

Plans and Progress in Decommissioning a Research Reactor. IAEA-SM-234/17; Decommissioning of Nuclear Facilities, Proceedings of an International Symposium, Vienna, Austria, November 13-17, 1978. International Atomic Energy Agency, (pp. 237-248). 694 pp. (IAEA-SM-234 17). (1979)

The Ames Laboratory Research Reactor (ALRR), a 5 MW heavy water reactor, was built for the Ames Laboratory by the U.S. Atomic Energy Commission from 1961 to 1965. It was operated from 1965 to 1977 for a total of 15 200 MW d and was closed down at the end of 1977. It is at present being dismantled. Plans include removal of the entire reactor structure and all related radioactivity, but retaining the reactor building intact for future Laboratory use. To date the following have been accomplished: removal and shipment of spent fuel and used D2O; sectioning of reactor plugs, liners, thimbles and control rods according to radioactivity, appropriate packaging and shipping for burial; transfer of experiments to other reactors or to storage; removal of nonessential control room electronics; removal of cooling tower. The dismantling sequence to be followed includes: removal and disposal of remaining plugs, etc., of top plug and appendant assemblies and core tank; sectioning, removal and disposal of six 2.5 cm stainless steel thermal shield plates, breakup, removal and disposal of concrete biological shield and thermal shield tank; removal of auxiliary systems such as exhaust ventilation and stack, not all; preparation of building for future use. The time projected for this task was three years, January 1978 through December 1980, and the projected cost was US $4.5 million. At this time the task is somewhat ahead of schedule and approximately 20% underspent. (Auth)

REACTORS, RESEARCH; AMES LABORATORY RESEARCH REACTOR; DISMANTLING; DISPLACEMENT; SPENT FUELS; REACTOR COMPONENTS; COST ESTIMATES; PACKAGING; TRANSPORTATION; BURIAL; DECOMMISSIONING; PLANNING

136
Wahlen, R.K. UNC Nuclear Industries, Richland, WA

Restoration of an Irradiated Fuel Storage Facility. Concrete Decontamination Workshop, Seattle, WA, May 28-29, 1980, (11 pp.). (1980, May)

The irradiated fuel storage basin in the KW nuclear production reactor at the Hanford Site in Richland, Washington, was decontaminated and painted in preparation for converting the facility to storage of irradiated fuel from N Reactor. The storage basin is a concrete structure constructed with the top of the basin at ground level and extending 25 feet below ground level. The basin measures 84-feet wide and 126-feet long. When full of water, it holds 1.2 million gallons. During the 15 years that KW Reactor operated, the irradiated fuel was packaged and held in temporary storage pending shipment of the fuel for plutonium separation. The basin was also used to package other solid waste from the reactor. Corrosion product, activation product, and some fission product built up in the basin over the years and was present in a layer of sludge about 3-inches deep on the basin floor. The solid waste was packaged in approved containers and buried in the 200 Area burial site on the Hanford Project. The concrete walls and pillars in the basin were decontaminated with a high-pressure aquablaster so there was no smearable contamination on the surfaces. Using a water jet, the sludge was flushed to a sump where it was picked up with a sludge pump and deposited in a crib which was formed in the basin area using a bulkhead to isolate the crib from the basin. After decanting the excess water from the sludge, it was pumped to a large tank designed to meet the burial and transport regulations. The tank containing the sludge was then transferred to the 200 Area burial site and placed in the burial trench. (Auth)

CONCRETES; DECONTAMINATION; WASTES, SOLID; WASTES, RADIOACTIVE; WATER JETS; SLUDGES; BURIAL; TRENCHES

137
Wheelock, C.W. Atomics International, Canoga Park, CA

Retirement of Piqua Nuclear Power Facility. AI-AEC-12832; DOCKET 115-2; 74 pp. (1970, April 1)

The Piqua Nuclear Power Facility (PNPF) was converted, in a period of one year, from an operating to a retired status. This work included the preparation of the buildings for use as office and warehouse facilities by the City of Piqua. The radioactive materials which remain on the site were confined within the reactor biological shielding. Protective measures were constructed to prevent access to them and/or their escape during a period of about 120 years, after which it is predicted that they will have decayed to nonhazardous levels of radioactivity.

DECONTAMINATION; FUEL HANDLING; REACTORS, ORGANIC COOLED; RADIATION MONITORING; DECOMMISSIONING; PIQUA NUCLEAR POWER FACILITY

138
Wheelock, C.W., and R.A. Hewson American Nuclear Society Reactor Operations Division; Puerto Rico Water Resources Authority, Puerto Rico Nuclear Center

American Nuclear Society Conference on Reactor Operating Experience at San Jeronimo Hotel, October 1-3, 1969, San Juan, Puerto Rico. Report; 10 pp. (1969, October)

Fuel, control rods, contaminated piping, and other accessible items were removed from the site. The reactor vessel and associated components were confined within the biological shielding and measures taken to prevent radioactivity release during time for decay to safe levels. Analyses predict that nonhazardous levels of radioactivity will exist after 120 years. Cobalt 60 is controlling. Also discusses radionuclides that could be a problem in other installations.

REACTORS, ORGANIC COOLED; DECOMMISSIONING; OPERATING EXPERIENCE; PIQUA NUCLEAR POWER FACILITY

139
Wickland, C.E. Rockwell International, Rocky Flats Division, Golden, CO

Summary Report of Soil Removal Preliminary Excavations. ES-389-75-171; CONF-750827; Decontamination and Decommissioning of ERDA Facilities, Proceedings of a Conference, Idaho Falls, ID, August 14-25, 1975, (pp. 463-500) (ES-389-75-171, CONF-750827). (1975, July)

The removal of approximately 2000 sq m of Pu 239 contaminated soil was planned for the summer of 1975 at Rocky Flats. Contamination levels were from 5000 to 22000 d/m/g. A practice excavation was carried out on uncontaminated soil simulating all aspects of the procedure to be followed when removing contaminated soil. Details of equipment and supplies used personnel requirements, air monitoring plan, technique for soil removal, and packaging requirements are given. Equipment used include a mobile trailer, a portable shed equipped with an air mover and HEPA filter, a water spray can, shovels and picks, a wheelbarrow, a waste box, plastic bags, a plywood walkway, a portable air sampler, and a scintillation counter. Two decontamination workers equipped with protective clothing and respirators carried out the soil removal after stabilizing the soil with water. Approximately one cu ft of soil was removed during one operation, bagged, sealed and checked for alpha-activity. Based on the results of the trial excavation and of the excavation of two trenches in contaminated soil, it is concluded that this technique is a satisfactory means of contaminated soil removal. It can be done safely with a release of airborne Pu a factor of 10 or more below the EPA limit. (RAF) Photographs of most aspects of the soil removal operation are given.

SOILS; DISPLACEMENT; EXCAVATION; CONTAMINATION; TRENCHES; METHODS; PLUTONIUM 239; PARTICLES, AIRBORNE; EQUIPMENT; MONITORING; AIR; PERSONNEL; PACKAGING

140
Woodruff, R.W., R.E. Durand, and J.E. Owens Atomics International, Canoga Park, CA

SRE and HNPF Operating and Modification Experience. CONF-670413; American Nuclear Society National Topical Meeting on Fast Reactors, April 10-12, 1967, San Francisco, CA (17 pp.) (CONF-670413). (1967, April)

Summarizes difficulties experienced at both plants with systems and equipment, including steam generators, heat exchangers, sodium pumps, valves, and fuel-handling machines. Describes maintenance problems and experience acquired while modifying the SRE for power uprating from 20 to 30 MWT. Briefly discusses the HNPF retirement and program for disposal of radioactive materials.

FAILURES; REACTORS, GRAPHITE MODERATED; HALLAM REACTOR; REACTORS, LMCR; MAINTENANCE; OPERATING EXPERIENCE; REACTORS, SRE; FUEL HANDLING; DECOMMISSIONING; POWER UPRATING; COOLING SYSTEMS, MAIN; PUMPS; VALVES; HEAT EXCHANGERS

FACILITY DECOMMISSIONING THEORETICAL STUDIES

141

Experts Mull Over Radioactive Waste Disposal. Chemical Engineering News 54(32):21-24. (1976, August 2)

The experts met last month in Denver at an International Symposium on the Management of Wastes from the LWR Fuel Cycle. Development of nuclear power and reprocessing of the resulting waste in the European countries and the U.S. are discussed. The need for international cooperation and standards is pointed out. Decommissioning of old reactors and facilities is also considered. (DLC)

REACTORS, BWR; DECOMMISSIONING; FUEL CYCLES; MEETINGS; NUCLEAR POWER; REACTORS, PWR; WASTE DISPOSAL; WASTE MANAGEMENT; REACTORS, WATER COOLED

142

Fermi Plant Proposals Include Donation to AEC. Atomic Energy Clearing House 18(15):34-38. (1972, April 10)

Exploring means of keeping Enrico Fermi plant operating, W.L. Cisler, Pres. Power Development Co., has proposed (A) that AEC provide assistance so plant may operate in 6-yr program, or (B) company donate plant to AEC. PDRC faces problem of being $8-9 million short of $47.5 million needed to operate for proposed 6 yr. He emphasized importance of plant for national LMFBR program and suggested AEC provide direct or indirect assistance of about $1 million/yr to close the gap. Failing assistance, to prevent permanent deactivation, he proposed donating the plant to AEC, complete with steam generators and deactivation fund. Chairman Schlesinger advised that commission is not in a position to accept donation of plant. He offered some hope by requesting an in-depth review to show how plant might help LMFBR program.

ECONOMICS; ENRICO FERMI REACTOR; DECOMMISSIONING; NUCLEAR INDUSTRY

143

JCAE Executive Session on Reactor Shutdowns. Atomic Energy Clearing House 17(7):42-3. (1971, February 15)

Sen. Henry Jackson declared that shutting down 2 plutonium reactors at Hanford would mean (1) that U.S. would lose capability to supply DOD with plutonium beyond its currently known needs, (2) that NPR is nation's only dual-purpose reactor which does not have long-lead time connected with reactivating a single-purpose plutonium producer, (3) that the 800 MWe of electricity produced by NPR is vitally needed, and (4) that shutdown of the 2 reactors will have serious economic effect upon area.

ECONOMICS; PLUTONIUM; ELECTRIC POWER; REACTORS, POWER; REACTORS, HANFORD PRODUCTION; DECOMMISSIONING; N-REACTOR; SOCIAL ASPECTS

144

LMFBR Environmental Statement, SEFOR to be Decommissioned. Atomic Energy Clearing House 18(16):1. (1972, April 17)

In response to presidential request last June, an environmental statement on the LMFBR has been issued by AEC. It is not intended to be a statement that will be issued with regard to actual plant itself. It revises and updates July 1971 draft and reflects comments received from various organizations, agencies, and the public. Reported is potential environmental impact of proposed 300-500 MW demonstration plant, on plant's role in AEC's overall R and D for breeder concept, and on environmental implications of large-scale commercial operation. The 5-yr fast-breeder research program at SW Experimental Fast Oxide Reactor has been concluded and facility is to be decommissioned. Although utility members of SE Atomic Energy Assoc. were willing to commit funds for further research, AEC indicated it did not have money available for its part in follow-up.

REACTORS, BREEDER; SEFOR REACTOR; DECOMMISSIONING; REACTORS, LMFBR; ENVIRONMENTAL IMPACT STATEMENTS; UTILITIES

145
Management of Commercially-Generated Radioactive Wastes: Preparation of Environmental Impact Statement. Federal Register 41(192):43446-43448. (1976, October 1)

Notice is hereby given that in accordance with the National Environmental Policy Act, the Energy Research and Development Administration (ERDA) has commenced the preparation of a generic programmatic environmental impact statement concerning the management of commercially-generated radioactive wastes. The scope of the statement encompasses the environmental impact of disposal of radioactive wastes: (a) in continental geologic formations; (b) in the seabed; (c) in ice sheets; (d) extra-terrestrially; and (e) by transmutation. Wastes to be disposed of include gaseous and solid wastes generated from the handling and reprocessing of spent reactor fuels, the decommissioning of reactors, spent fuel storage basins, reprocessing plants and mixed oxide fuel manufacturing facilities.

ENVIRONMENTAL EFFECTS; FUEL CYCLES; GOVERNMENT POLICIES; NUCLEAR POWER; PLANNING; WASTE DISPOSAL; WASTE MANAGEMENT; SOCIO-ECONOMIC FACTORS; REGULATIONS, FEDERAL; SOCIAL ASPECTS

146
New Nuclear Power Stations in the Federal Republic of Germany. Part 1: Report on Building Projects and Projects in Europe 1976. Atomwirtschaft-Atomtechnik 21(3):114-131. (1976, March)

In short sections characteristic features and data of power reactors either planned or under construction are presented. This survey is supplemented by statistics in tabular form which includes also the main data of the nuclear power stations in operation.

CONSTRUCTION; FORECASTING; NUCLEAR POWER PLANTS; PLANNING; REACTORS, POWER; REACTOR COMMISSIONING; REACTOR DECOMMISSIONING; REACTOR OPERATION; TABLES; DOCUMENTATION

147
Nuclear Reactors - 1976 for the First Time Critical. January 12, 1975 - November 30, 1976. Atomwirtschaft-Atomtechnik 22(1):44 (1977, January)

NUCLEAR POWER PLANTS; REACTOR COMMISSIONING; REACTOR DECOMMISSIONING; REACTOR OPERATION; TABLES; DOCUMENTATION

148
Nuclear Reactors - 1977 for the First Time Critical. Atomwirtschaft-Atomtechnik 23(1):40. (1978, January)

NUCLEAR POWER PLANTS; REACTORS, POWER; REACTOR DECOMMISSIONING; REACTOR OPERATION; TABLES; REACTORS, RESEARCH; REACTORS, TEST

149
Prompt Dismantling vs. Mothballing Decommissioned Plant Safety, Cost Studies. Nuclear Industry 24(2):6-10. (1977, February)

A major engineering evaluation by the Atomic Industrial Forum concludes that it is practical decommission reactors and outlines practical a cost-effective methods. The study estimates sho... a large reactor can be mothballed or entombed for over 100 years and then dismantled for between $13 and $15 million, not including the costs of a security force or dismantling nonradioactive structures. For about $10 million more, all other nonradioactive structures such as cooling towers can be removed from the site. The study lists alternative ways of decommissioning reactors that will assist utilities and their consultants in complying with NRC regulations.

NUCLEAR POWER PLANTS; DECOMMISSIONING; COSTS

150
Public Notice of Recommendations Made by the Reactor Safety Commission. Questions Concerning Safety with Regard to KWU Pressurized Water Reactors 1300 MWe (Kernkraftwerk Biblis C, Hamm, Philippsburg 2, Vahnum). Bundesanzeiger 29(121):2-4. (1977, July)

The RSC takes up an affirmative position concerning the following safety-relevant measures: 1. LOCA; 2. main-steam pipe rupture and related accidents combined with steam generator tube failure; 3. external impacts; 4. classification of technical requirements made on components; 5. fission product retention; 6. scram system failure during operational transients; 7. fuel element storage; 8. radiation exposure in connection with measures concerning in-service tests, maintenance and repair; 9. taking into account final decommissioning and dismantling in constructional planning; 10. in-core instrumentation; 11. functional efficiency of RHR pumps at atmospheric pressure in the containnent; 12. isolating valve for the sump suction pipe within the containnent, and 13. emergency system.

BIBLIS-3 REACTOR; HAMM-UENTROP REACTOR; PHILLIPPSBURG-2 REACTOR; ACCIDENTS, REACTOR; LICENSING; REACTOR SAFETY; RECOMMENDATIONS; VAHNUM-1 REACTOR; FISSION PRODUCTS, SCRAM; FAILURES; FUEL ELEMENTS; STORAGE; INSTRUMENTS, IN-CORE; PUMPS; VALVES; CONTAINMENT; EMERGENCY PROCEDURES; ACCIDENTS, LOSS OF COOLANT

151

Radioactivity Management and Nuclear Safety. IAEA Bulletin 19(3):21-25. (1977, June)

Survey report: several nations are studying the possibilities of vitrifying highly radioactive liquid waste resulting from reprocessing irradiated nuclear fuel and disposing of the solidified product in a deep geological formation. With the exception of radioiodine, gaseous radionuclides seem to be of limited importance to population exposures now. But hazards are possible in view of the expected expansion of nuclear plants. Some papers delivered at the IAEA International Conference held in May 1977 noted that more attention should be given to decommissioning. Emphasis was placed on justifying the risks associated with exposure to radiation. The excellent safety record based on many reactor years of operation was stressed. (36 references)

NUCLEAR POWER; WASTE DISPOSAL; REACTOR SAFETY; FUEL CYCLES; STORAGE, GEOLOGIC; RADIATION DOSE; REACTORS, LIGHT-WATER; NUCLEAR POWER PLANTS; DECOMMISSIONING

152

Reactor Siting and Decommissioning. Transactions of the American Nuclear Society 18: 242-264. (1974)

Presents abstracts of 6 papers on the following subjects: (1) siting using remote sensing, (2) safety and environmental assessment of underground siting, (3) rock caverns, (4) residual activity in power reactors, (5) a dual purpose HTGR for military installations, and (6) design basis coastal flooding.

CONTAINMENT; DECONTAMINATION; SITE SELECTION; REMOTE SENSING; ROCKS; FLOODS; UNDERGROUND NUCLEAR STATIONS; REACTORS; DECOMMISSIONING; REACTORS, HTGR; SAFETY; SHORES

153

The Elk River Reactor Will Be Dismantled Down to the Ground. Nucleonics Week 12:7. (1971, March 25)

This 22-MW boiling-water reactor in Minnesota, started up in 1962, was shut down in 1968 after the discovery of hairline cracks in the primary system piping. The United Nuclear Corp. is undertaking the engineering and dismantling planning, including a feasibility study and economics of taking out the 71 ton reactor vessel intact as against dismantling it in sections. The concrete and steel containment vessel will also be demolished. The underground concrete will remain unless it is found that there has been radiation leakage to it from the reactor. Dismantling is expected to take 1 1/2 - 2 years.

DECOMMISSIONING; ELK RIVER REACTOR

154

The European Community and Nuclear Safety. Combustion 47(12):32-39. (1976, June)

Feature article: EEC's efforts to promote nuclear safety are assessed. A plan has been developed to insure that planned expansion in the use of nuclear energy will be accompanied by strict measures to protect the health of the public and safeguard the environment. EEC's nuclear safety activities include: protection of workers and the public against ionizing radiation; protection of the environment with emphasis on thermal discharges and radioactive waste disposal; verification of operative reliability of plant components; supervision of radioactive materials transport; and supervision of fissionable materials used in nonmilitary nuclear installations. Radiation research, protection standards, and monitoring are examined.

NUCLEAR POWER; REACTOR SAFETY; WASTE MANAGEMENT; RADIATION MONITORING; NUCLEAR POWER PLANTS; DECOMMISSIONING; RESEARCH PROGRAMS; STANDARDS, INTERNATIONAL

155
Will Nuclear Power Plants be Shut Down. Umschauin Wissenschaft und Technik 76 (16):532-533. (1976, August)

The Committee for Research and Technology of the German Bundestag has performed a hearing on the peaceful use of nuclear energy. The experts have pointed out that in the eighties a shut-down of nuclear power plants is impending if the nuclear fuel cycle is not closed. This means the creation of storage dumps for spent fuel elements, building a reprocessing plant and provision for highly radioactive waste.

FORECASTING; FUEL CYCLES; FUEL REPROCESSING PLANTS; PLANNING; WASTE DISPOSAL; WASTE MANAGEMENT; REACTOR DECOMMISSIONING; SPENT FUELS; STORAGE

156
Final Report of the Safety Review Committee for Decommissioning and Dismantling of the United Power Association's Elk River Reactor. 21 pp. (1974, July 26)

The 7-member Elk River Reactor (ERR) safety review committee was organized as an independent advisory group to the United Power Association management, to provide a safety review of activities during the ERR dismantling program. The committee reviewed more than 100 documents relating to the dismantling plan, activity specifications, detailed working procedures, health and safety programs, health physics procedures, and other dismantling procedures to assure compliance with applicable safety standards. Procedures relating to radiation surveillance and monitoring, decontamination, liquid waste disposal and disposition of radioactive materials were also reviewed and approved by the committee. (RAF)

SAFETY EVALUATION; ELK RIVER REACTOR; REACTOR DISMANTLING; DOCUMENTATION; HEALTH PHYSICS; PROCEDURES; STANDARDS, FEDERAL; RADIATION MONITORING; DECONTAMINATION; WASTE DISPOSAL; WASTES, LIQUID

157
Environmental Assessment Argonne National Laboratory Decontamination and Decommissioning of Plutonium Fabrication Facility, Building 350. AG-70-01-04; 12 pp. (1978, December 6)

The goal of the proposed action is to decontaminate and decommission the Surplus Plutonium Fabrication Facility, Bldg. 350, to allow usage of the building space by the New Brunswick Laboratory and to remove the potential hazard for dispersal of residual Pu from contaminated unused equipment in the event it were subjected to a severe accidental event such as a tornado. The work will include decontamination of the interior of the glove boxes and removal of the glove boxes, ventilation ductwork, utility systems and the associated internal and external equipment glove boxes are contaminated with various of alpha radioactivity, some of which exceed 10(E+9) dpm/100 sq cm. Radioactive components will be size reduced to fit into acceptable packaging for DOT-approved shipment off-site to either a DOE transuranic retrievable storage site or to a licensed commercial site. Nonradioactive materials will be sold for scrap or disposed of in the laboratory's landfill. There will be both ANL and DOE health safety reviews. The "as low as reasonably achievable" concept will be used in control of radiation exposures. The work schedule calls for size reduction and waste packaging activation during FY 79, 80, 81, and 82 and for completion of the project in March 1982. It is estimated that a total of 15,000 cu ft of waste will be generated. It is anticipated that the project will have neither an adverse nor a beneficial environmental effect. (RAF)

NUCLEAR FACILITIES; ENVIRONMENTAL IMPACTS; DECONTAMINATION; DECOMMISSIONING; BUILDINGS; PLUTONIUM; EQUIPMENT; DISPLACEMENT; GLOVE BOXES; VENTS; ALPHA PARTICLES; PACKAGING; TRANSPORTATION; WASTE STORAGE; WASTES, TRANSURANIC; WASTES, NONRADIOACTIVE; SAFETY EVALUATION; EXPOSURE, OCCUPATIONAL; WORK SCHEDULE; WASTE VOLUME

158
Chicago Pile-5 Set to Retire. Nuclear News 22(15):60. (1979, December)

After 25 years of service, Argonne National Laboratory's CP-5 (Chicago Pile-5) research reactor is on its way to decommissioning for lack of financial support. Funding for the procedure is being set aside for fiscal year 1982. In the meantime, CP-5 is being dismantled and stored, and plans are being made for the decommissioning. The heavy-water-moderated reactor went critical on February 10, 1954, and since that time it has found many uses in work at Argonne, including the reactor program, biomedical research, nuclear physics, and, most recently, solid-state science CP-5 has even been used by the Illinois Bureau of Investigation in its forensic investigations. James H. Talboy, manager of the Research Reactor Operations Division at ANL, said there is probably no chance CP-5 will ever start up again once it is decommissioned. (Complete Text)

REACTORS, RESEARCH; CHICAGO PILE-5 REACTOR; REACTOR DECOMMISSIONING; REACTOR DISMANTLING; STORAGE

159
American Nuclear Society Conference on Decontamination and Decommissioning of Nuclear Facilties. CONF-790923; Decontamination and Decommissioning of Nuclear Facilties. Proceedings of a Conference, Sun Valley, ID. September 16-20, 1979, 90 pp. (CONF-790923). (1979)

The decontamination and decommissioning of nuclear facilities such as nuclear reactors, waste processing plants, and mill tailings in the uranium mine industry have reached a point of partial technical proficiency, but, also need many improvements to stay apace of the increasing number of different facilities requiring these services. Ever changing state and federal standards and regulations as well as concern for occupational exposure must be incorporated into the plans for decontamination and decommissioning. Regular maintenance of nuclear facilities is another area in which decontamination plays an increasingly large role as radiation levels increase with time in operation. Future decontamination and decommissioning endeavors will face structural decontamination problems as is the case with heavy concrete shielding. Continued effort in design improvements, which will lend themselves to easy decontamination and decommissioning, without compromising safety for the worker, the general population and the environment, should be the future goal. (Auth)(JMF)

The papers within this document are abstracts of the actual papers which are to be published later.

DECOMMISSIONING; DECONTAMINATION; WASHING; NUCLEAR FACILITIES; WASTE DISPOSAL; COSTS; EQUIPMENT; REACTORS; REGULATIONS, FEDERAL; REGULATIONS, STATE; ECONOMICS; WASTE DISPOSAL; WASTE MANAGEMENT; STANDARDS, FEDERAL; STANDARDS, STATE; EXPOSURE, OCCUPATIONAL; EXPOSURE, POPULATION; ENVIRONMENT; DESIGN; MAINTENANCE; CONCRETES; SHIELDING

160
Decommissioning of Nuclear Facilities. IAEA-SM-234; Decommissioning of Nuclear Facilities, Proceedings of an International Symposium, Vienna, Austria, November 13-17, 1978. International Atomic Energy Agency, 694 pp. (IAEA-SM-234). (1979)

The symposium, jointly sponsored by the Nuclear Energy Agency of the Organization for Economic Co-operation and Development (OECD/NEA) and the International Atomic Energy Agency (IAEA), was the first to be convened by an international organization on this subject. It was attended by more than 225 participants from 26 countries and 3 international organizations. The topics of the 41 papers presented ranged from consideration of national and international policy aspects to engineering evaluations, to radiological release assessments, to decontamination and decommissioning experience and related remote operations. Each paper of the symposium has been entered into the data base separately. (RAF)

NUCLEAR FACILITIES; DECOMMISSIONING; GOVERNMENT POLICIES; DECONTAMINATION; STANDARDS, INTERNATIONAL; DESIGN; REACTORS; WASTES, RADIOACTIVE; RESIDUAL ACTIVITY; INVENTORIES; REMOTE HANDLING

161
Aerojet-General Corporation, Nuclear Division, Sacramento, CA

Performance/Design and Qualification Requirements for Destruct Subsystem. Report; 14 pp. (1969, December 15)

Specifications are presented for the design, performance, testing, and qualification of the destruct subsystem for the NERVA engine. (JWR)

NERVA REACTOR; EXPLOSIONS, NON-NUCLEAR; DESIGN; PERFORMANCE; REACTOR DISMANTLING; TESTING

162

Albuquerque Operations Office, Albuquerque, NM; Sandia Laboratories, Livermore, CA

Proceedings of the Second Atomic Energy Commission Environmental Protection Conference. CONF-740406; WASH-1332(74); Proceedings of the Second Atomic Energy Commission Environmental Protection Symposium, Albuquerque, NM, April 16-19, 1974, 1151 pp. (1974, July)

In the first session of the conference the objectives were stated and following that the environmental protection policy and programs were obtained. Session three dealt with effluent surveillance and control including topics such as biological impacts of AEC Rocky Flats Plant waste discharged to surface waters and a new process for removing Pu from waste water. In session four, environmental monitoring and reporting were discussed, including papers on Pu in oil at the Savannah River Plant and studies of the apparent solubility of Pu 238 O(2) microspheres in an aquatic environment and the uptake of Pu from a soil matrix containing Pu 238 O(2). Session five dealt with environmental contamination and decontamination/decommissioning. Papers presented included decontamination of the Tatum Dome Test Site, buildings at Mound and Los Alamos Laboratories, environmental Pu studies at the Nevada Test Site, and decommissioning of the Elk River Reactor. In the final session, AEC waste management activities were discussed and the programs for waste treatment and disposal at various laboratories and plants were presented. (FMM)(RAF)

EFFLUENTS, RADIOACTIVE; WASTES, RADIOACTIVE; SURFACE WATERS; PLUTONIUM; ENVIRONMENT; MONITORING; SOILS; SOLUBILITY; MICROSPHERES; UPTAKE; CONTAMINATION; DECONTAMINATION; DECOMMISSIONING; REACTORS; WASTE DISPOSAL; WASTE TREATMENT

163

Anderson, D.R., and D.M. Talbert Sandia Laboratories, Albuquerque, NM

Seabed Disposal Program. DOE/EV-0042; Division of Environmental Control Technology Program-1978, (pp. 110-112), 259 pp. (1979, June)

The objectives of the program are to determine the environmental and technical feasibility of disposing of high-level radioactive wastes into the deep ocean floor in geologically stable and biologically inactive sediments and to develop and maintain a capability of assessing the ocean radioactive waste disposal programs of other nations. Analysis on the long core taken from the North Pacific in 1977 has continued to verify the assumptions that the mid-plate gyre regions are and have been continuously depositional, geologically and climatically stable, uniform, and predictable over tens of millions of years. Some of the activities expected to be accomplished in FY 1979 are (1) to develop a mathematical model to evaluate sediment column response to emplacement and heat burden; (2) develop a mathematical model to evaluate the sediment column response to quasistatic emplacement; (3) initiate the development of a biological transfer model to address pathways and rates of ion transport; (4) complete initial barrier assessment of bulk calcareous sediments for selected ions; (5) assess the retention factor of the red clay sediment column for ions of the reference waste, using both laboratory columns and mathematical models; (6) quantify the natural pore water movement by chemical and thermal means; (7) determine the effects of temperature on the permeabilities measured in the laboratory; (8) continue the detailed assessment of the vertical consistency of the sediment column in MPG-1; (9) complete the initial screening of canister materials using electrochemical methods; (10) begin studies addressing the leach rate of existing glass waste forms and begin developing a sub-seabed waste form; (11) develop techniques for culturing, handling, storing, and analyzing hypobaric micro-organisms; (12) complete the analysis of deep-sea near-bottom plankton samples; and (13) develop multiple open-closing net systems and animal trap respirometer for free vehicle use. Projected milestones are: (1) FY 1983 - Completion of the second assessment of the seabed disposal option using newly developed mass transport models and new essential oceanographic and effects data. Start detailed engineering plans and initiate studies addressing environment and safety. (2) FY 1990 - Collection of the main oceanographic and effects data. The third of four feasibility assessments will be made from a sound engineering base. A final choice of the optimum site with the appropriate qualities will be made. (3) FY 1995 - Final assessment of the concept from an ongoing demonstration plant. (Auth)(JMF)

ENVIRONMENT; WASTES, HIGH-LEVEL; WASTES, RADIOACTIVE; GEOLOGIC STRUCTURES; GEOPHYSICAL SURVEYS; SEDIMENTS; WASTE DISPOSAL; WASTE MANAGEMENT; MODELS, MATHEMATICAL; PERMEABILITY; POROSITY; MICROORGANISMS; CANISTERS; PLANKTON; SEA DISPOSAL; DISPOSAL SITE; FIELD STUDIES

164

Anderson, F.H., and C.M. Slansky Allied Chemical Corporation, Idaho Falls, ID

Decommissioning in the Mature Nuclear Fuel Reprocessing Industry. Transactions of the American Nuclear Society 22:350. (1975, November)

DECOMMISSIONING; EQUIPMENT; FUEL REPROCESSING PLANTS

165

Anderson, F.H., and C.M. Slansky Allied Chemical Corporation, Idaho Falls, ID

Decommissioning in the Mature Nuclear Power Industry. CONF-750411; European Nuclear Conference, Paris, France, April 21-25, 1975, (4 pp.) (CONF-750411). (1975)

The case of decommissioning a fuel reprocessing plant is described. The components of the plant to be examined are: fuel storage basin, separation process shielded cells, process equipment, out-of-cell piping, storage tanks for radioactive solids and liquids, off-gas stack, decontamination equipment, high-level waste solidification and treatment equipment, contaminated soil, and final cleanup equipment.

DECONTAMINATION; DECOMMISSIONING; REVIEWS; FUEL REPROCESSING; EQUIPMENT

166

Anderson, K.J. Atlantic Richfield Hanford Company, Richland, WA

Work Plan for P-11 Facility Cleanup. ARH-2939 REV; 17 pp. (1974, May 3)

The cleanup of the plutonium contaminated P-11 Facility will have the objectives of elimination of potential airborne contamination and prevention of subsequent migration of radioactive material in the event of a natural disaster and also reduction of radiation to natural background levels. Direct and smear readings, in disintegrations per minute (d/m) before decontamination, were found to be much higher than previous surveys had indicated. A listing of the maximum contamination taken by direct and smear readings respectively, in d/m, follows: Cell 1 - 20,000 and 5,000; Cell 2 - 2,000 and 1,000; Laboratory - 50,000 and 5,000; Mixing Room - 1,000,000 and 200,000; Change Room - 5,000 and 1,000; East Corridor - 5,000 and 1,000; and Attic - 20,000 and 5,000. Personnel surveys at completion of the survey work were 500 d/m or less. Should the level of contamination exceed 4 X 10(E-11) microcuries-/cubic centimeter, fresh air masks will be required. Coveralls, hoods, shoe covers, gloves and rubber slip-on shoe covers will be employed. Radiation monitors will perform all field and surface contamination surveys and will be responsible of specifying protective clothing and respiratory protection worn by personnel. Assault masks will be worn unless proven unnecessary. Step by step plans for the decontamination and decommissioning of the facility are included. (Auth)(JMF)

DECONTAMINATION; DECOMMISSIONING; NUCLEAR FACILITIES; PLUTONIUM; CONTAMINATION; RADIATION MONITORING; PROTECTIVE COVERING; PERSONNEL

167

Argonne National Laboratory, Argonne, IL

SAREF Project. Conceptual Design Report. Volume 1; 168 pp. (1975, December)

The Safety Research Experiment Facility concept is introduced, a brief description of the site and overall plant facilities is provided followed by a description of facility systems. The design requirements and criteria used to guide the conceptual design effort are discussed. The operational safety features of this facility are addressed to scope limiting operating conditions at the outset. The cost estimates developed for this design are summarized along with the corresponding construction schedule. Finally, decommissioning of this facility, at the end of its useful life, is considered.

DESIGN; PLANNING; REACTOR COMPONENTS; REACTOR EXPERIMENTAL FACILITIES; SAFETY RESEARCH EXPERIMENT FACILITY

168

Arizona Public Service Company, Phoenix, AZ

Response to Question 12A.2 - Occupational Radiation Exposures During Decommissioning. Amendment 2 to Palo Verde 4 5 License Application; DOCKETS STN 50-592/593; 1 p. (1979, January 12)

Procedures for decommissioning, currently, are not detailed enough to incorporate specific provisions for maintaining exposures alara. The NRC is presently developing procedures for decommissioning reactors. It is anticipated that this development will result in more definitive policies and procedures for decommissioning within 2-4 years. In general, decommissioning of reactors is a process which can use several radiation reduction methods for the protection of both the public and plant workers involved in the decommissioning effort.

PALO VERDE-4 REACTOR; PALO VERDE-5 REACTOR; REACTORS, PWR; RADIATION PROTECTION; DECOMMISSIONING; PERSONNEL; EXPOSURE, OCCUPATIONAL

169

Atomics International, Canoga Park, CA

Piqua Nuclear Power Facility Dismantlement Specification for the Reactor Complex. DOCKET 115-2; Dismantlement Specification; 40 pp. (1968, November 18)

The purpose of this specification is to state what will be done to the reactor complex as part of the PNPF dismantlement. The reactor complex consists of the reactor vessel, the cavity liner, the concrete biological shield and all other materials within and bounded by the biological shield which are to remain on site. (Note - the fuel, control rods, source and be sleeves, dummy fuel elements and charpy specimen have previously been removed. Radioactive materials are present within the reactor complex and will be left in place and will decay.)

REACTORS, ORGANIC COOLED; DECOMMISSIONING; PIQUA NUCLEAR POWER FACILITY

170

Aujollet, J., Marie, H. Pellissier, J. Sionnet, and B. Vere General Electric Company, Breeder Reactor Department, Sunnyvale, CA

Southwest Experimental Fast Oxide Reactor. Decommissioning Plan and Technical Specifications. Proposed Change 10. Report; 85 pp. (1972, March 10)

LEGAL ASPECTS; REACTOR DISMANTLING; REACTORS; LICENSING; REACTOR SHUTDOWN; SEFOR REACTOR; SPECIFICATIONS

171

Auler, I., R. Bardtenschlager, G. Lukacs, B. Broecker, G. Thalmann, and J. Vollradt NIS, Nuklear-Ingenieur-Service GmbH, Frankfurt/Main, German Federal Republic; Nordwestdeutsche Kraftwerke AG, Hamburg, German Federal Republic; Hamburgische Electrizitaetswerke AG, Hamburg, German Federal Republic; Vereinigte Electrizitaetswerke Westfalen AG, Dortmund, German Federal Republic

Decay Behaviour and Structure of the Radioactive Inventory during the Decommissioning of a Nuclear Power Plant with a Light-Water Reactor. IAEA-SM-234/1; Decommissioning of Nuclear Facilities, Proceedings of an International Symposium, Vienna, Austria, November 13-17, 1978. International Atomic Energy Agency, Vienna, (pp. 389-398), 694 pp. (IAEA-SM-234/1). (1979)

In conjunction with a study made for the Vereinigung Deutscher Elektrizitatswerke (Association of German Utilities), the decay behavior and the structure of the radioactive decommissioning wastes were studied theoretically. The decay behavior of the decommissioning wastes is of importance for the decision on the point of time for complete removal and for the selection of a suitable final storage facility. In order to permit the Co 60 with its hard gamma radiation to decay before removal of the plant, it is advisable to leave the radioactive equipment initially inside the power plant block for some decades in the form of protective storage. After several decades of decay time, the radiobiological significance of the Ni 63 begins to exceed that of the Co 60. The scope of the measures required to ensure that an incorporation of the Ni 63 is prevented during removal accordingly determines the storage time to be selected in the individual case. Because of the long life of some nuclides (Ni 63, Ni 59), complete removal cannot be postponed until the radioactivities have decayed to freely removable values. During the entire decay time the radiotoxicity of the most radioactive decommissioning wastes lies clearly below that of the reprocessing wastes from the fuel assemblies. Of the total mass of 150,000 Mg in the controlled area in a PWR nuclear power plant, about 8700 Mg must be removed as low-level radioactive decommissioning waste, and about 300 Mg must be removed as medium-level radioactive wastes. Highly radioactive decommissioning wastes are not produced. (Auth)

THEORETICAL STUDIES; RADIOACTIVE DECAY; DECOMMISSIONING; WASTES, RADIOACTIVE; WASTE STORAGE; COBALT 60; RADIATION, GAMMA; NICKEL 63; TIME FACTOR; NICKEL 59; WASTE VOLUME; WASTES, LOW-LEVEL; WASTES, INTERMEDIATE-LEVEL

172

Auler, I., G. Lukacs, and B. Broecker Nuklear-Ingenieur Service G.m.B.H., Hanau, German Federal Republic; Vereinigung Deutscher Elektrizitaetswerke e.y., Frankfurt am Main, German Federal Republic

Radioactivities and Amounts of Waste During LWR Nuclear Power Plant Shutdown. Reactor Congress, Hannover, German Federal Republic, April 4, 1978 (pp. 975-978). (1978)

Included are results on type (surface contamination, radioactivation - program system AKATII), composition and decay behavior of the radioactivity (Fe 55, Ni 59, Ni 63, Co 60) and on the structure of the solid wastes.

REACTORS, BWR; COBALT 60; RADIOACTIVE DECAY; IRON 55; NICKEL 59; NICKEL 63; REACTORS, PWR; WASTE MANAGEMENT; WASTE STORAGE; WASTES, RADIOACTIVE; REACTOR COMPONENTS; REACTOR DECOMMISSIONING; REACTOR DISMANTLING; WASTES, SOLID; CONTAMINATION, SURFACE; REACTORS, WATER COOLED

173

Bainbridge, G.R. United Kingdom Atomic Energy Authority, United Kingdom

Obsolete Nuclear Power Stations. Atom 120:230-232. (1966, October)

Suggests that locations of obsolete stations will be needed because of the same features that made them attractive in the first place. Preliminary studies of razing the Calder Hall Reactors indicate a few percent additional cost if site needed immediately, but less than 1 percent cost if 30-50 years delay possible. Demolition of everything but the concrete pressure vessel and its earth coverage is suggested.

ECONOMICS; DECOMMISSIONING; REACTORS, GCR TYPE

174

Bainbridge, G.R., P.A. Bonhote, G.H. Daly, E. Detilleux, and H. Krause United Kingdom Atomic Energy Authority, Risley, United Kingdom

Decommissioning of Nuclear Facilities: A Review of Status. Atomic Energy Review 12(1):146-160. (1974)

FUEL REPROCESSING PLANTS; NUCLEAR FACILITIES; NUCLEAR POWER PLANTS; RADIATION PROTECTION; REACTOR DECOMMISSIONING; REACTOR DISMANTLING; REGULATIONS

175

Bair, W.J. Battelle-Pacific Northwest Laboratories, Richland, WA

Environmental Control Technology. BNWL-2100 (Pt. 5); Pacific Northwest Laboratory Annual Report for 1976 to the ERDA Assistant Administrator for Environment and Safety. Part 5. Control

Technology, Overview, Safety, and Policy Analysis. (pp. 1-27). (1977, June)

The objective of the overall environmental control technology program is to assure that the environmental control capability for each ERDA energy technology is complete, practical, cost effective, and available in a timely manner as the energy source is developed. Program activities are oriented to identifying control technology status and needs for emerging energy systems, then developing methods and equipment for meeting these needs. Progress is reported on studies in support of both nonnuclear and nuclear technologies, with programs in oil shale, coal, energy materials transport, and nuclear fuel cycle analysis. Results are reported from studies on the environmental control technology treatment of oil shale; the assessment of environmental control technologies for commercial coal gasification; transportation safety studies; transportation problems for 1976 to 2000; a safety and economic study of special trains; development of high-level waste shipping cask models; analysis of nuclear fuel cycles; toxic materials in the nuclear fuel cycle; and decontamination and decommissioning of retired contaminated ERDA facilities at Hanford.

CASKS; DECOMMISSIONING; DECONTAMINATION; DESIGN; ENVIRONMENTAL EFFECTS; FUEL CYCLES; HAZARDOUS MATERIALS; WASTES, HIGH-LEVEL; KOPPERS-TOTZEK PROCESS; NUCLEAR FACILITIES; OIL SHALE PROCESSING PLANTS; POLLUTION CONTROL; RADIOACTIVE MATERIALS; RESEARCH PROGRAMS; TRANSPORTATION; WASTE PROCESSING; WASTE WATER; WINKLER PROCESS; POLLUTION, WATER

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Bartlett, J.W., J.R. Carrell, and M.R. Kreiter U.S. Energy Research and Development Administration, Washington, DC; Battelle-Pacific Northwest Laboratories, Richland, WA

Alternatives for Managing Wastes from Reactors and Post-Fission Operations in the LWR Fuel Cycle. Vol. 2 - Alternatives for Waste Treatment. ERDA-76-43 (Vol. 2); 250 pp. (1976, May)

Volume 2 describes alternate waste treatment technologies. Treatment as used herein refers to any action performed upon the primary waste to alter its form for transport, storage or disposal. Immobilization infers an altered form of the primary waste which is less subject to actions of the environment into which it is placed than is the original form. For certain cases treatment and immobilization may not be required. Treatment and immobilization are considered to be of advantage when they either protect the public health and safety or reduce costs without compromising public health and safety.

CARBON; DECONTAMINATION; FISSION PRODUCTS; IODINE; KRYPTON; TRITIUM; WASTE TREATMENT; WASTE MANAGEMENT; REACTORS, LIGHT-WATER; DECOMMISSIONING; SOLVENT EXTRACTION; FUEL REPROCESSING; TRANSURANICS; JACOBS; WASTES, SOLID

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Bartlett, J.W., J.R. Carrell, and M.R. Kreiter U.S. Energy Research and Development Administration, Washington, DC; Batteile-Pacific Northwest Laboratories, Richland, WA

Alternatives for Managing Wastes from Reactors and Post-Fission Operations in the LWR Fuel Cycle. Vol. 1 - Summary Alternatives for the Back End of the LWR Fuel Cycle. Types and Properties of LWR Fuel Cycle Wastes. Projections of Waste Quantities. Selected Glossary. ERDA-76-43 (Vol. 1); 100 pp. (1976, May)

This document describes technologies for managing radioactive wastes from commercial nuclear power. It is directed specifically at wastes associated with what is known as 'The back end of the LWR fuel cycle,' i.e., activities related to handling of spent fuel after it is removed from light-water-cooled reactors (LWRS). The LWRS are currently the predominant reactor type in the commercial U.S. nuclear pow[illegible] industry. The document characterizes the [illegible] and classsifies their state of [illegible] a decision or program doc[illegible] baseline or reference doc[illegible], and designed to serve as [illegible] nation on the technologies of [illegible] activ[illegible] management.

REACTORS, BWR; OXIDES; REA[illegible]RS, PWR; WASTE DISPOSAL; WASTE STORAGE; WASTE MANAGEMENT; REACTORS, LIGHT-WATER;

DECOMMISSIONING; FUEL REPROCESSING; FUEL CYCLES; JACOBS

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Battelle-Pacific Northwest Laboratories, Richland, WA

Geologic Storage Alternatives. Burial Grounds. ERDA-76-43; Alternatives for Managing Wastes from Reactors and Post-Fission Operations in the LWR Fuel Cycle, Vol. 4, (pp. 24.1-24.49) (ERDA-76-43). (1976, May)

Current disposal practices at the 6 commercial facilities and 5 ERDA sites for burial of wastes are briefly discussed. Burial in this instance is understood to mean "placement of waste at relatively shallow depths in earth materials, with no intent or provision for ready retrievability at a later date". Chem-Nuclear Systems, Inc. operates a commercial site at Barnwell, SC, while Nuclear Fuel Services operates one at West Valley, NY. The rest of the commercial sites are run by Nuclear Engineering Company at Sheffield, IL; Beatty, NV; Richland, VA; and Morehead, KY. The wastes generally accepted at these sites are low-level and come from the nuclear fuel cycle, educational institutions, hospitals, government installations, industrial research and production facilities, pharmaceutical manufacturers and waste disposal and decontamination companies. The exact wastes accepted, waste packaging required, waste treatment, burial procedures, special burial techniques, disposal location markings and records, burial site inventory, burial charges, licensing, and hydrologic characteristics are outlined in detail. A similar discussion of the wastes disposed of in the 5 ERDA sites is also presented. The ERDA sites are: Savannah River Laboratory, SC; Idaho National Engineering Laboratory, ID; Oak Ridge National Laboratory, TN; Hanford, WA; and Los Alamos Scientific Laboratory, NM. Decommissioning, perpetual care, and resource commitments are also included in the topic lists. Although no hazards have been found as a result of leakage from the above burial grounds better retention can be had by improved engineered containment, administrative measures and decommissioning. Finally, increased containment of radwastes by a burial site may be had by a better understanding of the geology and hydrology of the area and in what region the site is to be located. (NDV) Tables containing commercial burial ground operations, waste inventories, licensing of commercial sites, site characteristics, ERDA burial ground operations, waste inventories, and site characteristics are included. Monitoring programs are also tabulated.

BURIAL; BIOSPHERE; CEMENTS; CLAYS; CONTAINMENT; CONTAMINATION; COST BENEFIT ANALYSIS; DECOMMISSIONING; DISPOSAL SITE; DOSE RATE; ECONOMICS; ENVIRONMENT; GEOLOGY; GROUND WATER; HAZARD ANALYSIS; HYDROLOGY; MONITORING; RADIONUCLIDE MIGRATION; RETRIEVABILITY; SOILS; TRENCHES; WASTE DISPOSAL; WASTE MANAGEMENT; WASTES, LOW-LEVEL; WASTES, RADIOACTIVE; PACKAGING; WASTE VOLUME

179

Berners, O. Kraftanlagen AG, Heidelberg, German Federal Republic

Dismantling of Nuclear Power Stations. VGB Kraftwerkstech. 56(4):233-236. (1976, April)

The need ultimately to close down nuclear power stations and the development of concepts and techniques to achieve this lie beyond doubt. The limiting factors and problems of organization and of radiological protection and equipment techniques are discussed in relation to the limited experience available in both the demolition of nuclear power stations and maintenance procedures. Proposals are made for essential development work and experimentation, which are relevant to both techniques of closing down and also maintenance of nuclear plants.

NUCLEAR POWER PLANTS; PLANNING; RADIATION PROTECTION; REACTOR DECOMMISSIONING; REACTOR DISMANTLING; REACTORS; MAINTENANCE; SAFETY

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Bethlendy, G.

Environmental Aspects of Nuclear Power Stations. Environmental Letters 4(3):151-185. (1973)

The radioactivity to which we are exposed as a result of the development of nuclear power is a minute proportion of the total that we receive from nature and from diagnostic and therapeutic x-rays. The world's need for energy will quadruple in the next thirty years and for compelling reasons a growing share of the total will be provided by nuclear energy. The rapid growth in nuclear power production will inevitably increase the amount of radioactive wastes that must be managed in a way which avoids environmental pollution. The technology of waste management is well developed and this could be done. Nuclear energy, far from being a major contributor to the pollution of the environment, will in fact diminish pollution as it replaces other sources of electric power such as coal and oil. Nevertheless, particular attention must be, and is being, given to a number of problems such as the thermal effects of nuclear power plants; the improvement of the technology and economics of containment techniques for reactors and radioactive waste; decommissioning of old nuclear power plants; and the behavior of radioactive materials in water and aquatic organisms. The techniques developed to ensure the safety of the nuclear industry might be profitably studied by other industries. (Auth)

ENVIRONMENT; WASTES, RADIOACTIVE; CONTAMINATION; NUCLEAR POWER; CONTAINMENT; WATER; AQUATIC ORGANISMS; HAZARD ANALYSIS; REACTORS; NUCLEAR POWER PLANTS

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Bibby, D., and A.J.H. Goddard United Kingdom Atomic Energy Authority, Risley Nuclear Power Development Establishment, Risley, Warrington, United Kingdom; Imperial College of Science and Technology, Mechanical Engineering Department, London, United Kingdom

Long-Lived Activity of Structural Materials and Its Implications for Containment. IAEA-SM-234/12; Decommissioning of Nuclear Facilities, Proceedings of an International Symposium, Vienna, Austria, November 13-17, 1978. International Atomic Energy Agency, Vienna, (pp. 399-410), 694 pp. (IAEA-SM-234/12). (1979)

The paper presents an illustrative calculation of the activity, at the mid-height plane, of parts of a notional gas-cooled reactor. The accumulated operating time was taken as 15 years, and the parts considered are: the radial reflector (graphite), the core restraint system (steel), the thermal shield (steel), the pressure vessel (steel), and the biological shield (concrete). The main sources of activity are discussed. The payload of active steel that could be carried in a concrete transport/disposal container has been calculated, subject to transport regulation dose limits. The external dimensions of the container were fixed by handling and transport considerations; the wall-thickness and the specific activity of the steel are variables. Cobalt 60 caused the dominating contribution to the external dose. (Auth)

THEORETICAL STUDIES; CALCULATIONS; REACTORS, GAS-COOLED; REACTOR COMPONENTS; RADIOACTIVITY; STEELS; CONCRETES; CONTAINERS; TRANSPORTATION; COBALT 60; RADIATION DOSE

182

Blackith, R.E.

Power That Corrupts. The Threat of Nuclear Power Promotion in Ireland. Report; 88 pp. (1976)

This book sets out the case against nuclear power for Ireland, north and south. It is not a technical book; the issues involved are only partly technical, their more important content is social and moral. Because the Irish Electricity Supply Board have put American light water reactors on top of their shopping list and because the French have discovered what such purchases mean in practice, special emphasis is laid on recent French experience. A comprehensive list of references to literature critical of the use of nuclear power is given at the end of the book.

ACCIDENTS; ECONOMICS; HAZARD ANALYSIS; NUCLEAR POWER; POWER DEMAND; SOCIAL ASPECTS; WASTE DISPOSAL; REACTOR DECOMMISSIONING; REACTORS, WATER COOLED

183

Blechschmidt, M., and H. Keese International Atomic Energy Agency, Vienna, Austria

Status and Future Aspects of Nuclear Fuel Cycle Transports in the Federal Republic of Germany. International Conference on nuclear Power and Its Fuel Cycles, Salzburg, Austria, May 2-13, 1977 (9 pp.). (1977)

The transport practices in the Federal Republic of Germany for materials of the nuclear fuel cycle are discussed. Particularly containers and modes of transport for UF6, fresh and spent fuel elements, plutonium and radwaste are described, with main emphasis on transport to reprocessing and waste storage facilities. In most cases nuclear materials have to be shipped across the borders because at present neither an enrichment nor an industrial reprocessing plant exists in the Federal Republic of Germany. Transports are therefore carried out according to international standards, such as the IAEA recommendations laid down in legal traffic regulations. Control and physical protection are being exercised on the basis of national regulations. The paper summarizes the experience gained in performing quite a number of various shipments and deals with the application of the relevant transport regulations. It also gives a brief outlook on future aspects, such as the increasing transport volume, and transport problems related to decommissioning and the operation of a nuclear fuel cycle center.

CONTAINERS; NUCLEAR MATERIALS; FUEL CYCLES; NUCLEAR FUELS; SAFETY; SPENT FUELS; TRANSPORTATION; REGULATIONS; URANIUM HEXAFLUORIDE

184

Blomeke, J.O. Oak Ridge National Laboratory, Oak Ridge, TN

1972 Preliminary Safety Analysis Report Based on a Conceptual Design of a Proposed Repository in Kansas. ORNL/TM-5764. (1977, August)

This preliminary safety analysis report is based on a proposed Federal Repository at Lyons, Kansas, for receiving, handling, and depositing radioactive solid wastes in bedded salt during the remainder of this century. The safety analysis applies to a hypothetical site in central Kansas identical to the Lyons site, except that it is free of nearby salt solution-mining operations and bore holes that cannot be plugged to repository specifications. This PSAR contains much information that also appears in the conceptual design report. Much of the geological-hydrological information was gathered in the Lyons area. This report is organized in 16 sections: considerations leading to the proposed repository, design requirements and criteria, a description of the Lyons site and its environs, land improvements, support facilities, utilities, different impacts of repository operations, safety analysis, design confirmation program, operational management, requirements for eventually decommissioning the facility, design criteria for protection from severe natural events, and the proposed program of experimental investigations. (DLC)

ENVIRONMENTAL IMPACTS; WASTE MANAGEMENT; RADIATION HAZARDS; WASTE STORAGE; SAFETY; SOCIAL ASPECTS; STORAGE, GEOLOGIC

185

Botts, T.E., and J.R. Powell Brookhaven National Laboratory, Upton, NY

Waste Management Considerations for Fusion Reactors. Nuclear Technology 37(2):129-36. (1978, February)

To estimate the waste management needs of a fusion power reactor, a scheme for handling radioactive waste from a fusion plant has been devised. The handling scheme proceeds with radioactive waste, primarily from blanket replacement, being stored on-site; waste in cooled and shielded casks is then isolated off-site; finally, the materials are recycled. Using activities and component lifetimes supplied by designers, several conceptual fusion power reactors have been analyzed and their waste streams compared to fission reactors with regard to total activity, specific activity, and lifetimes of activity.

WASTE MANAGEMENT; WASTE TREATMENT; WASTE STORAGE; DECOMMISSIONING; FUSION; DEUTERIUM; TRITIUM; NEUTRONS

186

Bourgeois, J. CEA, Paris, France

Technical Aspects of Nuclear Plant Safety. Mediterr. Med. 98:77-78,80,83-84,87. (1976, April)

The potential risks resulting from the operation of nuclear power plants are evaluated, and the various stages required for the construction, starting, operation and decommissioning of the plants are stated.

ACCIDENTS, DESIGN BASIS; NUCLEAR FACILITIES; NUCLEAR POWER PLANTS; PHYSICAL PROTECTION DEVICES; RADIATION

MONITORING; ACCIDENTS, REACTOR; REACTOR SAFETY; SAFETY; SECURITY

187

Briggs, R.B., C.C. Burwell, R.E. Meunier, M.J. Ohanian, D.L. Phunh, B.D. Sivazlian, and A.M. Weinberg Oak Ridge Associate Universities, Oak Ridge, TN

Feasibility of a Nuclear Siting Policy Based on the Expansion of Existing Sites. ORAU/IEA-78-19(R); 308 pp. (1978, November)

Special report: the nuclear option is in jeopardy because it no longer commands a public consensus. New reactor licensing and construction require exorbitant amounts of time and money. Siting policy is suggested as a resolution to the nuclear impasse. An analysis of possible long-term and short-term nuclear systems indicates that the nuclear system will be more acceptable if it is confined to fewer, rather than more, sites. Arguments favoring a concentrated site policy include: minimal land commitment that could be vulnerable to radioactive contamination; security measure simplifications; minimal radioactive material transport and handling; operating crew strength; and minimal requirements for reactor decommissioning at permanent sites. Ultimate nuclear site configuration may well involve a political, not technical, decision, but the Inst. for Energy Analysis supports a concentrated site policy as necessary for a credible, very large nuclear energy system. (1 diagram, 3 graphs, 5 maps, 56 references, numerous tables)

NUCLEAR POWER; GENERATING CAPACITY; WASTE DISPOSAL; FUEL CYCLES; RADIATION PROTECTION; LICENSING; NUCLEAR POWER PLANTS; SITE SELECTION; DECOMMISSIONING; ECONOMICS; LAND USE; PLANNING; WASTE STORAGE; ENVIRONMENTAL IMPACTS; NUCLEAR PARKS

188

Brooksbank, R.E. Oak Ridge National Laboratory, Oak Ridge, TN

Decommissioning Reprocessing Plants. CONF-760701; International Symposium on Management of Waste from the LWR Fuel Cycle, Denver, Colorado, July 11, 1976, (9 pp.). (1976)

When a decision has been made to decommission a reprocessing plant, a considerable amount of planning must be done by the facilities engineering and operating staffs. Studies would be required to answer the questions: (1) What is the status of the plant when the decision is made to decommission or cease operation? (2) To what level must the plant be decontaminated? (3) Does the initial plant design incorporate systems that will enhance system decontamination - that is, can all surface be contacted with decontaminants at the proper conditions? (4) To what use will the site be put following decommissioning? (5) Are there current regulatory criteria that have applicability to reprocessing plant decommissioning, and what are the ultimate storage requirements for the numerous diversified wastes that will be generated.

REGULATIONS; FUEL REPROCESSING PLANTS; DECOMMISSIONING; DECONTAMINATION; DESIGN; WASTE DISPOSAL; STANDARDS, FEDERAL

189

Brosche, D.

On the Decommissioning of Nuclear Power Stations. Atom und Strom 22(3):81-87. (1976, May/June)

The federal government requires in its safety criteria, proof that it is possible to decommission nuclear power stations. The authors report on an investigation made by the VDEW in which the electricity supply undertaking give the results of their considerations and demonstrate that at the end of their operating life, nuclear power stations can be dealt with for a reasonable technical outlay.

DECOMMISSIONING; NUCLEAR POWER PLANTS

190

Brosche, D., and J. Essmann Bayernwerk AG, Munich, German Federal Republic; Preussische Elektrizitaets AG, Hannover, German Federal Republic

Decommissioning of Nuclear Power Stations. Atom und Strom 22(3):81-87. (1976, May)

The federal government requires in the safety criteria the proof that it is possible to shut down nuclear power stations. The authors report on an investigation made by the VDEW (Association of German Power Stations) in which the electricity supply undertakings give the results of their considerations and demonstrate that at the end of their operating life nuclear power stations can be shut down with reasonable technical outlay.

COSTS; NUCLEAR ENGINEERING; NUCLEAR POWER PLANTS; REACTOR DECOMMISSIONING; REACTOR SAFETY; REACTOR SHUTDOWN

191

Brosche, D., and J. Essmann Bayernwerk AG, Munich, German Federal Republic

Certain Aspects of the Shutdown of Nuclear Power Plants. VGB Kraftwerkstech. 57(9):598-603. (1977, September)

The need to develop a satisfactory concept of radiation protection during nuclear reactor shutdown operations, including the disposal of radioactive components, is stressed. A number of methods of achieving either partial or total removal of radioactive components are described. The experience acquired in the shutdown of a number of nuclear reactors in the United States and Europe is summarized. 7 refs.

DECONTAMINATION; NUCLEAR POWER PLANTS; RADIATION PROTECTION; WASTE MANAGEMENT; REACTOR DECOMMISSIONING; REACTOR SAFETY

192

Brynda, W.J., and R.W. Powell Brookhaven National Laboratory, Upton, NY

Design Guide for Category 1 Reactors - Critical Facilities. BNL-50831 ; 205 pp. (1978, August)

This design guide is intended to help the DOE facility contractor to meet the requirements of various DOE guides and comparable NRC codes regarding the siting, design, construction, modification, operation, maintenance, and decommissioning of Category 1 reactors. (RAF)

DESIGN; CONSTRUCTION; REACTOR OPERATION; REACTORS; REACTOR SITES; MAINTENANCE; DECOMMISSIONING; SITE SELECTION; STANDARDS; FEDERAL PROCEDURES

193

Buclin, J.P. S.A. L'Energie de l'Ouest Suisse, Lausanne, Switzerland

Decommissioning of the Lucens Experimental Nuclear Power Plant. IAEA-SM-234/8; Decommissioning of Nuclear Facilities, Proceedings of an International Symposium, Vienna, Austria, November 13-17, 1978. International Atomic Energy Agency, (pp. 449-475), 694 pp. (IAEA-SM-234/8). (1979)

The Appendix of Report IAEA-179 of the International Atomic Energy Agency (Vienna, 1975) contains a questionnaire on decommissioning operations that may have been carried out. The layout of this paper corresponds as far as possible to the 22 points making up the questionnaire. The first five sections serve as a brief introduction, describing the main features and the history of the facility. From Section 6 onwards the paper is divided into two parts: (A) a description of the way in which it was originally planned to dismantle the reactor when the first fuel loading was spent in order to convert the facility into an experimental unit for another type of reactor; and (B) a description of the method actually used following the incident of January 1969. Although these two operations are not comparable in every respect, nor entirely representative of the corresponding phase in the decommissioning of a nuclear power plant, it is instructive to examine some of the operations carried out at Lucens. A list of points deserving special attention during the decommissioning of nuclear facilities is given under the heading of conclusions. One cannot expect as special a case as Lucens to provide generally applicable solutions, but it nevertheless shows that the problems, administrative and technological alike, have been solved in a difficult situation. (Auth)

LUCENS REACTOR; REACTOR DECOMMISSIONING; PLANNING; DOCUMENTATION; DISMANTLING

194

Budnitz, R.J. Lawrence Berkeley Laboratory, Berkeley, CA

Plutonium: A Review of Measurement Techniques for Environmental Monitoring. LBL-2039; 9 pp. (1973, November)

Methods for measuring plutonium in air, water, soil, and certain other environmental media have taken an important role as concern over the environmental fate of the transuranics increases. The emphasis is on measurements for surveillance and protection in environmental and occupational situations. The half-lives of the three most important isotopes are relatively long, and the alpha energies are grouped such that present alpha spectrometry systems cannot separate Pu 239 from Pu 240, but can cleanly resolve all of the other plutonium isotopes. The most probable sources of plutonium in the environment are equally easy to classify: nuclear weapons already exploded; wastes or leads from the reactor fuel cycle, most likely around plutonium production facilities or fuel reprocessing plants; and occasional unique events, such as the burnup of a plutonium-fueled power cell in a satellite accident. A recent compilation indicates that in 1969, typical Pu 239 world-wide concentrations were in the range from 1 to 50 X 10(E-8) pCi/liter in air. The higher number is a factor of 40 lower than the Maximum Permissible Concentration for air [MPC(a)] value for exposure to large general populations. Studies of plutonium in surface soil in the Livermore Valley of California have found Pu 239 surface levels of 200 to 2000 pCi/sq m Childrens' diets in 1966 showed Pu 239 concentrations of about 0.002 to 0.006 pCi/kg. This is more than 5 orders of magnitude smaller than the general-population MPC(w). Among the environmental media requiring measurement of plutonium activity are silt and soil; natural and waste waters; food; and air. Techniques developed are: radiochemical analysis followed by counting or spectroscopy; air filter collection followed by counting; gamma and X-ray spectroscopy; and other methods which do not ultimately rely on alpha or gamma counting for the plutonium measurement (controlled-potential coulometry); constant-current potentiometric titration; amperometric techniques; spectrophotometry; and square wave polarography, but are not sufficiently sensitive for environmental measurements. The ideal instrument or technique for plutonium determinations should be capable of measuring concentrations down to fractions of MPC levels in the appropriate medium. There are two main classes of measurements considered here, only two are of the field type, namely surveys of plutonium deposition on the ground, and air concentration measurements. (Auth)(JMF) The document contains graphs of spectra obtained by the various techniques used.

PLUTONIUM: WASTES, TRANSURANIC: SPECTROMETRY; REACTORS; SAMPLING; RADIONUCLIDES; ENVIRONMENT; NUCLEAR FACILITIES; WEAPONS

195

Burch, W.D., M.J. Feldman, W.E. Unger, and B.L. Vondra Oak Ridge National Laboratory, Oak Ridge, TN

LMFBR Reprocessing Program Progress Report for Period January 1 to March 31, 1976. ORNL/TM-5463; 75 pp. (1976, June)

The LMFBR reprocessing program is aimed at providing the technology on which to base the design of commercial reprocessing facilities that will be required by the late 1990s. The process and equipment development phase of the program should culminate in a hot pilot-plant process demonstration tentatively scheduled for the period 1985-90. This will allow the requisite lead time of about 10 years for the design, construction, and startup of a commercial facility. Feed for the hot pilot plant will be available from the fast-flux test facility (FFTF) and the Clinch River Breeder Reactor (CRBR), which are scheduled to begin discharging core elements in 1980 and 1984 respectively.

CADMIUM; DESIGN CRITERIA; HOT CELLS; IODINE; MOLECULAR SIEVE; PLUTONIUM; TESTING; FFTF REACTOR; CURIUM; DECOMMISSIONING; COMPONENTS; FUEL REPROCESSING; REACTORS, LMFBR; ABSORPTION; CLINCH RIVER BREEDER REACTOR; JACOBS

196

Burwell, C.C. Oak Ridge National Laboratory, Oak Ridge, TN

Siting Studies for an Asymptotic U.S. Energy Supply System Based Primarily on Nuclear Energy. American Nuclear Society Executive Seminar on Nuclear Energy Centers, Arlington, VA, April 26, 1977 (36 pp.). (1977)

The Nuclear Energy Center (NEC) concept is an approach to siting wherein nuclear facilities would be clustered in and delimited to a relatively small number of locations throughout the United States. These designated centers would be concurrently developed to their full capability over several decades, at which time, they would be several times larger than the largest nuclear power stations in existence today. The centers would be permanently dedicated to nuclear operations including the future decommissioning of functionally obsolescent facilities as well as the commissioning of their replacements. The criteria for and characteristics of an acceptable nuclear energy system that could supply most of the U.S. energy requirements in the distant future are discussed. The time period is unspecified but occurs when fossil-fuel resources are depleted to such an extent that their use is economic only in special situations, and is not economic, in general, for use as fuel.

NUCLEAR PARKS; PLANNING; SITE SELECTION

197
Buschmann, W.

Dismantling of Shutdown Nuclear Power Plants with Pressurized Water Reactors. Using the Obrigheim Nuclear Power Plant as an Example. Fortschr.-Ber. VDI Z., Reihe 4 52:1-163. (1978, January)

A hypothetical dismantling of the Obrigheim Nuclear Power Plant, the first commercially operated nuclear power plant with a pressurized water reactor in the Federal Republic of Germany, is discussed. The total radiation load for the dismantling and removal of radioactive components of this power plant after 40 years of operation is determined on the basis of dose value calculations and measurements. Using an empirically obtained cost factor, the costs stemming from the radiation load are determined, and, taking into account the maximum permissible radiation load per person, an estimate is made of the number of persons required for the dismantling and removal of the radioactive components. In a similar manner, some alternative solutions to the problem of total dismantling of a nuclear power plant are discussed. 27 refs.

COSTS; NUCLEAR POWER PLANTS; OBRIGHEIM REACTOR; PERSONNEL; REACTORS, PWR; RADIATION DOSE; REACTOR DISMANTLING

198
California Energy Resources Conservation and Development Commission, Sacramento, CA

Nuclear Fuel Reprocessing and High-Level Waste Disposal: Informational Hearings. Volume 8. Waste Management. Part 2; 405 pp. (1977, March 22)

Testimony was presented on management of high-level liquid waste from military programs at ERDA sites, USGS's past and future hydrogeological research programs related to disposal of radioactive waste into geological formations, waste management, waste program alternatives, management of transuranium contaminated waste, handling waste from decommissioned nuclear facilities, and an overview of international programs for radioactive waste management. The supplemental testimony and materials submitted for the record covered radioactive waste disposal and storage of spent fuel assemblies. (LK)

HEARINGS; WASTE DISPOSAL; WASTE MANAGEMENT; WASTE STORAGE; REPROCESSING; STORAGE; SPENT FUELS; WASTES, HIGH-LEVEL; GOVERNMENT POLICIES

199
Carter, L.J.

West Valley: The Question is Where Does the Buck Stop on Nuclear Wastes. Science 195(4284):1306-1307. (1977, March 25)

Discusses the history of the West Valley fuel reprocessing facility, some of the problems the facility had, its closing and the quantity and type of wastes left in the facility. Responsibility for the facility is discussed indicating that New York State Energy Research and Development Authority assumed ultimate responsibility for the wastes. It is estimated that removal and proper disposal of the wastes could cost from $58 to $567 million. The writer suggests that a set of management options be developed for West Valley wastes, that NRC decide which options to be pursued, and that Congress appropriate money for ERDA to act on the options selected.

FUEL REPROCESSING; WASTE MANAGEMENT; WASTE DISPOSAL; DECOMMISSIONING

200
Centrala Driftledningen, Vaellingby, Sweden

Rock Siting of Nuclear Power Plants from a Reactor Safety Standpoint. Status Report, October 1974. Report. 20 pp. (1975, January)

The aim of this study is to clarify the advantages and disadvantages of an underground nuclear power plant from a reactor safety point of view, compared to a plant above ground. Principles for the technical design of a rock sited BWR nuclear power plant are presented. Also questions of sabotage and closing down the plant at the end of the operational period are treated.

REACTORS, BWR; REACTOR DECOMMISSIONING; REACTOR SAFETY; REACTOR SITES; ROCKS; SABOTAGE; SITE SELECTION; UNDERGROUND NUCLEAR STATIONS

201
Centrala Driftledningen, Vaellingby, Sweden

Rock Siting of Nuclear Power Plants from a Reactor Safety Standpoint. Report, 37 pp. (1975, November)

The study has aimed at surveying the advantages and disadvantages of a rock sited nuclear power plant from a reactor safety standpoint. The studies performed are almost entirely concentrated on the BWR alternative. The design of a nuclear power plant in rock judged most appropriate has been studied in greater detail, and a relatively extensive safety analysis has been made. It is found that the presented technical design of the rock sited alternative is sufficiently advanced to form a basis for further projecting treatment. The chosen technical design of the reactor plant demands a cavern with a 45-50 meter span. Studies of the stability of such caverns show that a safety level is attainable corresponding to the safety required for the other parts of the nuclear power plant. The conditions are that the rock is of high quality, that necessary strengthening measures are taken and that careful studies of the rock are made before and during the blasting, and also during operation of the plant. When locating a rock sited nuclear power plant, the same criteria must be considered as for an above ground plant, with additional stronger demands for rock quality. The presented rock sited nuclear power plant has been assessed to cost 20% more in total construction costs than a corresponding above ground plant.

REACTORS, BWR; COSTS; ENVIRONMENT; FEASIBILITY STUDIES; ACCIDENTS, REACTOR; REACTOR DECOMMISSIONING; REACTOR SAFETY; REACTOR SITES; ROCKS; SITE SELECTION; UNDERGROUND NUCLEAR STATIONS

202
Chapin, J.A., and R.E. Hine Idaho National Engineering Laboratory, Idaho Falls, ID

Decontamination and Decommissioning Long Range Plan: Idaho National Engineering Laboratory. Report, 134 pp. (1978, June)

The purpose of this document is to provide long-range planning for decontaminating and decommissioning of radioactive facilities at the Idaho National Engineering Laboratory (INEL). This plan will be revised and updated annually. The information developed during the decontamination and decommissioning (D and D) program will be collected and used to develop a handbook of D and D activities that will be updated annually and made available for the nuclear D and D community. Volume 1 is the management plan which includes schedules, costs, priorities, criteria, alternatives, and program management philosophy. Costs are order-of-magnitude and schedules are based on program operations through FY 1984. (ERA citation 04:008231)

DECONTAMINATION; REACTOR DECOMMISSIONING; NUCLEAR FACILITIES; REACTORS, RESEARCH; FUEL REPROCESSING PLANTS; PLANNING; WASTES, RADIOACTIVE

203
Chapin, J.A., and R.E. Hine EG and G Idaho, Inc., Idaho Falls, ID

Decontamination and Decommissioning Long Range Plan Idaho National Engineering Laboratory. TREE-1250 Volume 2; 319 pp. (1978, June)

Long range plans for decontamination and decommissioning at the Idaho National Engineering Laboratory necessitates the listing and categorizing of the different laboratory equipment and facilities. These fall under the general headings of reactor and associated facilities, reprocessing facilities, laboratory facilities, burial grounds, outside areas, and miscellaneous facilities. Also an accounting of the types and amounts of wastes produced, as well as the various methods of storage and/or disposal must be considered. For decontamination of seepage and disposal ponds to acceptable residual levels, the potential volume of soil to be removed, for a removal depth of 1 meter would be around 170,000 cubic meters for all sites involved, and for a depth of 3 meters, would be around 250,000 cubic meters for all sites involved. Individual figures, as well as the levels of radiation envolved for the separate sites are given. The total volume of contaminated soil not directly associated with the waste ponds is estimated to be around 9 X 10(E+6) cubic meters. Each discrete D and D project will have a detailed D and D plan, a corresponding Safety Analysis Report (SAR) and an Environmental Assessment. (Auth)(JMF)

The document contains numerous charts, tables, and graphs of the sites to be decontaminated and decommissioned.

DECONTAMINATION; DECOMMISSIONING; NUCLEAR FACILITIES; REACTORS; PLANNING; BURIAL; HOLDING PONDS; FUEL REPROCESSING; RADIONUCLIDES; SOILS

204

Chapuis, A.M., and M. Jacquemin CEA, Institut de protection et de surete nucleaire, Fontenay-aux-Roses, France

Acceptable Residual Activity Levels Allowing Waste to be Considered Inactive. IAEA-SM-234/31; Decommissioning of Nuclear Facilities, Proceedings of an International Symposium, Vienna, Austria, November 13-17, 1978. International Atomic Energy Agency, (pp. 285-298), 694 pp. (IAEA-SM-234/31). (1979)

The dismantling of nuclear facilities will in the course of a few decades give rise to large amounts of activated or contaminated solid waste, a large part of which will in fact have only a very low level of activity. The authors propose residual activity limits below which this type of waste could be disposed of as ordinary waste, which means that the scrap metal could be sold for melting down or the broken concrete could be used as filling material. The proposed limits are defined with reference to permissible concentrations of contaminants in air and in water and in terms of external exposure. Their application would have perfectly acceptable consequences for individuals and the population as a whole. (Auth)

NUCLEAR FACILITIES; DISMANTLING; WASTES, SOLID; WASTES, RADIOACTIVE; WASTES, LOW-LEVEL; RESIDUAL ACTIVITY; SCRAP; METALS; MELTDOWN; CONCRETES; MAXIMUM PERMISSIBLE CONCENTRATION; AIR; WATER; EXPOSURE, EXTERNAL

205

Chitwood, R.B. Idaho Operations Office, Idaho Falls, ID; Aerojet Nuclear Company, Idaho Falls, ID; U.S. Nuclear Regulatory Commission, Washington, DC

Decontamination and Decommissioning of Licensed Fuel Reprocessing Plants. CONF-750827; Decontamination and Decommissioning of ERDA Facilities, Idaho Falls, ID, August 19-21, 1975, (pp. 59-70). (1975, September)

DECOMMISSIONING; DECONTAMINATION; DESIGN; FUEL REPROCESSING PLANTS; WASTE DISPOSAL; REPROCESSING; SPENT FUELS

206

Christ, R., K. Schneider, and R. Schroder Transnuklear G.m.B.H., German Federal Republic

Decontamination and Transportation Problems Related to the Decommissioning of Nuclear Power Plants and the Elimination of Failure Consequences. Appendix 2 - Shipment of Heavy Components and Irradiated Sodium, Jan. 1, 1975-June 30, 1976. GERRSR-130; NUKEM-312; 62 pp. (1977, May)

Chapter 1 deals with the shipment of activated and/or contaminated heavy components from light water reactors from decommissioning operations; the second one the transfer and off-site removal of irradiated sodium from sodium-cooled fast reactors.

TRANSPORTATION; DECOMMISSIONING; DECONTAMINATION; REGULATIONS, INTERNATIONAL

207

Clement, B., and M. Feger Ministere de l'Industrie et de la Recherche, Service Central de Surete des Installations Nucleaires, Paris, France; Electricite de France, Service de la Production Thermique, Paris, France

Decommissioning of Nuclear Power Stations. Annales des Mines 182(3):63-169. (1976, March)

The various possible solutions of plant decommissioning of which the most elaborate is evidently the complete destruction of installations are examined. Then, reference is made to works and studies made abroad, and it is specified how the problem is dealt with in France. The definitive shut down of the first Chinon Graphite-Gas Station are described.

CHINON-1 REACTOR; FUEL ASSEMBLIES; NUCLEAR POWER PLANTS; REACTOR DECOMMISSIONING; REACTOR DISMANTLING; SAFETY; SECURITY

208
Commander, J.C. Aerojet Nuclear Company, Idaho Falls, ID

Program Plan for Decontamination and Decommissioning the EBR-1 Complex at NRTS. CONF-740406; Second Atomic Energy Commission Pollution Control Conference, Albuquerque, NM, April 16, 1974, (29 pp.) (CONF-740406). (1974)

Discusses a program plan for decontamination and decommissioning of the Experimental Breeder Reactor-1 Complex at the National Reactor Testing Station. The discussion will deal with: the scope of work; decontamination problems, particularly those due to the alkali metal inventory; proposed problem soultions; program funding requirement; and a summary of the program status.

DECONTAMINATION; PROCEDURES; DECOMMISSIONING; EBR-1 REACTOR; EBR-2 REACTOR; DOCUMENTATION

209
Commander, J.C., P.J. Macbeth, and D.E. Michels Aerojet Nuclear Company, Idaho Falls, ID

Safety Analysis Report - Decontamination and Decommissioning of the EBR-1 Complex. ANCR-1243; 55 pp. (1975, June)

This report assesses the safety aspects of the planned EBR-1 Complex decontamination and decommissioning operations. The major operations are: (1) removal of NaK from the EBR-1 primary and secondary coolant systems, (2) processing of the NaK to produce solid caustic for disposal, (3) decontamination of contaminated areas of EBR-1 and ZPR-3, (4) removal of items that cannot be decontaminated economically to acceptably safe levels, (5) isolation of contaminated areas, (6) demolition of the AFSR shielding, and (7) removal of contaminated vessels from the NaK storage pit.

DECONTAMINATION; COOLANTS, NAK; DECOMMISSIONING; SAFETY; EBR-1 REACTOR; EBR-2 REACTOR

210
Commission of the European Communities

Nuclear Science and Technology European Community Water Reactor Safety Research Projects. Report XII/816/78-EN, Vols. 12; 1500 pp. (1978, July)

This is the first compilation of community research formats to be produced by the commission on LWR research in 10 countries. Topics include blowdown and emergency core cooling; core meltdown power transients; external influences; transport and release of fission products; accident analysis; containment analysis; instrumentation and control; materials problems; pressure vessels, quality assurance; standardization; environmental protection; probabilistic analysis; human factors; environmental protection; and decommissioning.

REACTORS, LIGHT-WATER; BLOWDOWN; COOLING SYSTEMS, EMERGENCY CORE; REACTOR CORES; MELTDOWN; FISSION PRODUCTS; ACCIDENTS; PRESSURE VESSELS; QUALITY ASSURANCE; ACCIDENTS; DECOMMISSIONING; STANDARDS, INTERNATIONAL

211
Committee for Environmental Conservation, London, United Kingdom

Radiation. Chapter 6. pp. 15-22. (1974)

ACCIDENTS; RADIATION EFFECTS; REACTORS, BREEDER; CONTAMINATION; ENVIRONMENT; HUMAN POPULATIONS; NUCLEAR POWER PLANTS; RADIATION DOSE; RADIATION HAZARDS; WASTE STORAGE; WASTES, RADIOACTIVE; ISOTOPES; REACTOR DECOMMISSIONING

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Committee on Radioactive Waste Management. Panel on Hanford Wastes National Research Council. Commission on Natural Resources. Washington. DC

Low-Level Wastes. Radioactive Wastes at the Hanford Reservation: A Technical Review. National Academy of Sciences. Washington. DC. Chapter 4. (pp. 51-72). 269 pp. (1978)

The management of low-level wastes at the Hanford Reservation is reviewed. Low-level wastes include: condensate from fuel processing at the Purex Plant; liquid entrained into ventilating air of waste-tank systems and recovered after ion exchange; cooling water from reactor and chemical operations; liquid that has been percolated into the ground either intentionally or accidentally; gaseous wastes in stack effluents; solid trash and failed or obsolete equipment; and obsolete reactors and processing plants which must be decommissioned. Large quantities of liquid radwastes come from the cooling processes and these liquids are percolated into the ground where the nuclides are sorbed. If the concentration were to be lowered to MPC levels for all but two nuclides the capital expenditure would be $1.5 million and yearly expenses would be $1 million. For all nuclides to be at their MPC capital expenditure would be $35 million with yearly operating costs at $3 million. Wastes with less than 5 x 10(E-5) uci ml are placed in open ponds and wastes with greater radioactivity are discharged to cribs. In the unsaturated zone all the Pu is within 6 m beneath the point of release; Cs 137 is sorbed entirely; small concentrations of Sr 90 have escaped sorption and about 90% of Ru 106 has been sorbed in the zone. The pattern of nuclide distribution in the saturated zone appears to be relatively stable, only changing slightly from 1973 to 1974. Gaseous wastes have a small impact, so anticipated shutdowns of producing facilities may not be required. More than 140,000 cu m of solid waste have been buried. Low-level wastes at Hanford do not constitute an appreciable radiation hazard at present. Monitoring equipment is adequate for detecting accidental releases, and remedial action for accidents is automatic or can be instituted quickly. (NDV)

SORPTION; ACCIDENTS; BURIAL; CONTAMINATION; CRIBS; DISPOSAL SITE; GROUND WATER; MAXIMUM PERMISSIBLE CONCENTRATION; MONITORING; RADIONUCLIDE MIGRATION; PONDS; SATURATED ZONE, UNSATURATED ZONE; WASTE MANAGEMENT; WASTES, GASEOUS. WASTES, LIQUID. WASTES, LOW LEVEL; WASTES, SOLID

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Comptroller General of the United States General Accounting Office, Washington, DC

Improvements Needed in the Land Disposal of Radioactive Wastes-A Problem of Centuries. RED-76-54; 57 pp. (1976)

More comprehensive studies of existing disposal sites are called for in this report because after 30 years it is not clear as to what mix of hydrogeologic characteristics and not engineering features offers the greatest assurance that disposed radwastes will not be a public hazard. Six licensed commercial and five principal federal sites are in operation and through 1973 about 9.1 x 10(E+6) cu ft of solid wastes have been buried at the commercial sites. At federal facilities, 42 million cubic feet have been deposited through 1974. Before such sites are used, the geology and hydrology should be well-defined and compared against set criteria. However, the study found that site selection criteria have not been established, important geological and hydrological characteristics have not been defined, and some disposal sites are releasing radwastes to the environment. Also long-term care requirements should be identified before terminating and decommissioning disposal sites. These requirements have yet to be established by the Nuclear Regulatory Commission and Agreement States. A policy should be developed by ERDA and NRC in correcting migration problems at commercial disposal sites. While the report calls for ERDA and NRC to work together, there is reluctance because of their separate missions. However, a committee of experts in the relevant technical areas should be formed to advise and guide a joint NRC and state study of commercial waste disposal sites. (NDV)

CONTAINER INTEGRITY; CONTAINERS; CONTAINMENT; CONTAMINATION; DISPOSAL SITE; ENVIRONMENT; EQUIPMENT; FIELD STUDIES; FISSION PRODUCTS; GEOCHEMISTRY; GEOLOGY; FAULTS; GEOLOGIC STRATA; GEOLOGIC STRUCTURES; GROUND WATER; HYDRAULICS; HYDRODYNAMICS; HYDROLOGY; INFILTRATION; ION EXCHANGE; IONIC PROCESSES; LEACHING; LEAKAGE; LEGISLATION. MONITORING; NUCLEAR FACILITIES; NUCLEAR MATERIALS. NUCLEAR POWER; pH; POLLUTION, SOIL; POLLUTION, WATER. RADIONUCLIDE MIGRATION; SITE EVALUATION; SITE SELECTION; SITE SURVEILLANCE; SOILS; STANDARDS, FEDERAL; STANDARDS. STATE; TEMPERATURE;

TRENCHES; WASTE DISPOSAL; WASTE MANAGEMENT; WASTE STORAGE; TOXICITY; WASTES, LIQUID; WASTES, INTERMEDIATE-LEVEL; WASTES, LOW-LEVEL; WASTES, RADIOACTIVE; WASTES, SOLID; WASTES, TRANSURANIC; ALPHA PARTICLES; BETA PARTICLES; METEOROLOGY; TOPOGRAPHY; RADIATION, GAMMA

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Comptroller General of the United States, General Accounting Office

Before Licensing Floating Nuclear Powerplants, Many Answers are Needed. EMD-78-36; 47 pp. (1978, September 13)

Special report: NRC's procedures for evaluating the safety and environmental impact of floating nuclear power plants are examined. Conventional nuclear power plants could be mounted on a floating barge and located onshore, in estuaries, or in an ocean area protected by a breakwater. Such floating power plants are scheduled to begin operation by the late 1980's. Special attention to the safety and environmental aspects of such plants is required. NRC is conducting an ongoing review of floating nuclear plants, but many safety and environmental issues have not yet been resolved, including the potential problem of a core-melt accident in which hot molten nuclear fuel could breach containment structures and contaminate surrounding waters. (1 diagram, 1 photo, 1 table)

NUCLEAR POWER; NUCLEAR POWER PLANTS; LICENSING; NUCLEAR POWER PLANTS, OFFSHORE; REACTOR SAFETY; ACCIDENTS, LOSS OF COOLANT; NUCLEAR POWER; ESTUARIES; DECOMMISSIONING; RADIATION PROTECTION; ENVIRONMENTAL IMPACTS; SITE SELECTION

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Comptroller General of the United States, Washington, DC

Issues Related to the Closing of the Nuclear Fuel Services, Incorporated, Reprocessing Plant at West Valley, New York. EMD-77-27; Report to the Conservation, Energy, and National Resources Subcommittee, House Committee on Government Operations; 34 pp. (1977, March 8)

When the Nuclear Fuel Services reprocessing plant at West Valley, NY was shut down for enlargement and reduction of radiation exposure by the employees a number of questions were raised about the operation of such a plant. The site consists of 4 high-level storage tanks containing 612,000 gallons of waste, a high-level burial ground containing about 100,000 cu ft and a low-level burial ground containing about 2 million cu ft of solid radwastes. The tank integrity is in doubt, and before the wastes can be extracted and solidified the tank condition must be verified. There is also a question as to whether or not the tanks could withstand an earthquake. Since there has been a floatation problem below the tanks and vault system, the soil characteristics should be determined in case of a tank rupture. A priority item is the characterization of the physical and chemical properties of the high-level waste sludge for satisfactory extraction. No solidification process has been developed for managing the wastes. The government will have to provide technical assistance to NFS and New York for studying and correcting many of the site problems. Also the government will have to establish guidelines and plans for 1) handling the spent fuel stored and buried and decommissioning the reprocessing plant and 2) long term care requirements for the high- and low-level waste burial sites. A policy of assistance to New York State should be developed with the federal government. (NDV)

BURIAL; CONTAINER INTEGRITY; CONTAMINATION; COST BENEFIT ANALYSIS; DECOMMISSIONING; DISPOSAL SITE; FUEL ELEMENTS; HAZARD ANALYSIS; LEGISLATION; WASTE TREATMENT; SITE EVALUATION; WASTE MANAGEMENT; WASTES, HIGH-LEVEL; WASTES, LIQUID; WASTES, LOW-LEVEL; WASTES, RADIOACTIVE

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Cregut, A., R. Lurie, P. Pomie, and P. Biancale CEA, Institut de protection et surete nucleaire, Marcoule, France; CEA, Societe de systeme francaise pour le reacteurs avances, Cadarache, France; CEA, Department d'etudes mecaniques et thermiques, Saclay, France

Dismantling of French-Type Fast-Neutron Power Reactors. IAEA-SM-234/33; Decommissioning of Nuclear Facilities, Proceedings of an International Symposium, Vienna, Austria, November 13-17, 1978. International Atomic Energy

Agency, (pp. 187-202), 694 pp. (IAEA-SM-234/33). (1979)

On the basis of a study they carried out for Electricite de France on the Super-Phenix 1 (1200 MWe) reactor at Creys-Malville, the authors discuss the specific features of the French-type fast reactor system; they demonstrate the feasibility of decommissioning these power plants at the three standard levels defined by the IAEA and estimate the cost. Although the reactor concerned is a prototype and although certain technical problems are bound to be different, the authors find the costs to be of the same order of magnitude as those calculated for other types of facilities with the same output. They indicate certain modifications specifically applicable to fast reactors which, without increasing the initial investment, would simplify decommissioning operations. (Auth)

SUPER PHENIX REACTOR; REACTORS, FAST; NEUTRONS, FAST; REACTOR DECOMMISSIONING; COST ESTIMATES

217

Dabrowski, T.E. United Nuclear Industries, Inc., Environmental and Radiation Control

Management of Low-Level Radioactive Waste in United Nuclear Industries, Inc.-Managed Facilites. UNI-SA-00034; 12 pp. (1976, June 24)

United Nuclear Industries manages the N reactor, a light-water-cooled graphite moderated reactor, located near Richland, WA, for ERDA. This report describes the basic sources of radiation, the treatment and handling of the waste, and the impact of the radwaste discharges on the environment. Airborne waste comes from either the gas atmosphere surrounding the graphite moderator, or from the primary coolant. The 50 year whole body population dose commitment due to all airborne effluent discharged from N reactor during CY 1975 was 0.84 man rem, compared to 25,000 man rem from background radiation. The 50 year whole body population dose commitment due to airborne uranium discharges during CY 75 was 0.00056 man rem. Liquid radwaste is released to a soil column, and to date many thousands of curies have been released and retained by the soil column. Included in the report is a cost assessment of a storage basin cooling water recirculation system, a fuel quality monitor system, and a waste treatment facility, which would eliminate the use of soil columns. (PTO)

DUSTS; CHARCOAL; FILTERS; GASES; DOSE COMMITMENT; BACKGROUND RADIATION; WASTES, LIQUID; TRENCHES; GASES; WASTES, GASEOUS; COST BENEFIT ANALYSIS; NUCLEAR FACILITIES; WASTE TREATMENT; DECOMMISSIONING; WASTES, SOLID; WASTES, RADIOACTIVE; REACTORS

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Despotovic, R., S. Music, B. Subotic, and R.H.H. Wolf Ruder Boskovic Institute, Zagreb, Yugoslavia

Decontamination of Radioactive Isotopes. IAEA-SM-234/22; Decommissioning of Nuclear Facilities, Proceedings of an International Symposium, Vienna, Austria, November 13-17, 1978. International Atomic Energy Agency, (pp. 307-371), 694 pp. (IAEA-SM-234/22). (1979)

Removal of radioactive isotopes under controlled conditions is determined by a number of physical and chemical properties considered radiocontaminating and by the characteristics of the contaminated object. Determination of quantitative and qualitative factors for equilibrium in a contamination-decontamination system provides the basis for rational and successful decontamination. The decontamination of various "solid-/liquid" systems is interesting from the scientific and technological point of view. These systems are of great importance in radiation protection (decontamination of various surfaces, liquids, drinking water, fixation or collection of radiocontaminants). Different types of decontamination systems are discussed. The dependence of rate and efficiency of the preparation conditions and on the ageing of the scavenger is described. The influence of coagulating electrolyte on radioactive isotope fixation efficiency was also determined. The fixation of fission radionuclide on oxide scavengers has been studied. The connection between fundamental investigations and practical decontamination of the "solid/liquid" systems is discussed. (Auth)

RADIONUCLIDES; CONTAMINATION; DECONTAMINATION; SEPARATION PROCESSES; SURFACE CONTAMINATION; LIQUIDS; DRINKING WATER; FIXATION

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Detilleux, E. Organization for Economic Cooperation and Development, Paris, France; International Atomic Energy Agency, Vienna, Austria; Eurochemic, Mol, Belgium

Decommissioning of Reprocessing Plants: Results of Preliminary Studies Relative to Eurochemic Installation. CONF-721107; Symposium on the Management of Radioactive Wastes from Fuel Reprocessing, Paris, France, November 27-December 1, 1972, (pp. 1133-1155). (1973, March)

DECONTAMINATION; FUEL REPROCESSING PLANTS; WASTE DISPOSAL; WASTES, RADIOACTIVE; WASTES, SOLID; TRANSPORTATION

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Dickson, H.W. Oak Ridge National Laboratory, Health and Safety Research Division, Oak Ridge, TN

Waste Management Practices in Decommissioning Nuclear Facilities. EPA 520/3-79-002; Low-Level Radioactive Waste Management, J.E. Watson, Jr., (Ed.), Proceedings of Health Physics Society Twelfth Midyear Topical Symposium, Williamsburg, VA, February 11-15, 1979. U.S. Environmental Protection Agency, Washington, DC, (pp. 238-251), 540 pp. (1979, May)

Questions regarding potential public health hazards due to residual radioactivity and radiation fields at abandoned and inactive sites have prompted careful review of these sites by federal agencies including the Department of Energy (DOE) and the Nuclear Regulatory Commission (NRC). In some instances, these reviews are serving to point out poor low-level waste management practices of the past. Of immediate concern to DOE are 22 inactive uranium mill sites in the western part of the United States. In addition, DOE has the responsibility for reviewing more than one hundred excess MED and AEC sites that played a role in the early development of the atomic energy program. NRC has initiated a systematic program to review all of its docket files of licenses terminated prior to 1965. In addition, formal radiological surveys are being conducted at a few selected sites with a known potential for residual contamination. The NRC also has discovered previously licensed sites that have been decommissioned without adequate verification of the radiological status. It is difficult to assess the possible extent of this problem. The NRC estimates that as many as 8,000 source material and special nuclear material waste management practices in the past were not as thorough as present day decommissioning criteria without substantial decontamination. Users or handlers of large quantities of radioactive materials have tended to use large scale industrial processing techniques which have a few percent loss and/or spillage. As a consequence, the facility involved became generally contaminated with low-level radioactive waste. Much of the feed material contained "natural" radioactivity which was considered rather innocuous. Efforts to prevent the spread of materials which had been extracted recently from the earth received little attention. A number of factors have contributed to the marginal waste management practices observed in decommissioning of nuclear facilities: (1) lack of regulation-particularly with respect to naturally occurring radioactivity; (2) poor control measures on large scale industrial processes; (3) radioactive waste disposal by conventional methods such as dumps, landfills, and on-site burial; (4) misapplication of waste products containing radioactive material; (5) short-cutting of waste management procedures to increase the profit margin; (6) abandonment of sites; (7) lack of continuing surveillance over inactive sites; and (8) lack of comprehensive set of D and D criteria. As a consequence, recent investigations have revealed residual contamination and radiation levels on some sites which exceed present-day standards and guidelines. Efforts by major federal agencies including DOE, NRC, and EPA are serving to correct these deficiencies. An interagency task force could be the most expedient approach to arrive at the D and D guidance which is urgently needed by the nuclear industry. (Auth)(JMF)

HAZARD ANALYSIS; RESIDUES; WASTES, RADIOACTIVE; WASTE MANAGEMENT; WASTES, LOW-LEVEL

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Dionne, P.J., M.D. Erickson, E.R. Hill, R.A. Burnett, and L.E. Addison Battelle-Pacific Northwest Laboratories, Richland, WA

Computer Graphics Capabilities at Battelle, Pacific Northwest Laboratories. BNWL-SA-6499; CONF-7706144; ERDA Graphics Conference, Washington, DC, June, 1977 (42 pp.). (1977, September)

Some of the computer graphics capabilities at Battelle-Pacific Northwest Laboratories are discussed. Computer graphics philosophy, hardware systems, and software utilized by the computers and information systems section staff are described in an overview. Subsequent sections detail specific applications of these capabilities to research areas in which Battelle is involved. Use of computer graphics in cartography, decision making, and resource assessment is documented. (ERA citation 04:007137)

COMPUTER GRAPHICS; DECOMMISSIONING; DECONTAMINATION; GEOTHERMAL RESOURCES; MAPS; NUCLEAR FUELS; COMPUTER PROGRAMS

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Dippel, T., D. Hentschel, and S. Kunze

Decontamination and Decontamination Wastes. Kerntechnik 18(12):526-531. (1976, December)

Optimization work aimed at reducing the quantity of radioactive liquid wastes and nonradioactive matter has been carried out on a liquid cleaning agent, a washing agent for contaminated protective clothing, a decontamination paste, and decontamination with molten salts. The methods of surface decontamination practiced at present range from simple cleaning operations with conventional media to the use of special cleaning agents and aggressive chemicals, and up to mechanical ablation of superficial layers. Special liquid and also certain non-liquid decontamination agents have contributed to reduction of the amount of wastes produced by these conventional methods. The liquid agents contain, in addition to chemicals used in cleaning, chemicals which desorb the radionuclides adhering to contaminated surfaces and bind them in chemical compounds. Other properties being the same, the cleaning agents most suitable for decontamination purposes are those with a low foaming rate and a low stability of the foam not only at room temperature but also at the processing temperature of the liquid radioactive decontamination wastes, i.e., at the boiling temperature of the evaporator. The available alternatives among non-liquid decontamination agents are various pastes and melts. Cleaning pastes usually consist of a filler, a carrier and an acid or a mixture of acids as the active agent. Good decontamination results have been achieved with a paste containing a mixture of hydrofluoric, hydrochloric and nitric acids, with only a few precent of hydrochloric acid. The best available combination of filler and carrier is polyethylene granulate as filler and titanium dioxide powder as carrier. Even better properties may be expected from pastes in which a single inorganic material constitutes both the filler and the carrier. Recent investigations have shown that organic fillers can be entirely replaced by inorganic materials without deterioration of the high decontamination efficiency. Decontamination agents without inactive additives are molten salts. The material-dissolving and material-ablating action of salt melts is well known in preparative and analytic chemistry. Laboratory investigations have shown that salts or salt combinations in the molten condition have a high decontamination efficiency, especially in respect of firmly adhering corrosion layers. Both paste and melt techniques are effective in reducing the amount of waste generated during decontamination because of their non-liquid procedures. Washing agents for contaminated laundry have been developed which remove all radioactive substances in a single washing process, thus avoiding the need to repeat the entire cleaning process. This introduction has reduced the quantity of liquid wastes by about 10% and of the content of solids by about 30%. (Auth)(JMF)

DECONTAMINATION; WASHING; NUCLEAR FACILITIES; WASTES, RADIOACTIVE; WASTES, LIQUID; CORROSION

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Dlouhy, Z., J. Razga, and E. Hladky Nuclear Research Institute, Rez, Czechoslovakia; Research Institute for Nuclear Power Plants, Jaslovske Bohunice, Czechoslovakia

Establishment of Limits for the Release of Liquid Radioactive Wastes into the Environment Following Decommissioning of the Novovoronezh-Type Nuclear Power Plant. IAEA-SM-234/43; Decommissioning of Nuclear Facilities, Proceedings of an International Symposium, Vienna, Austria, November 13-17, 1978. International Atomic Energy Agency, (pp. 379-387), 694 pp. (IAEA-SM-234/43). (1979)

The paper deals with the evaluation of residual activity from decontamination when decommissioning a Novovoronezh-type nuclear power plant. The value was found to be about 50 Ci. A mathematical model for establishing the limits for release of this activity into the aquatic environment was used. The results indicate that the individual dose rate for the population tolerated by Czechoslovak regulations will not be exceeded. Values of 8.77 X 10(E-5) rem for whole body, 3.11 X 10(E-12) rem for thyroid, 1.05 X 10(E-5) rem for bone, and 4.83 X 10(E-5) rem for the gastro-intestinal tract per year were calculated. All these dose-rates are below the value of 10(E-4) rem/a selected as a guiding value for the Czechoslovak Nuclear Energy Program. (Auth)

RESIDUAL ACTIVITY; NUCLEAR POWER PLANTS; DECOMMISSIONING; NOVO VORONEZH REACTOR; MODELS, MATHEMATICAL; ECOSYSTEMS, AQUATIC; DOSE RATE; EXPOSURE, POPULATION; THYROID; BONES; GASTRO-INTESTINAL TRACT; STANDARDS, INTERNATIONAL

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Dodds, R.K., and P.H. Gilbert Foundation Sciences, OR; Parson, Brinkerhoff, Quade Douglas, San Francisco, CA

Underground Siting is a Nuclear Option. Electrical World 186(1):36-39. (1976, July 1)

Technical feature:underground siting of nuclear plants is technologically feasible and can be economically attractive. Although not a universal solution to siting problems, underground units should be as safe as surface facilities, cheaper, and less disruptive. Experience with four nuclear reactors placed in hard rock caverns in Europe is examined. A Swedish study of the economics of underground siting is discussed. Methods of handling such accident possibilities as steam pipe rupture, overpressures, groundwater contamination, fires, flooding, natural disasters, and radioactive releases are described. Items that should provide cost advantages for underground siting over surface siting include year-round construction, reactor foundation, emergency cooling, and site availability. (4 diagrams)

NUCLEAR POWER; UNDERGROUND NUCLEAR STATIONS; REACTOR SAFETY; NUCLEAR POWER PLANTS; DECOMMISSIONING; SEISMOLOGY; FLOODS; NATURAL DISASTERS; GROUND WATER; CONTAINMENT; ISOTOPES; FIRES

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Donoghue, J.K., F.R. Charlesworth, and A. Fairbairn British Nuclear Fuels Ltd.; Nuclear Installations Inspectorate, United Kingdom; Safety Reliability Directorate, London, United Kingdom

Safety Aspects of a Fuel Reprocessing Plant. IAEA-CN-36/75; International Conference on Nuclear Power and Its Fuel Cycles, Salzburg, Austria, May 2-13, 1977, (7 pp.). (1977)

The reprocessing of irradiated fuel presents a wider range of safety problems than any other part of the fuel cycle. In addition to problems similar to those encountered in a large-scale chemical plant there is need to protect operators from high levels of external radiation, to contain active materials, to avoid criticality and to protect members of the general public and the environment from the effects of radioactive materials discharged from the plant. These conditions must be assured during normal operation and any foreseeable accident situations.

FUEL REPROCESSING; RADIATION PROTECTION; CRITICALITY; SAFETY; WASTE MANAGEMENT; DECOMMISSIONING

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EA and T Company, Inc., Marina del Rey, CA

Decommissioning High-Level Waste Surface Facilities. Report; 120 pp. (1978, April)

The protective storage, entombment and dismantlement options of decommissioning a high-level waste surface facility (HLWSF) was investigated. A reference conceptual design for the facility was developed based on the designs of similar facilities. State-of-the-art decommissioning technologies were identified. Program plans and cost estimates for decommissioning the reference conceptual designs were developed. Good engineering design concepts were on the basis of this work identified.

COSTS; DECOMMISSIONING; WASTES, HIGH-LEVEL; WASTES, RADIOACTIVE; WASTE STORAGE; NUCLEAR FACILITIES

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Eder, D., A. Gasch, and F. Kaiser Nuklear-Ingenieur-Service G.m.B.H., Hanau, F. R. Germany

Specification of Conditions of a Nuclear Power Plant with a PWR Following a LOCA for Purposes of Studying the Ensuing Decontamination and Transport (In German). NIS-337; 230 pp. (1978, August)

Assumptions are made which provide a conservative picture of the reference plant studied (PWR, 1300 MW) with respect to the course of the accident and the resulting damage as well as the distribution of radioactivity in the plant. Assuming a double-ended rupture of the hot line in the piping chamber and a fuel assembly cladding tube damage of 10% corresponding to the licensing guidelines currently valid for the relase of iodine, the nuclide-specific distribution of the radioactivity in reference chambers in the containment is determined with the "corral" computer program.

REACTORS, PWR; ACCIDENTS, LOSS OF COOLANT; DECOMMISSIONING; TRANSPORTATION; RADIOACTIVITY; DISTRIBUTION; WASTE MANAGEMENT

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Edwards, J. Royal Naval College, Greenwich, United Kingdom

Review of the Status of, and Prospects for, Nuclear Marine Propulsion. Journal of the Institution of Nuclear Engineers 17(3):55-72. (1976, May)

It is stated that the matter of nuclear marine propulsion has been under consideration in the UK since 1957, at which time the Royal Navy commenced studies into the possibility of a nuclear powered 65,000 ton fleet support tanker. Nuclear warship studies started earlier in the USA, where studies were started in 1946 on the application of nuclear power to submarines and surface warships. The present position is that five nuclear merchant ships have been built, whereas 290 nuclear warships are either operational or building. Reference is made to a lecture given by the author in February 1974, in which the position at that time was reviewed, the present lecture updating that lecture with regard to subsequent events and their effects on the present prospects for nuclear merchant ships. Headings include the following: situation in early 1974; present situation; economic analyses; the energy situation; problems and prospects (economic assessments, inflation effects, safety requirements, construction time, refuelling requirements, ship residual value and decommissioning costs, training costs, insurance and indemnity, essential documentation, safety acceptance and port entry, licensing and legislative problems, accidents and their consequences); developments in marine reactor designs; and conclusions. The discussions are reproduced in full.

ACCIDENTS; ECONOMICS; NUCLEAR INSURANCE; LEGAL ASPECTS; LICENSING; PLANNING; REVIEWS; SAFETY; REACTORS, SHIP PROPULSION; SPECIFICATIONS

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Eggleston, R.R. Atomics International, Canoga Park, CA

Retirement of the Sodium Reactor Experiment. AE-AEC-12572; 114 pp. (1968, August 30)

Final summary of retirement effort from Feb. 67 to July 1, 68. Reviews alternative plans, describes eventual, minimum cost plan of indefinite storage under surveillance, with fuel and usable items shipped out. Describes status of various systems, deactivation schedule, and costs (total $843,000). Surveillance costs $2500/month. The most satisfactory procedures were those written assuming worker had no prior plant knowledge. Valves had to be reidentified and retagged. Installation of small subsystems on pallets made it easier to ship and bury than cleanup. Bibliography of all SRE topical reports included.

BIBLIOGRAPHIES; REACTORS, GRAPHITE MODERATED; REACTORS, LMCR; PROCEDURES; REACTORS, SRE; DECOMMISSIONING; DOCUMENTATION

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Ehringer, H., and J.P. Lecoq

Experimental Reactors in the European Community and Their Utilization. Atomwirtschaft-Atomtechnik 21(4):209-215. (1976, April)

Survey report: more than 100 experimental reactors are presently operated in EEC. Five types of reactor use are reported: for critical experiments and neutron physics experiments; for universities; for research; for materials tests; and for large experimental programs. The present use of 50-90% of the materials test and other types of reactors for development of LWR, LMFBR, and high temperature gas cooled reactor projects is likely to continue, though in some individual cases experimental reactors will be decommissioned because of insufficient use. (In German) (3 references, 5 tables)

NUCLEAR POWER; REACTORS; NUCLEAR POWER PLANTS; DECOMMISSIONING

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Emshwiller, J.R., and W.S. Mossberg

Nuclear Industry Faces Bleak Future as Orders Get Increasingly Scarce; Congress

Could Decide Nuclear Fate. Wall Street Journal 12:1. (1979, February)

News feature: as orders for new nuclear power plants become increasingly scarce, the nuclear industry has had to close supply plants and make settlements to uranium suppliers for commitments that cannot be kept. Unemployment in the nuclear industry is up, and there is no market for the specialized work force being laid off. Major companies, such as the General Electric Co. and the Westinghouse Electric Corp., believe that the market will eventually revive, although recovery could be slow. Current congressional debates about a proposed energy bill that would ease the cumbersome licensing process for nuclear plants could decide the ultimate fate of the nuclear industry. The emotional issue of radioactive waste disposal is a major stumbling block in the debates. The pros and cons of the nuclear issue, as voiced by opponents and proponents, are discussed.

NUCLEAR POWER; ENERGY CONSERVATION; NUCLEAR POWER PLANTS; DECOMMISSIONING; WASTE MANAGEMENT; LICENSING; ENVIRONMENTAL IMPACTS

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Eng, J., J. Feldman, P.A. Giardina, and D.W. Hendricks

Low-Level Radioactive Waste From Rare Metals Processing Facilities. CONF-790923; Decontamination and Decommissioning of Nuclear Facilities, Proceedings of a Conference, Sun Valley, ID, September 16-20, 1979. Session II-B, (p. 5), 90 pp. (CONF-790923). (1979)

In the past year, problems of disposal of byproducts, tailings, and wastes from rare metals and thorium producing facilities have received the attention of radiological agencies. Mill tailings from the uranium mining industry have only recently come under federal regulation. The amount of zircon ore imported into the United States has been increasing steadily since 1930. Efforts to determine the extent of possible radiological problems are difficult for sites which have ceased rare metals processing activities for several years either due to changes in site ownership or unfavorable economic climate. This paper will review the situations at the existing Teledyne Wah Chang Co., Inc. located at Albany, Oregon, and the former Carborundum Corp./Amax Specialty Metals, Inc., facilities located at Parkersburg, West Virginia, and Akron, New York, in order to show the extent of the radioactivity problem at rare metals processing facilities and the need to identify for radiological review other rare metal and rare earth processing sites. (Auth)(JMF)

This paper is only an abstract of the actual paper which is to be published later.

DECONTAMINATION; WASHING; TAILINGS; THORIUM; RARE EARTHS; RADIOACTIVE MINERALS; RADIATION SOURCES

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Erickson, P.B.

U.S. Licensed Reactor Decommissioning Experience. CONF-790923; Decontamination and Decommissioning of Nuclear Facilities. Proceedings of a Conference. Sun Valley, ID. September 16-20, 1979. Session III-B, (p. 1), 90 pp. (CONF-790923). (1979)

Decommissioning of reactors licensed under 10 CFR Part 50 has involved research reactors, test reactors and relatively small power reactors. Decommissioning of research reactors has usually been accomplished by dismantlement with termination of the reactor license, while decommissioning of licensed test and power reactors has been accomplished by protective storage/"mothballing" with conversion of the operating license to a possession only license. When "mothballed", dismantling of the reactor is delayed for an indeterminate period. No licensed reactors have been decommissioned by entombment. Three demonstration nuclear power plants, however, which were owned by the Federal Government and operated under 10 CFR Part 115 authorization have been entombed. Our experience with licensed research reactor dismantlement along with experience in the dismantlement of the Elk River demonstration nuclear power plant indicates that dismantlement is a viable alternative for larger nuclear power plants. Similarly, the satifactory status of licensed test and power reactors now in protective storage/"mothballed" indicates that this is a viable alternative for allowing a significant decay of radioactive isotopes prior to the dismantling of larger power reactors. Permanent entombment will have to consider the significance of long-lived activation products such as Nickel 59 and Niobium 94. Safe storage using removable concrete structures for shielding and access control, however, may be an acceptable alternative for these large nuclear power plants to allow decay of major activation products prior to dismantling. (Auth)(JMF)

This paper is only an abstract of the actual paper which is to be published later.

DECOMMISSIONING; NUCLEAR FACILITIES; RADIOACTIVE DECAY

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Provision for Decommissioning Light Water Reactor Power Plants by the German Utilitie-s. IAEA-SM-234/2; Decommissioning of Nuclear Facilities, Proceedings of an International Symposium, Vienna, Austria, November 13-17, 1978. International Atomic Energy Agency, Vienna, (pp. 41-64), 694 pp. (IAEA-SM-234/2). (1979)

In the Federal Republic of Germany the licensing procedure for nuclear power plants under the Atomic Energy Act requires provision of proof that the plants can be decommissioned and removed at the end of their operating time. In particular, the requirement is specified that the design of the plants must take account of decommissioning. The German utilities which operate nuclear power plants have long concerned themselves with aspects of decommissioning, and they have especially studied the question of whether there are aspects of decommissioning which could necessitate a change in the concept of the plant. For this purpose, an engineering company was given a contract to make a study with the objective of analyzing the entire spectrum of decommissioning, ranging from determination of the decommissioning techniques and extending to the calculation of the masses of decommissioning wastes and the costs expected to be incurred during the decommissioning. Initial results of this study are now available and are described in this paper. These results already indicate that changes in the concept of the plant for decommissioning reasons are not necessary. Using these results of the study it is possible to indicate to the licensing authorities what range of techniques can be applied to decommission a nuclear power plant. The purpose of these studies is not to establish the decommissionability of every plant individually, but instead to point out the feasibility in general of decommissioning a large-scale plant. Finally, an estimate will be presented of the maximum costs which can be expected in a decommissioning operation and of what influence these costs will have on power production costs. (Auth)

NUCLEAR POWER PLANTS; REACTOR DECOMMISSIONING; REACTORS, LIGHT-WATER; WASTE VOLUME; COSTS; UTILITIES

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Essmann, J., G. Lukacs, and G. Watzel

Decommissioning Status in Germany. CONF-790923; Decontamination and Decommissioning of Nuclear Facilities, Proceedings of a Conference, Sun Valley, ID, September 16-20, 1979. Session III-B, (pp. 2-3), 90 pp. (CONF-790923). (1979)

Decommissioning nuclear power plants was first introduced in Germany in 1974 through BMI safety criteria. The criteria concerning decommissioning (No. 2.10) was made evident by the checklist for a BMI standard safety report and by the corresponding directory from the committee of reactor safety. Financial reserves must be set up during plant operating time for compliance with decommissioning and removal regulations. A draft of the safety criteria, to begin in 1975, has been submitted by the operators. The operators have issued an order to NIS (Nuklear-Ingenieur-Service GmBH) for a study which should determine quantitative values for the activity inventory, expected mass, volume and composition of materials, the application of decommissioning methods to be applied in consideration of variants of decommissioning, expected personnel staff, dose rate in personnel exposure, and expected costs. Preliminary results show that a total removal of light-water reactors is already possible, but it is important that the design of nuclear plants not be compromised where safety is concerned. Decommissioning projects already begun are as follows: HDR (superheated steam reactor Grosswelzheim, 25 MWe) - Some dismantling has already taken place. KKN (Pressure Tube Reactor, 100 MWe) - Protective storage is already finished and total removal is beginning. FR I (Research Reactor) - Dismantling is in the preparatory stage. KWL (Boiling Water Reactor 237 MWe) - Protective storage has begun. NS "Otto Hahn" (Nuclear Ship with PWR) - The decommissioning will probably begin near the end of 1979. (JMF)

This paper is only an abstract of the actual paper which is to be published later.

DECOMMISSIONING; DECONTAMINATION; WASHING; NUCLEAR FACILITIES; REACTORS, PWR; REACTORS, LIGHT-WATER; PERSONNEL; EXPOSURE, OCCUPATIONAL; COSTS; STORAGE, INTERIM

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Evans, J.C., J.C. Laul, and L.A. Rancitelli

Long-Lived Activation Products in Reactor Materials. CONF-790923; Decontamination and Decommissioning of Nuclear Facilities, Proceedings of a Conference, Sun Valley, ID, September 16-20, 1979. Session IV-A, (pp. 1-2), 90 pp. (CONF-790923). (1979)

Identifying radionuclides in the various components of a reactor will be of major concern to decommissioning strategies over periods of time from a few years to a thousand years. A major concern in the decommissioning and ultimate disposal of nuclear reactors is the radionuclide content of the construction materials which must be handled. Radionuclides produced in reactor construction materials fall into two categories: (1) Activation products in the reactor vessel, internal piping and biological shield, and (2) neutron activated corrosion products and fission products which are transported by the cooling system or collected on filters and ion exchange resins. This problem has been considered in detail from the standpoint of radiation exposure to personnel during the dismantling phase of a reactor. However, from the standpoint of the total radionuclide content of irradiated reactor components, particularly those radionuclides which do not offer a gamma dose to personnel, but may be in high concentrations from the standpoint of ultimate disposal, very little consideration has been given. Coarse estimates indicate the activated steel components will contain at least 4.8 X 10(E+6) Ci and the biological shield X 10(E+3) Ci after 30 effective full-power years (EFPY) of reactor operation. However, as the authors note, "The potentially large impact of a minor trace constituent such as europium on the total radionuclide inventory in the concrete makes an a priori prediction of that inventory to within a factor of ten unlikely." It is obvious that the major radionuclides produced in reactor components as well as their availability to the environment must be determined in a reasonable manner if a safe and acceptable strategy is to be developed for ultimate reactor decommissioning. It is anticipated that nearly 60 radionuclides with half-lives greater than one year can be produced in the various components, depending on location in the reactor and the target element abundances. The program under way at our laboratory to determine the inventory of long-lived radionuclides produced as activation products in the structural materials of LWR power reactors is limited to activation products with half-lives longer than Co 60 (5.3 y). Efforts are currently under way to obtain irradiated concrete samples. Radiochemical separations will be carried out for several selected long-lived isotopes to attempt to verify the accuracy of the calculations. (Auth)(JMF)

This paper is only an abstract of the actual paper which is to be published later.

DECOMMISSIONING; NUCLEAR FACILITIES; EXPOSURE, OCCUPATIONAL; REACTORS; RADIOACTIVITY; RADIOACTIVE DECAY; RADIONUCLIDES; SHIELDING; REACTORS, PWR; REACTORS, LIGHT-WATER; CONCRETES; STEELS; WASTES, RADIOACTIVE; WASTES, TRANSURANIC; ACTIVATION PRODUCTS; ACTIVATION ANALYSIS

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Field, F.R. Savannah River Laboratory, Aiken, SC

Decommissioning Plan for the Heavy Water Components Test Reactor. DP-MS-75-61; CONF-750822; Decontamination and Decommissioning of ERDA Facilities, Proceedings of a Conference, Idaho Falls, ID, August 19-21, 1975, (23 pp.)(CONF-750822). (1975)

Three alternatives to decommissioning the heavy water components test reactor (HWCTR) have been analyzed. The major elements of the alternatives are shown. No final choice has been made between alternatives, and all are feasible. The protective confinement approach is advantageous as long as current activities onsite require limited access by the general public, and because excellent confinement of the residual activity (2.3 x 10(E+4) curies) is provided by in situ dry storage as the radiation from Co 60 diminishes. Entombment provides the most-secure confinement of the activity at some increased cost.

DECONTAMINATION; REACTORS, HWCTR; DECOMMISSIONING

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Flanagan, T.M. Mound Laboratory, Miamisburg, OH

Hazard Evaluation of the Special Metallurgical (SM) Building at Mound Laboratory. MLM-MU-76-66-0001; 20 pp. (1976, August 6)

The Special Metallurgical (SM) Building, although a nonoperational Pu 238 facility, is Mound Laboratory's major source of Pu 238 airborne effluents. The SM Building has contributed approximately 70% of the Laboratory's effluent since termination of the facility ceased. Indications are that the SM Building will continue to be the major source of effluents in the future. The levels of Pu 238 are not in excess of the guidelines given in ERDAM-0524 but are considered to be unwarranted and inconsistent with ERDA's policy of "as low as practicable". A credible hazard exists in that a fire involving the roof will occur and result in an environmental release of 800 uCi of Pu 238. Such an incident is comparable to the design basis accident documented for Mound Laboratory's major operational Pu processing facility. It is anticipated that as the SM Building continues to deteriorate additional release pathways will occur. Smears of the roof have indicated Pu 238 surface contamination. The roof has also deteriorated to the point where rain water leaks into the decommissioned portion of the SM Building. The hazards associated with the SM Building are unacceptable because ERDA, Monsanto Research Corporation, and members of the general public are deriving no benefits from the contaminated portion of the SM Building. (Auth)(RAF)

HAZARD ANALYSIS; BUILDINGS; PLUTONIUM 238; CONTAMINATION; AIR; ACCIDENTS; FIRES; EXPOSURE, POPULATION; DOSE COMMITMENT; SOILS; SURFACE CONTAMINATION; ROOFS

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Florida Power and Light Company, Miami, FL

A Comparison of Meteorological Data Collected at Turkey Point and South Dade. Letter with Report to NRC Office of Nuclear Reactor Regulation. DOCKETS 50-250 251; 450 pp. (1976, August 24)

On the basis of this study, it is recommended that the Turkey Point meteorological instrumentation system in its present form be decommissioned since some of the equipment does not meet Regulatory Guide 1.23 measurements and the exposure of the equipment is questionable. To provide adequate meterological data for dispersion evaluation, it is recommended that the atmospheric stability conditions at Turkey Point be determined from data to be telemetered from the South Dade Meteorological Tower. However, low level wind conditions should be evaluated by instrumentation conforming to Regulatory Guide 1.23 and located in the Turkey Point plant area, in flat, open, unobstructed terrain.

TURKEY POINT-3 REACTOR; TURKEY POINT-4 REACTOR; REACTORS, PWR; METEOROLOGY; WINDS; DECOMMISSIONING; INSTRUMENTS

240

Fountain, G.R., M.B. LeBoeul, J.T. Mahar, J.C. O'Hara, R.J. Ondek, and W.R. Towle General Electric Company, Knolls Atomic Power Laboratory, Schenectady, NY

Scoping and Cost Estimates for the Decontamination and Disposal of Separations Processing Research Unit Facilities. REO-M-422, 44 pp. (1972, March)

The present physical layout and radiological conditions of the Separations Process Research Unit (SPRU) plant and associated facilities in building G-2 and H-2 are described. Estimated costs and the general scope of work to either decontaminate or demolish these facilities are outlined. The areas to be decontaminated consist largely of inoperative buildings, underground tunnels, vaults, and associated chemical processing equipment which are contaminated with microgram quantities of Pu and millicurie amounts of mixed fission products. Estimates of loose and fixed activity are provided. Fixed activity is considered that activity which has leaked into floors and walls and is contained in sumps, tanks, pipes, and other equipment. The entire SPRU area was broken down into the following component parts to simplify costing and scoping: Bldg. H-2 tank farm cells: Bldg. H-2 and G-2 tunnels; Bldg. H-2: and Bldg. G-2 SPRU cells. Estimated costs to strip out equipment, decontaminate, and ship off-site for burial are $6,513,000. Estimated costs to completely demolish the SPRU facilities, including initial decontamination costs are $14,563,000. The estimated costs to decontaminate Bldg. H-2, Bldg. G-2, Bldgs. H-2 and G-2 tunnels, and completely remove the Bldg. H-2 tank cells are $7,197,000. (RAF)

COST ESTIMATES; PLANNING; DECONTAMINATION; DISPLACEMENT; NUCLEAR FACILITIES; DEMOLITION; WASTE DISPOSAL; BETA PARTICLES; RADIATION, GAMMA; ALPHA PARTICLES; BUILDINGS; TUNNELS; PLUTONIUM; FISSION PRODUCTS; TANKS; RADIOLOGICAL SURVEYS

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French, J.D. Idaho Operations Office, Idaho Falls, ID; Aerojet Nuclear Company, Idaho Falls, ID; U.S. Energy Research and Development Administration, Washington, DC

Disposal of Personal Property from ERDA Facilities Being Decommissioned. CONF-750827; Decontamination and Decommissioning of ERDA Facilities, Idaho Falls, ID, August 19-25, 1975, (pp. 501-508). (1975, September)

DECOMMISSIONING; DECONTAMINATION; NUCLEAR FACILITIES; PLANNING; WASTE DISPOSAL

242
Friedlander, G.D.

Decommissioning Commerical Reactors. Electrical World 189(4):44-48. (1978, February, 15)

Feature article: the problem of decommissioning commercial nuclear reactors after their useful lifetime of 35-40 yr expires, is analyzed. Five decommissioning methods recommended by the Atomic Industrial Forumothballing, entombing, immediate removal/dismantling, the combination of mothballing and delayed removal/dismantling, and the combination of entomoing and delayed removal/dismantlingnd associated NRC guidelines are outlined. Planning for decommissioning is now under way by NRC, the Atomic Industrial Forum, Battelle Memorial Inst.-Pacific Northwest Labs., and others. The press offers warnings that decommissioning nuclear plants may cost more than the original construction. The NRC indicated that if a sinking fund were established with an annual payment of $255,000, enough funds would be generated in 30 years to cover decommissioning and long-term maintenance of a retired reactor. In addition, future plans for decommissioning must be included in the decision-making process during the initial operating license application and review per[illegible]. (3 diagrams, 1 photo, 1 table)

NUCLEAR POWER; NUCLEAR POWER PLANTS; DECOMMISSIONING; REACTORS; WASTE MANAGEMENT; ECONOMICS,

243
Garrett, P.M. Atomic Industrial Forum, Washington, DC

Environmental Considerations for Power Reactor Decommissioning. CONF-780622; American Nuclear Society Annual Meeting, San Diego, CA, June 18, 1978; Transactions of the American Nuclear Society 28:665. (1978, June)

ENVIRONMENTAL IMPACTS; NUCLEAR POWER PLANTS; RADIATION DOSE; RADIATION HAZARDS; REACTOR DECOMMISSIONING; REACTOR DISMANTLING

244
Gasch, A., G. Loercher, and G. Lukacs NIS, Nuklear-Ingenieur-Service GmbH, Frankfurt/Main, German Federal Republic

Results of an [illegible]lysis of the Quantities of Radioactive Wa[illegible] Developing during the Decommissioning of Nuclear Power Plants. IAEA-SM-234/3; Decommissioning of Nuclear Facilities, Proceedings of an International Symposium, Vienna, Austria, November 13-17, 1978. International Atomic Energy Agency, Vienna, (pp. 299-306), 694 pp. (IAEA-SM-234/3). (1979)

The Federal Ministry for Research and Technology of the Federal Republic of Germany has issued a contract to NIS, Nuklear-Ingenieur-Service GmbH, to study the radioactive wastes resulting from the decommissioning of light-water reactors currently existing and planned in the FRG. In this study, the existing masses of radioactive waste which must be placed in protective storage, as well as their radioactivity, were estimated for individual reference plants. On the basis of these individual reference plants and probable commissioning dates, the development of the masses of waste and their radioactivity with respect to time was then determined. This study is based on 31 nuclear power plants. It was found that the total mass of waste which must be placed in protective storage is about 290,000 Mg with a maximum radioactivity of about 3.7 x 10(E+18) Bq (10(E+8) Ci) without fuel assemblies, which were not considered in the study. (Auth)

WASTES, RADIOACTIVE; WASTE VOLUME; REACTOR DECOMMISSIONING; REACTORS, LIGHT-WATER; WASTE STORAGE; NUCLEAR POWER PLANTS

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General Accounting Office, Washington, DC

Cleaning Up the Remains of Nuclear Facilities. A Multibillion Dollar Problem. NP-22292; EMD-77-46; Report to the Congress by the Comptroller General of the U.S.; 41 pps. (1977, June 16)

Discusses the problems in making sure that the facilities, equipment, and materials involved in nuclear activities are disposed of in a way that precludes any health or safety hazards-now or in the future. Recommends that Congress designate one lead federal agency-the Nuclear Regulatory Commission-to approve and monitor an overall decommissioning strategy. ERDA should continue its research and development efforts aimed at finding alternatives for decommissioning and decontamination of nuclear facilities.

DECOMMISSIONING; DECONTAMINATION; REGULATIONS, FEDERAL; REGULATIONS, STATE; REVIEWS

246
General Electric Company, Pleasanton, CA

Annual Report No. 3, Esada Vallecitos Experimental Superheat Reactor (Deactivated-). DOCKET 50-183; Letter-General Electric Company to AEC Division of Reactor Licensing; 6 pp. (1971, February 22)

The facility remains in essentially the same condition described in the Second Annual Report. A significant change in the licensing status of the plant was requested in Application Amendment No. 16 dated October 16, 1969, and Modification No. 1 to Application Amendment No. 16 dated March 9, 1970. The request was to remove the dump condenser and miscellaneous equipment building, the gas-fired boiler, the cooling tower, the stack and the control room from the defined plant area for the EVESR facility. The requested change was authorized by commission in Amendment No. 2 to license DPR-10 dated April 15, 1970.

LICENSE STATUS; REACTORS, INTERNAL SUPERHEAT; DECOMMISSIONING; REACTOR OPERATION; DOCUMENTATION

247
Gilbert, R.O. (Coord.) Battelle-Pacific Northwest Laboratories, Richland, WA

Statistics for Environmental Transuranic Studies. PNL-SA-7585; 43 pp. (1979, March)

Estimating the mean and standard deviation of environmental radionuclide data sets that contain "less-than detectable" (LD) concentrations, zeros, unreported concentrations below the detection limit, and negative concentrations is part of the concern for statistical analysis in this area. Two types of data sets are dealt with here. One type is characterized by the absence of net concentration data less than a lower limit called the threshold value X sub 0. In our application X sub 0 may be the lower detection limit of the analytical and counting system in use. All net concentrations greater than X sub 0 are assumed to be present and available for statistical analysis. Data sets with these characteristics may be termed left-censored, or censored on the left. The other type of data set discussed here may contain both positive and negative concentrations, but no unreported or LD values. This type of data set is referred to here as "uncensored". Throughout most of this discussion, we assumed an underlying 2 or 2-parameter lognormal frequency distribution of the concentration values from some conceptual population of interest. Such a population might be the set of all possible soil samples that could be collected from a specified geographical area. This underlying lognormal distribution has a mean and standard deviation that would be known exactly if we could collect and analyze all possible samples from the population. The assumption is made that samples have been drawn at random from the population. The interest is in obtaining unbiased (accurate) estimates of the mean and standard deviation. Observed frequency distributions are typically skewed to the right. Hence, distributions such as the gamma, Weilbull, and the 2 and 3-parameter lognormal are potential candidates. The 2 and 3-parameter lognormal distributions was chosen here because they give reasonable fits to radioactivity data sets in many cases and because estimation of the mean and standard deviation is relatively straightforward for these distributions. (Auth)(JMF)

This report presents a methodology and, in doing so, contains numerous graphs, charts, and formulate.

STATISTICS; ENVIRONMENT; TRANSURANICS; SAMPLES; SAMPLING; CHEMICAL ANALYSIS; RADIOACTIVITY; POPULATIONS

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Gilbert, R.O. (Coord.) Battelle-Pacific Northwest Laboratories, Richland, WA

Statistics for Environmental Transuranic Studies. PNL-SA-6697; 21 pp. (1978, February)

The statistics of environmental transuranics sometimes centers on the aspects of compositing field samples with subtopics of compositing designs, adequacy of mixing, and statistical models and their role in compositing designs. The "composite sample" may be defined as the mass of material resulting for pooling several individual samples together before any chemical analysis or counting is done. Compositing (pooling) may be done to obtain a more "representative" concentration for fixed costs, and to increase the amount of radioactivity present so that the number of "non-detectable" counts is reduced. In general, compositing becomes attractive when the cost of a single analysis is large relative to the costs of collecting, pooling, and adequately mixing samples. Careful thought should be given to the meaningfulness of pooling samples in each field situation and to the definition of the population from which field samples are drawn. How are the results obtained from pooled samples to be used? Can the scientific questions being asked be answered from pooled samples? Will important variables (changes over time, differences between locations, soil types, vegetation species, microhabitats, etc.) be masked by the pooling and mixing process? (Auth)(JMF)

STATISTICS; ENVIRONMENT; TRANSURANICS; SAMPLES; SAMPLING; CHEMICAL ANALYSIS; RADIOACTIVITY; SOILS; VEGETATION; COSTS

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Gilbert, R.O., and L.L. Eberhardt Battelle Memorial Institute, Pacific Northwest Laboratory, Richland, Washington 99352

An Evaluation of Double Sampling for Estimating Plutonium Inventory in Surface Soil. BNWL-SA-5338; CONF-750503; Proceedings of the 4th National Symposium on Radioecology, Corvallis, OR, May 12-14, 1975 (22 pp.) (BNWL-SA-5338, CONF-750503). (1975)

The Nevada Applied Ecology Group (NAEG), established by the Atomic Energy Commission (Nevada Operations Office) in July, 1970, is currently obtaining estimates of the total amount (inventory) of Pu 239-240 in surface soil using stratified random sampling at a number of "safety-shot" locations on the Nevada Test Site (NTS) and the Tonopah Test Range (TTR). Since radiochemical analyses for plutonium are costly and large numbers of samples are usually required, we investigate here the usefulness of double sampling in combination with stratified random sampling for estimating plutonium inventory, wherein a less costly method of analysis is used to estimate plutonium concentrations using a linear regression relationship between the two variables. The regressions of Pu 239-240 concentrations on the following auxiliary variables are considered: (1) Ge(Li) scans for Am 241 on soil samples brought to the laboratory, and (2) FIDLER (Field Instrument for the Determination of Low Energy Radiation) net 60 KeV counts per minute (cpm) readings of Am 241 taken in the field. Data from two NTS safety-shot sites (Project 57 in Area 13 and GMX site in Area 5) indicate that except for the lower plutonium concentration zones, the use of either Ge(Li) scans or FIDLER counts in conjunction with Pu 239-240 radiochemical analyses can yield estimates of inventory with greater precision than possible with plutonium analyses alone. Percentage reductions in standard errors up to 35% using Ge(Li) scans and up to 45% using FIDLER counts appear to be possible with no increase in total costs. Also, the data suggest that double sampling will supply standard errors equal to those being obtained using only plutonium analyses at cost savings of 20 to 30 percent. (Complete Text)

This paper contains maps of the sampling area and contains tables and graphs demonstrating the statistical analysis used.

SAMPLING; RADIONUCLIDES; SAMPLES; PLUTONIUM; ISOTOPES; COSTS

250

Giraud, B., and P. Candes Ministere de l'Industrie et de la Recherche, Paris France; Service Central de Surete des Installations Nucleaires, Paris, France

Radioactive Wastes. Annales des Mines 182(3):45-162. (1976, March)

A classification of radioactive wastes is proposed and an inventory of the wastes produced by the different lines is made. The possible storage solutions for high activity wastes (according to their characteristics) as well as for medium and low activity wastes are described. Finally, the problems of wastes together with dismantling of definitively shut down nuclear installations are recalled.

CLASSIFICATION; INVENTORIES; WASTE DISPOSAL; WASTE PROCESSING; WASTE STORAGE; WASTES, RADIOACTIVE; REACTOR DECOMMISSIONING; SAFETY

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Glauberman, H. Albuquerque Operations Office, Albuquerque, NM; Sandia Laboratories, Albuquerque, NM; U.S. Atomic Energy Commission, Washington, DC

Disposition of AEC Radioactively Contaminated Facilities. CONF-740406; WASH-1332(74)(Vol.2); Proceedings of the Second Atomic Energy Commission Environmental Protection Symposium, Albuquerque, NM, April 16-19, 1974, (pp. 699-703) 1151 pp. (1974, July)

BUILDING MATERIALS; BUILDINGS; BUILDINGS, CONTAINMENT; CONTAMINATION; DECOMMISSIONING; DECONTAMINATION; FUEL HANDLING; MECHANICAL STRUCTURES; NUCLEAR FACILITIES; PLANNING; RADIOACTIVE MATERIALS; WASTE DISPOSAL; WASTE MANAGEMENT; WASTES, SOLID

252

Glauberman, H. Idaho Operations Office, Idaho Falls, ID; Aerojet Nuclear Company, Idaho Falls, ID; U.S. Energy Research and Development Administration, Washington, DC

Decontamination and Decommissioning Policy and Programs. CONF-750827; Cecontamination and Decommissioning of ERDA Facilities, Idaho Falls, ID, August 19-25, 1975, (pp. 7-14). (1975, September)

DECOMMISSIONING; DECONTAMINATION; NUCLEAR FACILITIES; WASTE MANAGEMENT

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Glauberman, H., and W.J. Manion International Atomic Energy Agency, Vienna, Austria

Technical and Economic Aspects of Nuclear Power Plant Decommissioning. IAEA-CN-36/16; International Conference on Nuclear Power and Its Fuel Cycles, Salzburg, Austria, May 2-13, 1977 (12 pp.). (1977)

Nuclear power plants may be decommissioned by one of three primary methods, namely, mothballing, entombing, or dismantling or by using combinations such as mothballing or entombing for a period of time followed by dismantling. Mothballing or entombing both result in an end-product which require surveillance and maintenance for a significant period of time to ensure protection of public health and safety. This paper discusses costs for each of the decommissioning methods, including factors that will influence the method selected as well as the total costs. Decommissioning costs have been estimated for a 100 MWe light water reactor within one year after shutdown following forty years of operation. The basic economic parameters for each decommissioning method were developed using unit cost factors based on known costs of previously decommissioned reactors. Decommissioning cost estimates range from less than four million dollars for mothballing to about forty million dollars for complete dismantling. Estimated cost of entombment is about ten million dollars. Subsequent annual cost of surveillance and maintenance for a reactor facility using the mothballing or entombment method could be as high as $200,000. Although some tooling development will be needed for the removal of the highly activated reactor vessel segments and internals, technology is currently available and has been demonstrated on prior decommissionings, e.g., the Bonus and Hallam reactor entombments and the Elk River reactor complete dismantling. Costs associated with decommissioning are significant; however, allowance for them either as a one-time construction period sinking fund or annual depreciation type operating allowance will have little impact on either construction or operating costs. (Atomindex citation 08:303858)

NUCLEAR POWER PLANTS; REACTOR DECOMMISSIONING; COSTS; ECONOMICS; ENVIRONMENT; RADIATION PROTECTION; WASTE DISPOSAL; REACTOR DISMANTLING

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Graves, A.W. Rockwell Hanford Operations, Richland, WA

Decontamination and Decommissioning Plutonium-Contaminated Facilities at the Hanford Site. DOE/EV-0046; CONF-791114; Proceedings of the U.S. Department of Energy Environmental Control Symposium, Volume 2. Nuclear Energy and Transportation. Washington, DC, November 28-30, 1978 (pp. 149-158)(DOE/EV-0046, CONF-791114). (1978)

In 1942 Hanford was commissioned as a site for the production of weapons-grade plutonium by the Manhattan District of the U.S. Army Corps of Engineers. However, since that time approximately thirty of the plutonium contaminated facilities have put on retired status in addition to the 300 controlled outdoor contaminated sites. These retired outdoor sites are composed of over 3,000 acres related to past radioactive waste management. The purpose of this paper is to describe Hanford's decommissioning and decontamination (D and D) program as being performed for the DOE Environmental Control Technology (ECT) division. DOE is attempting to establish procedures concerning the D and D process. This paper outlines the methods and procedures used in the process and describes them as follows: surveillance and control technology prior to D and D; formulate long range plans for the surveillance and maintenance of D and D projects; develop broad based planning systems for application to all DOE D and D projects; and develop and standardize detail work procedures and execute D and D operations on the basis of an identified long-range plan and schedule. The methods just described are then applied to the plutonium-separation process facility at the Rockwell Hanford site. (WJE)

DECOMMISSIONING; DECONTAMINATION; PLANNING; GOVERNMENT POLICIES; DOE

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Greer, W.

What Do You Do With a Dead Nuke? Environmental Action 9(9):4-5. (1977, September 10)

This article makes a critical and environmentalistic review of decommissioning of nuclear power plants. The article is critical of the methods currently acceptable to NRC for decommissioning. Several studies and numbers of interest are presented, but the technical content is questionable when it is stated that nickel 59 is produced when nickel 58 captures an electron. Other points relative to decommissioning which are discussed include additional research and development, NRC regulations, and associated costs.

NUCLEAR POWER PLANTS; DECOMMISSIONING; ECONOMICS; NUCLEAR INDUSTRY

256
Guenther, R., B. Boehm, G.M. Daerr, H.U. Freund, A. Kaltenhaeuser, G. Kling, and H. Winter Battelle-Institut eV, Frankfurt/Main, German Federal Republic

Design Concepts for Facilitating the Dismantling of Pressurized Water Reactor Power Plants. IAEA-SM-234/42; Decommissioning of Nuclear Facilities, Proceedings of an International Symposium, Vienna, Austria, November 13-17, 1978. International Atomic Energy Agency, Vienna, (pp. 177-186), 694 pp. (IAEA-SM-234/42). (1979)

The pressurized water reactor power plants to be constructed in the future in the Federal Republic of Germany should be designed so that the personnel having to dismantle the radioactive components run a lower risk of radiation than during the dismantling of existing nuclear power plants. In addition, environmental risks resulting from the transportation and disposal of radioactive components should be reduced to a minimum. The following means of achieving these aims are considered: alterations to the design of the reactor building and to the shielding around the preserve vessel; minor alterations to the piping of the main coolant loops and the pumps, as well as to the piping and vessels of the auxiliary installations.

No alterations appear necessary to the design of the reactor pressure vessel itself, nor to the ventilation systems of the power plant. Two methods of dismantling the reactor pressure vessel on site are proposed. (Auth)

REACTORS, PWR; DISMANTLING; EXPOSURE, OCCUPATIONAL; PERSONNEL; DESIGN; BUILDINGS; PRESSURE VESSELS; SHIELDING; PIPES; COOLING SYSTEMS; THEORETICAL STUDIES

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Gustafson, P.D., and J.H. Opelka Argonne National Laboratory, Argonne, IL

Study of Decommissioning Accelerators and Fusion Devices. DOE/EV-0042; Division of Environmental Control Technology Program, 1978, (pp. 110-112), 259 pp. (1979, June)

The objective of this study is to prepare a document describing the general technical and environmental effects of the decommissioning of particle accelerators. High-energy accelerators to be studied will include the Princeton-Penn Accelerator at the University of Pennsylvania, the Cambridge Electron Accelerator at Harvard University, and the old Cornell Electron Accelerator at Cornell University. In addition, other smaller accelerators, such as synchrocyclotrons, betatrons, linear accelerators, and electro-static accelerators that have been decommissioned will be investigated. Estimates of future usage and anticipated scheduling of decommissionings will be ascertained and obvious technical, economic, and environmental implications associated with their future decommissioning will be noted. A plan for decommissioning a particle accelerator will be developed. The economic cost of decommissioning will be assessed. Costs will be determined by activity and by period. Activity costs will be estimated as fixed cost and as unit cost. The volume, composition, and radiation level of radioactive material that will require disposal at appropriate waste disposal sites will be estimated. Based on the known similarities of fusion devices and particle accelerators, technical, environmental, and economic problems associated with decommissioning fusion devices will be assessed. A plan for decommissioning representative fusion demonstration devices will be developed. (Auth)(JMF)

The paper contains a chart showing expected progress of the study.

DECOMMISSIONING; NUCLEAR FACILITIES; COSTS; ENVIRONMENT; ECONOMICS; WASTE VOLUME; WASTE DISPOSAL; WASTES, RADIOACTIVE

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Gustafson, P.F. U.S. Energy Research and Development Administration, Division of Operational Safety, Washington, DC; Argonne National Laboratory, Argonne, IL

Some Suggestions for Change in the Implementation of NEPA. 3rd ERDA Environmental Protection Conference, Chicago, IL, September 23, 1975 (pp. 984-993). (1975)

The National Environmental Policy Act (NEPA) requires that federal agencies prepare an environmental impact statement (EIS) prior to taking any major action significantly affecting the quality of the human environment. The act is general in its intentions, yet has very broad implications, and has been interpreted differently by each agency. The question of what actions require an EIS, and in what depth of detail, is being determined by the federal courts. As a result of the Calvert Cliffs decision, the U.S. Nuclear Regulatory Commission (NRC) has developed an effective methodology for EIS preparation as part of the routine nuclear regulatory process. The Energy Research and Development Administration (ERDA) also has a formalized approach to the statement preparation, and has or is preparing a number of statements on R and D programs as well as on individual facilities, each of which has unique characteristics which may lead to environmental impact. Both agencies tend to "overkill" in some areas, yet as a matter of policy use a standardized approach to describe other aspects which actually deserve more individualized treatment to fully disclose and discuss impacts and alternatives. It is suggested that areas of modest impact be treated accordingly, and those more critical and more difficult areas be analyzed and discussed in more detail. NRC requires an EIS at both the construction (design) and operational stage, whereas for ERDA a single EIS suffices all the way from conceptual design to decommissioning. It is suggested that ERDA adopt the two-step approach as being more realistic, and that both agencies formally adopt a procedure for evaluating, or requiring correction if necessary for, such impacts as actually occur as evidenced by monitoring program data. (Auth)

ENVIRONMENTAL IMPACT STATEMENTS; GOVERNMENT POLICIES, EPA; LEGAL ASPECTS; POLLUTION; REGULATIONS, FEDERAL; RECOMMENDATIONS

259
Hahnel, W.F., and R.C. Stebbings Pratt and Whitney Aircraft, Connecticut Advanced Nuclear Engineering Laboratory, Middletown, CT

PWAR-11C Core Removal. Report; 7 pp. (1960, June 21)

Directions are provided for the removal and disassembly of the core PWAR-11C. This operation is to be done remotely in an inert atmosphere 72 days after the test reactor is shut down. (LTN)

REACTORS, AIRCRAFT PROPULSION; REACTOR DISMANTLING; HOT CELLS; REMOTE HANDLING; SPECIFICATIONS

260
Hanfling, R.I., H.L. Falkenberry, R. Nieder, G. Ivens, E. Ziermann, L.L. Swanson, and H.L. Brey FEA

Conference on Reactor Operating Experience August 7-10, 1977, Chattanooga, Tennessee. Transactions of the American Nuclear Society 26:97. (1977)

Special report: summaries of papers presented at the Conference on Reactor Operating Experience, Chattanooga, TN, are presented. Topics include: national energy policy and status; advanced reactor experience; operator requalification training; radioactive waste management; startup test techniques; meeting of regulatory requirements; research and test reactor operating experience; nuclear plant staffing and nonlicensed personnel training; research for improved plant performance, safety, and decommissioning; power reactor operating experience; maneuverability and fuel performance; planning and management of outages; backfitting of operating power plants with high-density spent fuel storage; and an overview of fuel rack backfitting from a utility viewpoint. (numerous diagrams, drawings, graphs, maps, tables)

NUCLEAR POWER; REACTOR OPERATION; REACTORS, ADVANCED GAS COOLED; WASTE MANAGEMENT; REGULATIONS, FEDERAL; EMPLOYMENT; FUEL CYCLES; PLANNING; GOVERNMENT POLICIES; REACTOR SAFETY; NUCLEAR POWER PLANTS; DECOMMISSIONING; EMERGENCY PROCEDURES; NUCLEAR FUELS; STORAGE; MAINTENANCE; PERSONNEL

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Harmon, K.M. Battelle-Pacific Northwest Laboratories, Richland, WA

PNL Studies of D and D at Hanford. BNWL-SA-5514; CONF-750822; Decontamination and Decommissioning of ERDA Facilities, Proceedings of a Conference, Idaho Falls, ID, August 19-21, 1975, (20 pp.) (BNWL-SA-5514; CONF-750822). (1975)

The Hanford Reservation in the State of Washington was selected in 1943 by the United States Army Corps of Engineers as the location for reactor and chemical separation facilities for the production and purification of plutonium. The years since 1943 have seen the construction, use and retirement of graphite-moderated reactors, several generations of chemical processing plants, facilities ancillary to the production plants, laboratories, and a large number of ground sites used for the disposal or storage of contaminated equipment and solid or liquid wastes. In consequence, the decontamination and decommissioning (D and D) of retired, contaminated facilities at Hanford offers a great engineering and economic challenge.

CONTAINMENT; DECONTAMINATION; CONTAMINATION; DECOMMISSIONING

262
Harmon, K.M. Battelle-Pacific Northwest Laboratories, Richland, WA

Decommissioning of Retired Contaminated Facilities at Hanford. BNWL-2245; Nuclear Waste Management Quarterly Report, October-December 1976, A.M. Platt (Comp.), (pp. 13.1-13.4), 60 pp. (1977, April)

An important parameter in evaluating the potential offsite hazard from the presence of fission products and transuranics in subsurface soils of the 200 Area plateaus is the extent to which they might migrate from their present location if inundated by groundwater. A modeling study is currently being conducted to estimate potential migration of radionuclides sorbed on soil beneath 200 Area cribs under conditions which would cause a rise in the water table. A stage equilibrium method was used originally whereby unit cells of a soil column attained equilibrium with a radioactive solution passing through the column. This model later was modified by use of a delay factor (velocity of the radionuclide divided by the velocity of the water) so that separate equilibrium distribution calculation was not required for each cell. Strontium results obtained using the delay factor are in good agreement with the stage equilibrium method, both showing migration no further than about 100 meters for the 10 pCi/g Sr 90 isopleth in 140 years. Cesium 137 showed essentially no migration before it decays to less than 10 pCi/g. Plutonium was found to migrate about 500 m in southeasterly directions from the crib over a period of 72,000 years. A radiological design guide for decontamination and decommissioning and decommissioning operations at Hanford is nearly complete and provides release criteria, results of hazards analysis studies, and guidance for detailed planning activities. Limited work was continued during the last quarter on the project to test the use of a "biobarrier" to protect subsurface radioactive waste repositories from penetration by plant roots and animals. Initial calibrating tests were made on a new field instrument (a planar, intrinsic germanium diode spectrometer) for measuring residual transuranic activity in structural materials and soils at very low level. (Auth) (HT)

Information pertinent to decommissioning of a shallow waste site is presented. (DM/HT).

RADIONUCLIDE MIGRATION; CONTAINMENT; MODELS; DECOMMISSIONING; DECONTAMINATION; MONITORING; RADIATION DETECTORS; FISSION PRODUCTS; SOILS; ENVIRONMENT; WASTES, RADIOACTIVE; HAZARD ANALYSIS

263

Harmon, K.M., C.E. Jenkins, D.A. Waite, R.E. Brooksbank, B.C. Lunis, and J.F. Nemec Battelle-Pacific Northwest Laboratories, Richland, WA

Decommissioning Nuclear Facilities. CONF-760701; International Symposium on Management of Waste from the LWR Fuel Cycle, Denver, CO, July 11, 1976 (46 pp.). (1976)

This paper describes the currently accepted alternatives for decommissioning retired light water reactor fuel cycle facilities and the current state of decommissioning technology. Three alternatives are recognized: protective storage; entombment; and dismantling. Application of these alternatives to the following types of facilities is briefly described: light water reactors; fuel reprocessing plants, and mixed oxide fuel fabrication plants. Brief descriptions are given of decommissioning operations and results at a number of sites, and recent studies of the future decommissioning of prototype fuel cycle facilities are reviewed. An overview is provided of the types of operations performed and tools used in common decontamination and decommissioning techniques and needs for improved technology are suggested. Planning for decommissioning a nuclear facility is dependent upon the maximum permitted levels of residual radioactive contamination. Proposed guides and recently developed methodology for development of site release criteria are reviewed.

DECOMMISSIONING; FUEL CYCLES; FUEL REPROCESSING PLANTS; FABRICATION PLANTS, MIXED OXIDE FUEL; NUCLEAR FACILITIES; REACTORS, POWER; REACTOR DECOMMISSIONING; REVIEWS; REACTORS, WATER COOLED

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Haywood, F.F., W.D. Cottrell, and H.M. Hubbard, Jr. Oak Ridge National Laboratory, Oak Ridge, TN

Radiation Measurements and Assessments. Health Physics Division Annual Progress Report for Period Ending June 30, 1976 (pp. 261-274). (1976, October)

Methods are discussed that were developed to evaluate the characteristics of radiation fields in areas where selected segments in the nuclear fuel cycle or other energy-producing operations were carried out resulting in the possibility for exposure to the public. Inactive uranium mills were surveyed for radionuclides in tailings piles that might pose radiation hazards for human populations. The radiation doses from external exposure or from the inhalation or ingestion of Rn 222, Th 230, Ra 226, and Ra 226 daughters in the mill tailings were estimated. Radiation monitoring surveys were also made at a number of decommissioned ERDA sites. Gamma sources in soil and associated dose rates in surface air were measured at selected ORNL sites. Solid waste residues from oil shales were monitored for Rn 226 content to determine if any health hazards would result from the use of spent shales as fill material or in concrete products. Progress is reported for a study of ways to reduce the radiation exposure of personnel at light water reactors. It was concluded that the occupational exposure at operating LWR sites can be reduced by 10 to 20 percent.

EXPOSURE, EXTERNAL; EXPOSURE, OCCUPATIONAL; URANIUM; MILLING; TAILINGS; HAZARD ANALYSIS; RADIATION DOSE; HUMAN POPULATIONS; INHALATION; INGESTION; RADON 222; THORIUM 230; RADIUM 226; DAUGHTER PRODUCTS; RADIATION MONITORING; RADIATION, GAMMA; DOSE RATE; AIR; WASTES, SOLID; OIL SHALES; REACTORS, LIGHT-WATER

265

Heckman, R.A. Lawrence Livermore Laboratory, Livermore, CA

Decommissioning of the Surface Facilities Associated with Repositories for the Deep Geological Disposal of High-Level Nuclear Waste. IAEA-SM-234/19; Decommissioning of Nuclear Facilities, Proceedings of an International Symposium, Vienna, Austria, November 13-17, 1978. International Atomic Energy Agency, Vienna, (pp. 105-120), 694 pp. (IAEA-SM-234/19). (1979)

A methodology is presented in this paper to evaluate the decommissioning of the surface facilities associated with repositories for the deep geological disposal of high-level nuclear wastes. A cost/risk index (figure of merit), expressed as $/man . rem, is proposed as an evaluation criterion. On the basis of this cost/risk index, we gain insight into the advisability of adapting certain decontamination design options into the original facility. Three modes are considered: protective storage, entombment, and dismantlement. Cost estimates are made for the direct labor involved in each of the alternative modes for a baseline design case. Similarly, occupational radiation exposures are estimated, with a larger degree of uncertainty, for each of the modes. Combination of these estimates produces the cost/risk index. To illustrate the methodology, an example using a preliminary baseline repository design is discussed. (Auth)

DECOMMISSIONING; REPOSITORY; STORAGE, GEOLOGIC; WASTES, HIGH-LEVEL; COSTS; HAZARD ANALYSIS; DESIGN; EXPOSURE, OCCUPATIONAL; WASTES, RADIOACTIVE

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Herzog, J., G. Zellinsky, R. Christ, and K. Schneider. Transnuklear G.m.B.H., German Federal Republic

Decontamination and Transportation Problems Related to the Decommissioning of Nuclear Power Plants and the Elimination of Failure Consequences. Main Work, Vol. 1: Decommissioning. Jan. 1, 1975-June 30, 1976. GERRSR-128 K; NUKEM-312; 127 pp. (1977, May)

This first volume of the main work begins with a review of the possible facilities for decontamination and conditioning, and the shipment options related to the normal decommissioning of large nuclear power plants.

TRANSPORTATION; DECOMMISSIONING; REGULATIONS, INTERNATIONAL; DECONTAMINATION

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Herzog, J., G. Zellinsky, R. Christ, and K. Schneider. Transnuklear G.m.B.H., German Federal Republic

Decontamination and Transportation Problems Related to the Decommissioning of Nuclear Power Plants and the Elimination of Failure Consequences. (Appendix 1) - Principles, Jan. 1, 1975-June 30, 1976. GERRSR-129; NUKEM-312; 61 pp. (1977, May)

The technical conditions which must be cleared in order to overcome the decontamination and shipment problems arising from the decommissioning of nuclear power plants at the end of their service life and from the elimination of system failure consequences in such plants, are compiled and subjected to a preliminary assessment.

CONTAINERS; DECOMMISSIONING; TRANSPORTATION; REGULATIONS, INTERNATIONAL

268

Hill, G.S. Oak Ridge National Laboratory, Health and Safety Research Division, Oak Ridge, TN

Doses for Various Pathways to Man Based on Unit Concentrations of Radionuclides Pertinent to Decontamination and Decommissioning of Properties. ORNL/OEPA-7; 47 pp. (1979, March)

Radiation doses are tabulated for concentrations of radionuclides likely to be encountered in the decommissioning of properties contaminated with uranium and thorium ores and residues. Tables of doses for all significant pathways to man have been developed. The listed doses may be ratioed to known air, soil, and water concentrations, exposure time, dietary intake, and other known parameters to estimate the total radiation dose for individuals. All internal doses listed are 50-year dose commitments; all external doses are given as annual dose rates. In almost all cases of dose calculations, maximum conditions of exposure were assumed. Directions how to use the tables for site-specific dose determinations are given. (RAF)

THEORETICAL STUDIES; RADIATION DOSE; RADIONUCLIDES; URANIUM; THORIUM; ACTINIDES; PLUTONIUM; ORES; AIR; SOILS; WATER; TABLES; ENVIRONMENTAL EXPOSURE PATHWAY; DOSE COMMITMENT CALCULATIONS; INHALATION; RESUSPENSION; EXPOSURE, EXTERNAL; RADIATION, GAMMA; BUILDINGS; INGESTION; PICA; BEEF; MILK; VEGETABLES; ROOTS; UPTAKE; DRINKING WATER; FISH; STREAMS; BONES; KIDNEYS; LUNGS; RADON 222

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Hoenes, G.R., L.D. Perrigo, J.R. Devine, and L.G. Faust

The Impact of Decontamination of Light Water Reactor Radioactive Waste Treatment Systems. CONF-790923; Decontamination and Decommissioning of Nuclear Facilities, Proceedings of a Conference, Sun Valley, ID, September 16-20, 1979. Session V-A, (pp. 1-3), 90 pp. (CONF-790923). (1979)

One of the options in dealing with increased radiation levels and personnel exposure is decontamination of the primary system or parts of that system. This prompted the Nuclear Regulatory Commission (NRC) to ask Battelle-Northwest to identify and assess the effects of such decontamination the emphasis being on the adequacy of existing systems to accommodate a primary decontamination. What can be done in the way of cleanup to a primary system is governed by what can be done with the waste that is generated. Indirect matters such as layout, planning and operational approaches to decontamination and radwaste treatment were considered to be as important as those having to do with the specification of chemicals, the means for introducing and removing solutions from reactor primary systems, the storage of liquid waste or use of ion exchange resins to concentrate radioactive materials. Key conclusions and recommendations from the Battelle-Northwest study are as follows: (1) N-Reactor is the only operation power reactor in the United States that is currently ready for either a full system concentrated of dilute process decontamination. (2) Only the N-Reactor system is currently ready to accommodate radwaste produced during decontamination. (3) A bottleneck in radwaste treatment system operation, insofar as decontamination in concerned, appears to be the disposal of the concentrated waste that would result from such operations. (4) Another weak point is current radwaste systems is their capability to handle decontamination solutions. It is also clear that the ion exchange systems are not properly shielded, nor the plants capable of remotely handling highly radioactive ion exchange beds for dilute processes. (5) Greater attention should be placed on designing reactors and radwaste treatment systems for decontamination. In addition, adequate specification of materials and means for introduction and removing chemicals from reactors and radwaste treatment systems must be made. (6) Application of the ALARA philosophy is not an alternative to good design of reactors and radwaste treatment systems for decontamination, but complementary. (7) As long as concentrated decontamination procedures are considered to be viable alternatives for reducing radiation levels around reactor primary systems, fuel decontamination procedures should be considered and developed. (8) If dilute solution decontamination is to be considered as a means for reducing radiation levels and exposure around reactor primary systems, a demonstration of such processes is needed on a boiling water reactor and a pressurized water reactor. (9) A better transfer of information and better communications are needed. (10) Research and development work is needed. Noncondensed phase and foam phased chemistries are suggested as areas that might be considered. (Auth)(JMF)

This paper is only an abstract of the actual paper which is to be published later.

DECONTAMINATION; WASHING; NUCLEAR FACILITIES; EXPOSURE, OCCUPATIONAL; WASTES, RADIOACTIVE; WASTES, LIQUID; ECONOMICS; REACTORS, PWR

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House, K.E.

U.S. is Facing Problem of How to Dismantle Used Nuclear Reactors. Wall Street Journal, Oct. 12, 77:1. (1977, October 12)

News feature: the U.S. government is grappling with the problem of how to dismantle used nuclear reactors. Because of the long-term dangers of radioactivity, the reactors cannot simply be abandoned. Some experts believe the reactors could be buried in concrete vaults or put under guard for a few thousand years. However, both alternatives pose safety risks. GAO has accused the government of ignoring the problem, which will become much more serious when the larger commercial reactors used by utilities begin to wear out. No big commercial reactor has ever been dismantled, and it is unclear whether such a task could be completed.

NUCLEAR POWER; NUCLEAR POWER PLANTS; DECOMMISSIONING

271
IIT Research Institute, Chicago, IL

Deactivation of Homogeneous Liquid Reactor. Letter - IIT Research Institute to Division of Reactor Licensing (AEC); 2 pp. (1970, May 15)

Deactivated reactor can be treated as by-product material if control console is disconnected, control rods and motors removed, reactor core and recombiner drained, fuel, liquid, and gaseous wastes removed, and tubing to core interior severed and sealed. AEC will approve a contractor to do this work.

REACTORS, HOMOGENEOUS; BYPRODUCT MATERIAL; REGULATIONS, FEDERAL; DECOMMISSIONING; CONTROL ELEMENTS; COOLING SYSTEMS

272
Industrial Reactor Laboratories, Inc.

Industrial Reactor Laboratories Dismantling Plan. Letter with Attachments to NRC Office of Nuclear Reactor Regulation DOCKET 50-17; 44 pp. (1975, June 12)

The IRL reactor facility remains in a standby condition in preparation to the license transition from operating to possession only status. Reactor fuel and radioactive sources are in the process of being transferred off site to other licensees. Following this accomplishment, work will proceed on the decontamination of fixed components; radioactive waste materials will be packaged and shipped to license burial grounds, and certain equipment and system components which may be taken apart under established maintenance procedures will be disassembled. The dismantling of fixed reactor components will not be initiated until the commission authorizes such activities.

REACTORS, RESEARCH; DECOMMISSIONING; PROCEDURES

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International Atomic Energy Agency, Vienna, Austria

Present Trends in Radioactive Waste Management Policies in OECD Countries and Related International Co-operative Efforts. IAEA-CN-36/491; International Conference on Nuclear Power and Its Fuel Cycles, Salzburg, Austria, May 2-13, 1977, (13 pp.). (1977)

In recent years waste management has received increased attention not only at the national level but also internationally in order to harmonize to some extent the policies and practices to be followed and to continue to achieve a high safety standard in this field. In particular, discussions are taking place between OECD member countries on the definition of objectives, concepts and strategies for radioactive waste management with a view to presenting coherent overall systems covering not only the treatment and storage aspects for the short term but also the longer term problems of disposal in the context of a rapidly developing nuclear fuel cycle. The technical, administrative, legal and financial aspects of the waste management problems are being discussed and various approaches are envisaged for the future. In addition to the discussion of policies and practices, a significant effort is also being initiated on research and development. The disposal problem has been given priority particularly as far as high-level waste and alpha-bearing wastes are concerned. Close international co-operation has been initiated in this sector as well as on the conditioning of high-level radioactive waste. As a result of these efforts an international R and D program is being established at the site of the Eurochemic Reprocessing Plant on the incorporation of high level waste into metal matrices. Increased co-operation is also taking place concerning other waste management problems such as the management of gaseous waste, alpha waste and cladding hulls and the question of dismantling and decommissioning of obsolete nuclear facilities. The paper describes in detail the results achieved so far through this co-operation between OECD member countries and presents current plans for future activities.

FORECASTING; FUEL CYCLES; INTERNATIONAL COOPERATION; WASTE DISPOSAL; WASTE MANAGEMENT; WASTE STORAGE

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International Atomic Energy Agency, Vienna, Austria

Decommissioning of Nuclear Facilities. Report of a Technical Committee Meeting Organized by the IAEA, Vienna, Austria, October 20-24, 1975, 44 pp. (1975)

Present concepts on stages of, designing for, and costs of decommissioning, together with criteria for site release, are described. Recent operations and studies and assessments in progress are summarized. Wastes from decommissioning are characterized.

COSTS; NUCLEAR FACILITIES; RADIOACTIVITY; REACTOR DECOMMISSIONING; REACTOR SITES; REGULATIONS; WASTE MANAGEMENT; WASTES, RADIOACTIVE

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International Atomic Energy Agency, Vienna, Austria

Decommissioning of Nuclear Facilities, 1977 Edition. Report of a Technical Committee Meeting Organized by the IAEA, Vienna, Austria, October 24-28, 1977, 23 pp. (1978)

The need for development or refinement of some technical aspects of decommissioning and for international acceptance of definition of "stages" is reviewed. The bases for a code of practice and a guide to the code for decommissioning land based reactors are outlined.

BIBLIOGRAPHIES; COSTS; DECOMMISSIONING; DECONTAMINATION; NUCLEAR FACILITIES; NUCLEAR POWER PLANTS; REACTOR DECOMMISSIONING; RECOMMENDATIONS; STANDARDS, INTERNATIONAL

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International Atomic Energy Agency, Vienna, Austria

Decommissioning of Nuclear Facilities. IAEA Bulletin 21(1):58-61; Proceedings of an IAEA/NEA International Symposium, Vienna, November 13-17, 1978. International Atomic Energy Agency, Vienna. (1979, February)

Much information on decommissioning has been developed over the past years in various IAEA Member States; thus, the primary objective of the symposium was to review progress and air concerns on decommissioning for subsequent dissemination to interested countries. It was pointed out that in order to have appropriate national and international policies on decommissioning, we must have a knowledge of the alternatives and their impacts. In the USA the Nuclear Regulatory Commission is re-evaluating its policy on decommissioning. Present regulations, guidance and experience are being reviewed and detailed engineering studies on alternatives and costs are being sponsored for most types of commercial fuel cycle facilities. Based on past experience in decommissioning a relatively large number of small nuclear facilities, many Member States have been carrying out engineering analyses on decommissioning existing large installations. The unanimous conclusion from all these studies is that safe decommissioning of large nuclear facilities, including dismantling, is feasible with existing technology and at costs that would add no more than a few percent to the cost of nuclear electricity. Potential release of radionuclides during decommissioning, the acceptibility of low residual levels of radioactivity in decommissioning facilities, sites or materials and the classification of wastes arising from decommissioning are receiving major emphasis in most countries with nuclear power. About 65 licensed reactors have been or are in the process of being decommissioned. Most of these were demonstration, test or research reactors; some were small power reactors. A significant number of other small fuel cycle facilities have also been decommissioned. Chemical and mechanical decontamination and operations controlled remotely are key activities in decommissioning. Several types of French telemanipulators were described that should be applicable to remote operations required in decommissioning. These devices can use many tools such as television cameras, plasma torches, inspection devices, etc. It is generally felt that by the time decommissioning becomes a major activity, improvements to decommissioning technology will have been developed further. The consensus in the community is that only minor changes, if any, need be made to the designs of nuclear facilities to ease decommissioning efforts. There was a clear consensus that terminology for decommissioning should be standardized, both nationally and internationally, with careful attention. (Auth)(JMF)

DECOMMISSIONING; NUCLEAR FACILITIES; REACTORS; STANDARDS, FEDERAL; STANDARDS, INTERNATIONAL; COSTS; RADIONUCLIDES; FUEL REPROCESSING; REGULATIONS, FEDERAL

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International Chemical and Nuclear Corporation

Further Decontamination Plans. Letters to Region V Compliance. (1968, October 2)

Correspondence Oct. 2, 4, 29, and Nov. 12 supplementing the decontamination plans of Sept. 6 for 801 N. Lake St. culminated in Region V Compliance Permission (Nov. 18) to proceed with dismantling. Items had included air and personnel monitoring, decontamination procedures, AEC responsiblity secondary to California except for Pu lab and facility, transfer of licensed materials.

DECONTAMINATION; FABRICATION PLANTS; HOT CELLS; PLUTONIUM; NEUTRONS; COMPLIANCE; DECOMMISSIONING

278

International Chemical and Nuclear Corporation

Justification for Delay in Decommissioning Nuclear Facility. Letters of Segal and Karp and Inc Corporation; 20 pp. (1969, March 31)

(Letter, 3/31/69) Licensee wants to comply with decommission order but State of California has not approved decommissioning process. (Letter 3/28/68). Delay is extended because AEC and State of California want approve procedures. Present delay is for approval of shipping container for Pu-Be sources. Decommissioning scheduled to decontaminate and release building by mid-October 1969. Outside contract for decontamination is for economic consideration.

BERYLLIUM; LICENSE STATUS; PLUTONIUM; COMPLIANCE; DECOMMISSIONING; NUCLEAR MATERIALS; REGULATIONS, STATE

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Jenkins, C.E., E.S. Murphy, and K.J. Schneider Battelle-Pacific Northwest Laboratories, Richland WA

Technology, Safety and Costs of Decommissioning a Reference Small Mixed Oxide Fuel Fabrication Plant, Vol. 1 - Main Report. NUREG/CR-0129(Vol. 1); 315 pp. (1979, February)

Safety and cost information are developed for the conceptual decommissioning of a small mixed oxide fuel fabrication plant (MOX) with characteristics similar to the Cimmaron Plutonium Facility. The process building, the contaminated sewage lagoon, and the conceptual liquid waste evaporation and uranium nitrate load-in facilities are postulated to be decommissioned in this study. The plant is conceptually decommissioned to three decommissioning states or modes: immediate dismantlement, safe storage with deferred dismantlement, and entombment. These modes range from complete removal of radioactivity above de minimus levels, with subsequent release of the site for unrestricted use, to minimal decommissioning requiring significant continued maintenance and surveillance.

ACCIDENTS; REGULATIONS; SAFEGUARDS; NUCLEAR MATERIALS; SITE SELECTION; LICENSING; DECOMMISSIONING; WASTE TREATMENT; WASTE STORAGE; PLUTONIUM; OXIDES; COSTS

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Jenkins, C.E., E.S. Murphy, and K.J. Schneider Battelle-Pacific Northwest Laboratories, Richland, WA

Technology Safety and Costs of Decommissioning a Reference Small Mixed Oxide Fuel Fabrication Plant, Vol. 2 Appendices. NUREG/CR-0129(Vol. 2); 355 pp. (1979, February)

Detailed technology, safety and cost information are presented for the conceptual decommissioning of a reference small mixed oxide fuel fabrication plant. Alternate methods of decommissioning are described including immediate dismantlement, safe storage for a period of time followed by dismantlement and entombment. Safety analyses, both occupational and public, and cost evaluations were conducted for each mode.

SITE SELECTION; FABRICATION; RADIOCHEMICAL PROCESSING; ENVIRONMENT; RADIATION DOSE; SOLVENT EXTRACTION; DECOMMISSIONING; CONCRETES; CONTAINERS; QUALITY ASSURANCE; FUEL REPROCESSING; TRANSPORTATION

281

Jersey Central Power and Light Company

Saxton Decommissioning Plan and Safety Analysis Report. DOCKET 50-146; Letter to AEC Div. of Reactor Licensing from Saxton Nuclear Experimental Corp.; 1 p. (1972, April)

Reactor operation with Core 3 will end May 1. Reactor will be defueled and ready to begin decommissioning June 15, 1972. The final plant configuration will resemble that of the CVTR and Pathfinder reactors except that all by-product material will be within the containment vessel. More than 99% of the activity is induced activity in the reactor vessel walls and reactor intervals. The vessel will be inside the reactor/fuel-storage compartment. Describes decommissioning plan and presents safety analysis. Includes technical specifications.

REACTORS, PWR; PROCEDURES; SAXTON REACTOR; SPECIFICATIONS; DECOMMISSIONING; SAFETY; DOCUMENTATION

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Jones, T.F. Idaho Operations Office, Idaho Falls, ID; Aerojet Nuclear Company, Idaho Falls, ID

Program Plan for Decontamination and Decommissioning the Materials Testing Reactor at the INEL. pp. 325-344. (1975, September)

DECONTAMINATION; MTR REACTOR; PLANNING; REACTOR DECOMMISSIONING; REACTOR DISMANTLING

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Jouannaud, C., D. Mechali, P. Regnaut, J. Leclerc, and F. Niezborala International Atomic Energy Agency, Vienna, Austria

Analysis of Safety and Protection in Fuel Reprocessing Plants. International Conference on Nuclear Power and Its Fuel Cycles, Salzburg, Austria, May 2-13, 1977 (19 pp.). (1977)

The industry of irradiated fuel processing plants has already a long experience, since it began operating in the last few years of World War 2. The recent development of nuclear energy, in particular with light water reactors and fast breeders, gave rise to some new problems which are worthy of attention from the standpoint of safety and protection. The safety analysis of a facility must be made with the aid of a strict method, such that no important safety-related point is overlooked. This is the essential condition for overcoming nuclear hazards. The main problems of the irradiated fuel processing plants are surveyed. Liquid and gaseous effluents are the main noxious products for the environment. Their effect is evaluated and a description is made of the means used, or being studied, to reduce the releases. The safety problems of various solid waste products, in particular fuel claddings and concentrated fission products are studied. The main steps of the process such as reception and storage of the irradiated fuel, dissolution, extraction, are examined from the standpoint of nuclear hazards: irradiation, contamination, criticality. The safety of a plant rests for a great part on the operation. The authors emphasize the main features of this function. Lastly are recalled the problems of dismantling after decommissioning.

ACTINIDES; FISSION PRODUCTS; FUEL REPROCESSING PLANTS; HEAD END PROCESS;

WASTE DISPOSAL; WASTE STORAGE; SAFETY; SOLVENT EXTRACTION; SPENT FUELS STORAGE

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Kikta, M.J., G.J. Marmer, R.L. Mundis, J.H. Opelka, J.M. Peterson, and B. Siskind

A Decommissioning Plan for Particle Accelerators. CONF-790923; Decontamination and Decommissioning of Nuclear Facilities, Proceedings of a Conference, Sun Valley, ID, September 16-20, 1979. Session II-B, (pp. 10-12), 90 pp. (CONF-790923). (1979)

Decommissioning a particle accelerator is different in some respects than decommissioning a fuel reprocessing plant (FRP) or pressurized water reactor (PWR). The residual radiation at an accelerator is primarily due to neutron-induced activity and there is generally no surface or airborne contamination. The time for radioactive components to decay to essentially background radiation levels is less than one hundred years for most accelerator components rather than thousands of years as for reactors. Dismantlement for scrap metal value and storage at above-ground retrievable sites have occurred. The entombment alternative is generally unattractive since the accelerator components are already in solid form, generally contain small induced activity densities and have future metal recycle potential. Mothballing can be permanent or serve as temporary retrievable storage until reutilization or radioactive disposal. Managerial and operational requirements for an accelerator decommissioning are similar to but not on the same scale as for PWR and FRP decommissioning. At smaller accelerators where little or no interest has been expressed in component reutilization, it may be best to request competitive bidding on a single contract or dismantling and removal for radioactive burial or scrap resale. The dismantling sequence for a large accelerator will include rigging services, demolition of concrete structures, possibly land reclamation and will require about eighteen to twenty-four months, not including a possible mothballed period following shutdown. High energy accelerators (above 1 GeV) will require remote handling techniques or a mothballed period prior to disassembly of highly activated components. Most medium energy accelerators can be dismantled using contact methods with localized shielding. The estimated costs associated with the dismantling of four representative accelerators at Argonne National Laboratory are: (1) Proton synchroton - 5.6 X 10(E+6) dollars; (2) Medium size cyclotron - 1.3 X 10(E+6) dollars; (3) Tandem van de Graaf - 1.2 X 10(E+5) dollars; (4) Electron linac - 7.6 X 10(E+4) dollars. As references a pressurized water reactor would be 4.2 X 10(E+7) dollars and a fuel reprocessing plant would be 5.8 X 10(E+7) dollars as of 1975. Although hundreds of components of major accelerators are extremely massive, they present generally manageable activation levels. The massive waste, substantial cost and potential future recycle of valuable copper and iron from an accelerator decommissioning should not be ignored in the development of an overall decommissioning policy for nuclear facilities. (Auth)(JMF)

This paper is only an abstract of the actual paper which is to be published later. The document contains tables of the radioactive mass at decommissioning for various accelerator designs and dismantling costs.

DECOMMISSIONING; NUCLEAR FACILITIES; REACTORS, PWR; FUEL REPROCESSING; CONTAMINATION; STORAGE, INTERIM; REGULATIONS, FEDERAL; COSTS; RECYCLING

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Kluk, A.F.

Management of the Department of Energy Inventory of Excess Radioactively Contaminated Facilities. CONF-790923; Decontamination and Decommissioning of Nuclear Facilities, Proceedings of a Conference, Sun Valley, ID, September 16-20, 1979. Session IV-B, (pp. 2-3), 90 pp. (CONF-790923). (1979)

The DOE program for managing the inventory of surplus facilities is divided into four major budget categories including surveillance, development of disposition methods, planning, and disposition. Surveys have been conducted under AEC, ERDA, and now DOE to identify those radioactively contaminated facilities that were no longer required to support planned or ongoing programs. The inventory results of the latest survey are documented in the "Preliminary Plan for Decommissioning of Department of Energy Radioactively Contaminated Surplus Facilities," which identifies about 450 facilities. Included are numerous reactor buildings, stacks, laboratories, fuel reprocessing plants, and waste management facilities, most of which are located at Hanford.

An important part of the program is the development of new and improved technology for disposition of nuclear facilities including decontamination of concrete, volume reduction of process equipment, and the decontamination of metals by smelting. These RD studies are designed to improve: (1) the efficiency of disposition techniques, (2) consistency in planning, (3) the cost estimating process, and (4) design techniques will ease eventual disposition of nuclear facilities. The first version of a decommissioning plan was prepared in FY 1978 and proposed that a twenty-year program be undertaken to eliminate the backlog of suplus facilities at a total cost of over $400 million. Such a program will require an annual funding level of $20-25 million to maintain continuity of contractor staffing for technical planning, supervising, and implementing disposition operations in a cost effective manner. Under the disposition category, selected disposition projects are implemented. Disposition projects currently underway include decommissioning the plutonium contaminated gloveboxes in Building 350 at Argonne National Laboratory to permit alternative use of the building; decommissioning the Gnome Site at Carlsbad, New Mexico, to remove restrictions on surface use; dismantling the Redox Plutonium Concentration Building at Richland as a demonstration project; decontamination of the uranium raffinate pits at the Weldon Spring Site near St. Louis, Missouri, to begin the rehabilitation of that site for future alternative uses; and dismantling the Sodium Experiment at Santa Susana to permit reuse of the reactor building. (Auth)(JMF)

This paper is only an abstract of the actual paper which is to be published later.

DECOMMISSIONING; DECONTAMINATION; WASHING; NUCLEAR FACILITIES; COSTS; CONTAMINATION; REPROCESSING; MAINTENANCE; WASTE MANAGEMENT; CONCRETES; VOLUME REDUCTION; COST ESTIMATES; PLUTONIUM; GLOVE BOXES

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Kock, R.C.

Final Decontamination Plans for Plutonium Lab. *Letter to Revion V Compliance,* USAEC, Berkeley, Calif., September 6, 1968, from R. C. Koch. (1968, September 6)

Complete procedures for final decontamination and dismantling Pu processing lab at 801 N. Lake Street, Burbank, California (hot cell, storage pool, machine shop, chem lab). Pool contaminated with soluble Cs 137 and Co 60, other surfaces with Pu 238 to 5 x 10(E+6) dpm/100 sq cm. Neutron fields range 10-280 mrem/hr.

CESIUM; COBALT; DECONTAMINATION; FABRICATION PLANTS; HOT CELLS; PLUTONIUM; NEUTRONS; RADIATION SOURCES; COMPLIANCE; ISOTOPES; DECOMMISSIONING

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Karlsruhe, Abteilung Reaktorbetrieb und Technik, Karlsruhe, German Federal Republic

Development of Methods and Techniques for Decommissioning and Ultimate Disposal of Nuclear Facilities. First Semiannual Report 1976 (pp. 514-518). (1976, November)

The possibilities of dismantling and removing large components from modern PWR and BWR plants were studied with respect to the problems arising from the activation and contamination. Various possibilities of shipment and loading of large components and their bagging into the conditioning plant and support in the hot disassembly cell were investigated and the pros and cons of the different techniques were discussed. The design drafts of conditioning plants were completed by entering the necessary auxiliary rooms. Concerning the 'in situ conditioning' investigations were made, to find out the best places for the conditioning plant in a power reactor site.

BUILDINGS; REACTORS, BWR; DECONTAMINATION; PLANNING; REACTORS, PWR; REACTOR COMPONENTS; REACTOR DECOMMISSIONING; REACTOR DISMANTLING; TRANSPORTATION

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Konzek, G.J., and C.R. Sample Battelle-Pacific Northwest Laboratories, Richland, WA

Decommissioning of Nuclear Facilities - An Annotated Bibliography. NUREG/CR-0131; 525 pp. (1978, October)

This bibliography compiles pertinent, unclassified references relating to the decommissioning, including decontamination and disposal, of nuclear equipment and nuclear fuel cycle facilities. This document contains the results of a literature review sponsored by NRC to establish an information source to aid researchers, scientists, and engineers currently engaged in decommissioning studies. This document presents abstracts from 726 references, along with identification numbers (1 through 726) that are cross-referenced to author, report number, and subject (keyword) indexes.

BIBLIOGRAPHIES; DECOMMISSIONING; DECONTAMINATION; WASTE DISPOSAL; EQUIPMENT; NUCLEAR POWER PLANTS; MINING; MILLING

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Koochi, A.K. United Nuclear Industries, Inc., Richland, WA

Project Plan Disposition of the 303-L Oxide Burner Building 300 Area. UNI-1377; 6 pp. (1979, July 30)

The oxide-burning facility consists of two butler-type steel buildings located on top of a curb-enclosed concrete pad. Together, the buildings measure 8.23 m x 7.32 m x 3.66 m. Throughout the 1960's and early in the 1970's, uranium and zircaloy-2 scrap were burned in a controlled manner to convert the metals to more stable oxide. In april 1971, the facility was shut down and all the equipment was removed. The objective of the 303-L disposition effort is to safely remove and dispose of the loose uranium oxide contained within the building and to completely dismantle the facility, down to the concrete pad. Planned disposition steps are outlined. They include site preparation, removal of the interior structure, removal of the exterior structure, and stabilization of the concrete floor. Procedures will be prepared to identify the radiological controls necessary to limit personnel exposure to fixed and airborne radioactivity. It is estimated that a total of 24 man-weeks will be utilized to complete the project at a cost of $53000. (RAF)

NUCLEAR FACILITIES; DISMANTLING; BUILDINGS; CONCRETES; STEELS; URANIUM COMPOUNDS; OXIDES; ZIRCALOYS; DISPLACEMENT; SAFETY; HAZARD ANALYSIS; RADIOLOGICAL SURVEYS; COST ESTIMATES; WORK SCHEDULE; EXPOSURE, OCCUPATIONAL

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Kroeger, W., J. Altes, and K. Schwarzer Kernforschungsanlage Juelich G.m.b.H., Institut fuer Nukleare Sicherheitsforschung, Juelich, German Federal Republic

Underground Siting of Nuclear Power Plants with Emphasis on the 'Cut-and-Cover' Technique. International Seminar on Extreme Load Conditions and Limit Analysis Procedures for Structural Reactor Safeguards and Containment Structures, Berlin, German Federal Republic, September 8, 1975; Nuclear Engineering and Design 38(2):207-227. (1976, August)

The paper provides a survey of activities in the field of underground siting in Europe. Emphasis is placed on the 'cut-and-cover' technique because of the geological and topographical conditions prevailing in Germany. Basic considerations show the potential of an additional level of containment, of better protection against external effects, and of better conditions for decommissioning. Design concepts for HTR systems and especially for LWR systems which do not require extensive changes in the above-ground design are defined, and a preliminary assessment is given.

CONTAINMENT; DESIGN; EARTHQUAKES; REACTORS, HTGR; REACTORS, LWGR TYPE; REACTOR SAFETY; SITE SELECTION; SPECIFICATIONS; UNDERGROUND NUCLEAR STATIONS

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Kulcinski, G.L., G. Kessler, J. Holdren, and W. Hafele University of Wisconsin

Energy for the Long Run: Fission or Fusion? American Scientist 67(1):78-89. (1979, January-February)

Technical report: the present status and future applicability of fission and fusion nuclear energy are compared. World energy resources are summarized. Fuel costs and fuel usage are discussed. The development of prototype fission FBR's in various countries is assessed. RD costs, capital costs, technical complexity, potential biological and social hazards, and time factors involved in implementing fission and fusion reactor programs are assessed and compared. The problems of materials deterioration, radioactivity, accidental release of radioisotopes, nuclear safeguards, and commercialization are addressed. (8 graphs, 13 references, 4 tables)

NUCLEAR POWER; TOKAMAKS; REACTORS, LMFBR; NUCLEAR FUELS; PLASMA; INERTIAL CONFINEMENT; RADIATION PROTECTION; NUCLEAR POWER PLANTS; DECOMMISSIONING; ISOTOPES; REACTOR SAFETY; SAFEGUARDS; DEUTERIUM; TRITIUM; FUEL CYCLES

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Kusler, L.E. Atlantic Richfield Hanford Company, Richland, WA

Survey of Decontamination and Decommissioning Techniques. ARH-CD-984; 18 pp. (1977, May 25)

A review has been made of decommissioning studies and reports as part of the General Project for the Savannah River Laboratory (SRL) program to develop a conceptual design of a commercial reprocessing plant for fuel from Light Water Reactors (LWR). The optimum method for a given situation in decontamination of metal surfaces will depend on a number of factors including: (1) the types and amounts of contamination present, (2) accessibility of the contaminated surface, (3) the degree of decontamination required, and (4) the methods available for disposing of contaminated wastes generated. The decontamination of metal surfaces normally involves the use of liquid decontamination solutions. This requires, however, that facilities for disposing of the contaminated liquid wastes be available. If disposal facilities are not available, dry decontaminating procedures must be used. The degree of decontamination of nonmetallic surfaces depends largely on the type of surface to be cleaned. Relatively nonporous surfaces such as wood, transite and masonite present much more difficult problems. Nonporous surfaces can be effectively decontaminated manually using the appropriate cleaning solutions. Effective decontamination of porous surfaces depends on the depth to which the activity is penetrated. Concrete surfaces which have been exposed only to radioactive solids or slurries, where the activity has not penetrated significantly, can be decontaminated by vacuuming the surface to remove loose contamination; mopping or wiping the surface with a mild detergent solution or solvent to remove any soil, grease or adherent dirt. A minimum of liquid should be used, and the contact time should be as short as possible. Alternatively, dry steam could be used; vacuuming the surface again after it has dried. This approach or modifications thereof will remove most of the surface contamination. If the radioactivity has penetrated into the concrete, effective decontamination requires removal of the contaminated surface layer. Dry sandblasting or shot blasting, vacuum blasting, mechanical abrasion, abrasive sawing, flame spalling, and explosive spalling may be used. Battelle Northwest Laboratories is currently investigating the use of rock splitters and water cannon for removing contaminated concrete. Special precautions must be taken to minimize the spread of airborne contamination and prevent recontamination of clean surfaces. Contaminated equipment have generally been removed using standard metal cutting equipment. The plasma torch is one tool that has received considerable development effort in order to cut remotely under water or in air. The use of shaped charges has been used successfully in cutting contamination pipes and structural components. Quantities of waste generated during the decommissioning activities and detailed costs identifying various components included in the total cost are areas in which published data are limited. (Auth)(JMF)

DECONTAMINATION; DECOMMISSIONING; NUCLEAR FACILITIES; FUEL REPROCESSING; REACTORS, LIGHT-WATER; METALS; METHODS; CONCRETES; CONTAMINATION; WASTES, RADIOACTIVE; WASTE DISPOSAL; PLASTICS; GLASS; DETERGENTS; WASTES, LIQUID; WASTES, SOLID; WASHING; EXPLOSIONS, NON-NUCLEAR; COSTS

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Laguardia, T.S. Nuclear Energy Services, Inc., Danbury, CT

Nuclear Power-Reactor Decommissioning. Nuclear Safety 20(1):15-23. (1979, January-February)

This article summarizes the major findings of an evaluation of several alternatives for decommissioning 1000-MWe nuclear power reactors. The evaluation included the technical feasibility of decommissioning and the costs, schedule, environmental impacts, and occupational exposures for three decommissioning alternatives: mothballing, entombment, and prompt removal of radioactive components and dismantling. Also, two combinations of these alternatives were evaluated: mothballing-delayed removal and dismantling and entombment-delayed removal and dismantling. The evaluation demonstrated that no new technology is required to safely decommission a large power reactor.

NUCLEAR POWER PLANTS; DECOMMISSIONING; COSTS; ECONOMICS; PERSONNEL; EXPOSURE, OCCUPATIONAL; WASTE DISPOSAL

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LaGuardia, T.S.

Decommissioning Methods and Equipment. CONF-790923; Decontamination and Decommissioning of Nuclear Facilities, Proceedings of a Conference, Sun Valley, ID, September 16-20, 1979. Session IV-A, (pp. 5-6). 90 pp. (CONF-790923). 1979)

The U.S. Department of Energy (DOE) Division of Environmental Control Technology requested Nuclear Energy Services to prepare a handbook for the decontamination and decommissioning (D and D) of DOE owned and commercially owned radioactive facilities. The major areas of interest in D and D programs are decontamination, removal of contaminated piping and components, removal of reactor vessels and internals, and demolition of radioactive and non-radioactive concrete. The primary methods for decontamination of piping systems, building surfaces, tools, etc., are mechanical, chemical, ultrasonic and electopolishing methods. Mechanical techniques involve the removal of the contaminated surface by grinding, scraping, machining of piping and components, and scarifying of concrete surfaces. Chemical decontamination methods include destructive and non-destructive chemical dissolution of the contaminated layer of material whether within piping systems or on external metal surfaces. Ultrasonic methods employ high frequency sound generators in a fluid couplant to agitate the adherent surface contamination and lift it from the surface. Electropolishing is a relatively new application of an old technique whereby thin layers (0.002 inches) of contaminated metals are removed using an electrical potential difference between the work piece and the cathode in a phosphoric acid electrolyte. Removal of contaminated piping and components is a well-developed practice with a great deal of nuclear experience available to demonstrate feasibility. The high radiation levels associated with removal of reactor vessels and internals necessitates the use of remote operated cutting devices capable of penetrating steels almost 10 inches thick. Major advancements to the state-of-the-art were made during the decommissioning of the Elk River Reactor in Minnesota where a 4-inch thick carbon steel vessel clad with stainless steel was cut with a remote operated plasma arc torch. The capability of the plasma torch to cut steels and much greater than 7-inches thick has not yet been demonstrated. A recent application of a technique formerly used in the steel industry for cutting thick steels is the arc saw. This method uses a rotating circular toothless saw blade through which is passed a high amperage direct current. The high current arcs between the workpiece and blade to melt kerf in the workpiece, and the rotating water-cooled blade blows the molten metal from the kerf. This arc saw method is capable of cutting through 36-inch thick steel sections and is limited only by the power supply and the diameter of the blade. However, for massive concrete demolition, the explosive method is most reliable and fastest. (Auth)(JMF)

This paper is only an abstract of the actual paper which is to be published later.

DECONTAMINATION; WASHING; DECOMMISSIONING; NUCLEAR FACILITIES; EQUIPMENT; COSTS; ENVIRONMENT; CONCRETES; CONTAMINATION; RADIATION HAZARDS; RADIATION SOURCES; METHODS; REVIEWS

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Lahs, W.R., R.B. Paulson, and W.B. Sayer Atomics International, Canoga Park, CA

Preliminary Report Postoperational Safety of Reactor Power System for NASA Space Station. Volume 3. Safety Analysis. Report; 181 pp. (1970, June 30)

A preliminary safety analysis of the post operational questions regarding the use of reactor power systems for an orbital space station is presented. The objective of the analysis is to provide a quantitative measure of the risk to man from the disposal of a space nuclear power system after its useful lifetime.

REACTOR DISMANTLING; REACTOR SAFETY; REACTOR SHUTDOWN; REACTORS, SPACE POWER

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Landon, J.L., and R.L. Miller

Decontamination and Decommissioning of the Shippingport Atomic Power Station. CONF-790923; Decontamination and Decommissioning of Nuclear Facilities, Proceedings of a Conference, Sun Valley, ID, September 16-20, 1979. Session III-B, (pp. 5-6), 90 pp. (CONF-790923). (1979)

The Division of Naval Reactors (NR) will be completing the LWBR core power operations for the Shippingport Atomic Power Station's (SAPS), conducting end-of-life tests, and defueling to terminate operation of the plant. The power station is located on the south bank of the Ohio River in the Borough of Shippingport, Beaver County, Pennsylvania, on a 486.8 acre tract owned by the Duquesne Light Company. The reactor is a pressurized water reactor (PWR) with four loops. Two of the steam generators are of U-tube design by the Babcock and Wilcox Company and two are of straight tubed design by the Foster Wheeler Company. It has previously been operated with a "seed-blanket" core with power levels as high as 150 MWe. The cores operated prior to the current LWBR were designated PWR-1 and PWR-2. The reactor, steam generators, pressurizer, coolant pumps, and other components directly associated with the primary system are located within steel chambers which are enclosed within a reinforced concrete structure. The SAPS has all auxiliary systems normally associated with a PWR type reactor, i.e., off-gas decay tanks, radwaste treatment, component cooling water, high pressure injection, etc. All systems which may be contaminated are included in the scope of work. Initial D and D activities will be concurrent with end-of-life testing and defueling of the reactor. The D and D of SAPS will be performed in such a manner so as to serve as example for future D and D work. A disposition assessment to estimate waste volumes, transportation modes, occupational exposure, costs/schedule, and environmental risks for alternative modes of decommissioning is being prepared. This evaluation of alternative modes of decommissioning, which range from total entombment to immediate dismantlement, is scheduled to be complete by June 1, 1979. Based on the data gathered during the disposition assessment, an environmental assessment will be prepared for each viable alternative. The environmental assessment scheduled for completion July 1, 1979, will also serve to determine the need for an environmental impact statement (EIS). Detailed engineering for the chosen alternative(s) from the disposition and environmental assessments will provide detailed procedures, tool/equipment requirements, schedule/costs, waste disposal requirements, safety/exposure requirements, and work packages. The detailed engineering is currently planned for completion by January 1, 1981. Concurrent with detailed engineering, an environmental impact statement will be prepared (if determined to be necessary by the environmental assessment), by March 31, 1981. Depending on the reactor operating/shutdown schedule, the date of actual D and D initiation is tentatively scheduled for January 1, 1982. The project management for the decommissioning of the SAPS will be by the National D and D Program Office, DOE/RL and coordinated through the National D and D Programs Department of UNCNI as lead contractor. (Auth)(JMF)

This paper is only an abstract of the actual paper which is to be published later.

DECOMMISSIONING; DECONTAMINATION; WASHING; NUCLEAR FACILITIES; REACTORS, PWR; WASTES, RADIOACTIVE; REACTORS, BREEDER; WASTES, TRANSURANIC; WASTE MANAGEMENT; CONTAMINATION; WASTE DISPOSAL; EXPOSURE, OCCUPATIONAL; COSTS; ENVIRONMENT; ENVIRONMENTAL IMPACT STATEMENTS; SHIPPINGPORT REACTOR

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Lanni, L. International Atomic Energy Agency, Vienna, Austria

Some Realities of Nuclear Power Plant Decommissioning. IAEA Bulletin 20(6):24-28. (1978, December)

The IAEA currently has defined three basic options for decommissioning a nuclear reactor: lockup with surveillance, restricted site release, and unrestricted site release. Other topics discussed are: decommissioning costs, decommissioning experience, and future decommissionings.

DECOMMISSIONING; WASTE MANAGEMENT

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Lapp, R.

Nader's Nuclear Issues: A Critique of Ralph Nader's Charge that "Nuclear Fission Power is Unsafe, Unnecessary, and Unreliable" 124 pp. (1975)

A critique of some of Nader's issues is made for the following topics: nuclear subsidy; nuclear risk; Nader on Weinberg and Lapp; secrecy; AEC defections; plutonium hazards; radioactivity; radiation effects; waste disposal; abnormal events; reliability; nuclear economics; insurance; the Rasmussen reactor safety study; geologic faults; sabotage; pressure vessel failure; the Titanic; and the Garrison State; safeguards; decommissioning; energy detours; technological choice; energy alternatives; Nader and PIRG; nuclear power issues 1975; Nader's nobel response; and Nader's congressional fact sheet. Major nuclear accidents, a paper entitled "Human Costs of Nuclear Power", a statement of Congressman McCormack before the Joint Engineering Legislative Forum, and a scientists' statement on energy are covered in four appendices. (MCW)

ACCIDENTS; ECONOMICS; FAILURES; NUCLEAR POWER; PRESSURE VESSELS; RADIATION EFFECTS; SABOTAGE; SAFEGUARDS; SAFETY; WASTE DISPOSAL; COSTS

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LaRiviere, J.R., and E.L. Moore Atlantic Richfield Hanford Company, Richland, WA

Conceptual Design Considerations for the Storage of Solidified High-Level Waste in Canisters at a Commercial Fuel Reprocessing Plant. Report; 19 pp. (1975, November)

Onsite storage of canisters of solidified high-level waste generated by the commercial fuel reprocessing plants (FRP) may be required prior to shipping these canisters to a federal repository. The most likely storage concept is to hold the waste-filled canisters in water storage basins. In the retrievable surface storage facility conceptual design studies, air-cooled and water-cooled storage of solidified high-level wastes has been considered. The studies of water-cooled storage included design considerations, as part of the conceptual design of the canisters and water storage basins, that would apply also to the conceptual design of similar facilities at an FRP. These similar considerations include: types of corrosion likely to develop on canisters stored in water, conditions that promote stress corrosion cracking (SCC), prevention of SCC, routine basin water cleanup, cleanup of a grossly contaminated water basin, effluent discharge discussions, storage basin integrity, and designing for decommissioning. (GRA)

CONTAINERS; DESIGN; WASTE STORAGE; RESEARCH PROGRAMS; AIR; COOLANTS; COOLING SYSTEMS; CORROSION; CRACKS; DECONTAMINATION; FUEL REPROCESSING PLANTS; WASTES, SOLID; STAINLESS STEELS; WATER

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Lavie, J.M., R.G. Giraud, G.B. Bardet, M.P. Pouteaux, and A.C. Charamathieu Commissariat a l'energie atomique, Paris, France; PEC Engineering/Infratome, Paris, France; Societe de travaux en milieux ionisants, Paris, France

Disposal of Waste Resulting from the Dismantling of Nuclear Facilities. IAEA-SM-234/32; Decommissioning of Nuclear Facilities, Proceedings of an International Symposium. Vienna, Austria, November 13-17, 1978. International Atomic Energy Agency, (pp. 337-352), 694 pp. (IAEA-SM-234/32). (1979)

The decommissioning of nuclear facilities will raise the problem of ultimate disposal of materials and equipment contaminated by a wide range of natural and artifical radioactive products. Classification of the waste stemming from the dismantling of nuclear facilities is based on the nature and half-life of the contaminating radionuclides. The presence of large quantities of noble metals and alloys among such waste is an incentive to devise decontamination procedures which would allow them to be reused. The problem has been solved as far as the storage and disposal of waste contaminated by activation products and fission products are concerned; the approach is described and illustrated by its application at the La Manche storage site in France. With regard to alpha-contaminated waste where the decay times are very long, the aim is to find and develop effective decontamination procedures for treating the waste and concentrating the alpha radioactivity. Furthermore, in the international organizations the representatives of the countries concerned are seeking to promote a consistent policy in seeking solutions to the problems of final storage of waste contaminated by transuranium elements. Studies have already begun, and will be continued, aimed at thorough decontamination of metal waste with a view to eliminating the 'extrinsic' radioactivity. The limits accessible by chemical and mechanical processes are inadequate and a research program is now under way to ascertain how effective the fusion decontamination process may be. (Auth)

NUCLEAR FACILITIES; DECOMMISSIONING; WASTE DISPOSAL; METALS; ALLOYS; DECONTAMINATION; RECYCLING; ACTIVATION PRODUCTS; FISSION PRODUCTS; WASTE STORAGE; ALPHA PARTICLES; GOVERNMENT POLICIES; WASTES, TRANSURANIC

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Lenneman, W.L., H.E. Parker, and P.J. West International Atomic Energy Agency, Vienna, Austria

Management of Radioactive Wastes. Annals of Nuclear Energy 3:285-295; CONF-750411; European Nuclear Conference, Paris, France, April 21-25, 1975, (11 pp.)(CONF-750411). (1976)

Areas bordering on or regarding radioactive waste management in the nuclear fuel cycle are discussed. Better management and control over mill tailings, a shortage of irradiated fuel storage space, and decommisioning criteria are areas that require immediate attention or preparation for future implications. Radium 226 is the chief concern with respect to mill tailings not because of its low concentration, 800 pci/g, but due to its long half-life, 1620 yr and the radon gas decay daughter. The tailings should be disposed of in areas where they can ultimately be stabilized and revegetated. It has been tacitly assumed that the fuel reprocessor would provide for adequate management of spent fuel so now there is a problem of fuel storage space. But storage is and will be a viable alternative to reprocessing for the next 10 years. Storage maybe achieved with existing technology at reactors with appropriately planned storing capability. Decommissioning of facilities should be included in the design. Criteria should be set up by governmental regulatory bodies. Techniques need to be developed for concentrating and containing krypton and tritium from fuel reprocessing effluents. The work is as yet experimental and involves incorporation in to polymers and resins. Another serious problem is resolving how high-level and alpha-bearing wastes are disposed. The most promising disposal method is disposal in suitable (salt, granites and shales) geologic formations. This method should be proven as the problem is a critical issue to the nuclear power industry. Regional fuel and management centers have been shown by cost analysis the best way of handling the wastes with the exception of tailings and fuel storage. It minimizes the potential hazard of handling. International cooperation is a must to achieve nuclear maturity. (NDV) Good overview of the state of the art and potential problems is presented. (ESIC NDV)

ACTINIDES; ALPHA PARTICLES; BIOSPHERE; CONTAINMENT; COST BENEFIT ANALYSIS; DAUGHTER PRODUCTS; EVALUATION; FUEL REPROCESSING; FUEL CYCLES; GASES; GEOLOGIC STRATA; GEOLOGIC STRUCTURES; GEOLOGIC TIME; GROUND WATER; HAZARD ANALYSIS; LITHOLOGY; MILLS; NUCLEAR FACILITIES; DECOMMISSIONING; REPROCESSING; SALT DEPOSITS; STORAGE, GEOLOGIC; TAILINGS; URANIUM COMPOUNDS; WASTE MANAGEMENT; WASTE STORAGE; WASTES, HIGH-LEVEL; WASTES, LIQUID; WASTES, LOW-LEVEL; WASTES, RADIOACTIVE; WASTES, SOLID

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Lester, R.K., and D.J. Rose

Nuclear Wastes at West Valley, New York. Technology Review 79(6):20-29. (1977, May)

A two-tiered approach is proposed for separating questions of who manages nuclear wastes from who pays for the management. The proper role of the federal government in the nuclear fuel cycle is explored in the historical context of the West Valley, New York reprocessing plant, which operated on a private basis from 1966 to 1972. The plant reprocessed 600 metric tons for fuel and produced 600,000 gallons of liquid high-level radioactive waste, most of which remains in a carbon steel tank waiting for the Nuclear Regulatory Commission or some other agency to assume responsibility for it. A review of the plant's purposes, operations, and shutdown illustrates the difficulties of establishing policies and rules for managing the wastes. Future use of the site will dictate the extent of decontamination and decommissioning that is needed, while legal and political issues of responsibility will also affect the rules. The case is made for conducting the cleanup as an experiment, using a prudent, rational, resolute, and charitable approach to taking necessary risks. A step-by-step process of decision and rule-making is proposed as an acknowledgement of the fact that all the answers are not known. ERDA is felt to be the best-suited for management, with guidelines formulated by the NRC. Financial responsibility could be divided between the National Science Foundation and federal and state governments. (DCK)

FUEL REPROCESSING PLANTS; GOVERNMENT POLICIES; NUCLEAR FACILITIES; NUCLEAR MATERIALS MANAGEMENT; RADIATION HAZARDS; RADIOACTIVE MATERIALS; WASTE DISPOSAL; WASTE STORAGE; RECOMMENDATIONS; REGULATIONS; REPROCESSING

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LeSurf, J.E., and H.E. Tilbe

Decontamination for Continued Operation - An Industrial Approach. CONF-790923; Decontamination and Decommissioning of Nuclear Facilities. Proceedings of a Conference, Sun Valley, ID, September 16-20, 1979. Session II-A (pp. 9-10). 90 pp. (CONF-790923). (1979)

There are several reasons for performing a decontamination, and many considerations to evaluate when deciding how and when to do it. Ethical and social aspects are equally as important as those related to power generation, energy conservation, availability of skilled workers and the economics of electricity. In the short term, the emphasis should be on determining the effects of the decontamination process on materials, components, and fuel assemblies, and on achieving reductions in radiation fields and man-rem exposures. In the long term, reactor design should be tailored to ease decontamination, maintainability, and reliability of equipment, so as to further reduce man-rem exposures. In both the short term and the long term, it is necessary to promote awareness in station staff of the need to minimize personnel exposures. A continued effort is also necessary on the development of equipment and techniques which will permit work to be done without high exposures. (Auth)(JMF)

This paper is only an abstract of the actual paper which is to be published later.

DECONTAMINATION; WASHING; NUCLEAR FACILITIES; CONTAMINATION; ECONOMICS; EXPOSURE, OCCUPATIONAL; SOCIAL ASPECTS; NUCLEAR POWER

304
Levenson, M., J. Kendall, R.R. Gay, and O. Ozer Electric Power Research Institute, Palo Alto, CA

RD Status Report: Nuclear Power Division. EPRI Journal 1(8):42-46. (1976, October)

Technical feature: end of life study of the Peach Bottom Unit 1 High Temperature Gas Cooled Reactor operated by the Philadelphia Electric Co., research projects in the thermal-hydraulic aspects of nuclear reactor safety, and projects relating the nuclear cross-section data base of the Electric Power Research Inst. are described. The primary objective of the Peach Bottom study is to document the performance of plant systems and materials and to compare the findings with the calculated results that would have flowed from a plant built with today's design practice so as to validate design methods for high temperature gas cooled reactors. (2 graphs, 3 photos)

NUCLEAR POWER; REACTORS, HTGR; DESIGN; NUCLEAR POWER PLANTS; DECOMMISSIONING

305
Lichfield, J.W., and J.C. King Battelle-Pacific Northwest Laboratories, Richland, WA

Interactive Planning System for Developing Decommissioning and Decontamination Plans at Hanford. ERDA/AESOP 17; CONF-770937; Proceedings of AESOP Conference, Boston, MA, September 13, 1977, Volume 17 (pp. 78-107) (ERDA/AESOP 17, CONF-770937). (1978, January)

The history and status of the Hanford Reservation are reviewed. Long-range plans for decommissioning and decontamination (D and D) of facilities must include methods, budget requirements, and schedules required to achieve specific goals for the future use of the reservation. Alternative plans and assessments of their effects are also necessary. Although these have not been completed, the planning methodology is fully developed and supporting computer models are operational. Steps in the planning approach include facility characterization, information management, facility prioritization, D and D mode selection, D and D activity characterization, scenario definition, and integrated planning and plan assessment. The methodology is illustrated by an example. 6 figures, 3 tables. (RWR)

DECOMMISSIONING; DECONTAMINATION; PLANNING; COSTS

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Litchfield, J.W., and J.C. King Battelle-Pacific Northwest Laboratories, Richland, WA

Planning for Decommissioning and Decontamination of Hanford Nuclear Facilities. BNWL-SA-6450; CONF-771102; 20th Annual AIChE Meeting, New York, NY, November 13, 1977 (47 pp.)(1977, September)

The 570-square mile Hanford Project contains facilities with varying degrees of radioactive contamination as a result of plutonium production operations. With the evolution of production requirements and technology, many of these have been retired and will be decommissioned and decontaminated (D and D). Planning for D and D at Hanford requires identification and characterization of contaminated facilities, prioritization of facilities for decommissioning, selection of D and D modes, estimating costs and other characteristics of D and D activities, definition of future scenarios at Hanford, and preparation and assessment of plans to achieve defined scenarios. A multiattributed decision model using four criteria was used to prioritize facilities for decommissioning. A computer-based interactive planning system was developed to facilitate preparation and assessment of D and D plans. (ERA Citation 03:055586)

NUCLEAR FACILITIES; COSTS; DECOMMISSIONING; DECONTAMINATION

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Lockheed-Georgia Company, Marietta, GA

Decommissioning of Radiation-Effects Reactor at the Lockheed-Georgia Company. DOCKET 50-172; Letter-Lockheed-Georgia Co. to AEC Division of Reactor Licensing; 6 pp. (1971, April 12)

Lockheed applies for authority to decommission the radiation effects reactor. The overall objective is to restore the site to such a low radiation level that surveillance can be greatly reduced or eliminated and part or all of the site may be released for unrestricted occupancy. Decommissioning will be considered complete when all the fuel and control-rod drives are transferred to licensed receivers. Detailed plans are given.

REACTORS, RESEARCH; REACTORS, POOL TYPE; DECOMMISSIONING; FUEL ELEMENTS; CONTROL ROD DRIVES; REACTOR OPERATION; LICENSING; RADIATION EFFECTS REACTOR LOCKHEED

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Logan, D., J. Landoni, and C. Baroczy Atomics International, Canoga Park, CA

Annual Technical Progress Report, AEC Unclassified Programs, GFY 1969. AI-AEC-12860; pp. 5-21. (1969, December)

Annual progress report on two projects - the general objective of the first project is to develop basic information of two-phase flow and boiling required in the safety evaluation of LMFBR designs. This information is important because of the key role that sodium boiling plays in reactor dynamics, in fuel meltdown accidents, and in the ultimate shutdown mechanism of the reactor. The objective of the second project is to provide technological support to the AEC and consumers public power district in the retirement of the HNPF.

REACTORS, GRAPHITE MODERATED; HALLAM REACTOR; HEAT TRANSFER; REACTORS, LMCR; SODIUM; DECOMMISSIONING; FLOW, TWO PHASE; REACTORS, LMFBR; BOILING

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Los Alamos Scientific Laboratory, Los Alamos, NM

Los Alamos Scientific Laboratory Ten Year Decontamination/Decommissioning Site Plan, Fiscal Year 1980 thru Fiscal Year 1989. 55 pp. (1977)

A plan for decontaminating and for decommissioning (D and D) radioactive contaminated facilities and land areas which are expected to become surplus to Los Alamos Scientific Laboratory (LASL) programmatic needs during the period from FY 1978 through FY 1989 is described. Also discussed are plans for D and D operations prior to FY 1980. The physical characteristics of the facilities and land areas, the nature and extent of radioactive contamination, D and D procedures, and cost estimates in FY 1979 dollars are given. Twelve contaminated facilities or major equipment items are identified as being excess to LASL programmatic needs. There are no land areas which are excess to identifiable needs of ERDA. There are, however, land areas which are contaminated and cannot be used for other programs until decontamination is effected. The priority listing of D and D projects at LASL is as follows: Ta-21-2, -3, -4, -5, and -150 plutonium facility; Ta-35-2, tritium facility; Ta-3, sewer lines; Ta-21-153 filter building; Ta-2-1; Ta-42, incinerator facility; Ta-35, LAMPRE reactor vessel; Ta-52 UHTREX reactor facility; Ta-35, air washers; Ta-35, sodium storage tanks; Ta-1 hillsides; ten site canyon; DP-Los Alamos Canyon; Mortandad Canyon; Ta-21-61, laboratory building; Ta-35, LAMPRE reactor; and septic tanks and seepage fields. (RAF)

NUCLEAR FACILITIES; DECONTAMINATION; DECOMMISSIONING; COST ESTIMATES; RECLAMATION, LAND; PLANNING; EQUIPMENT; REACTORS, RESEARCH; BUILDINGS; PLUTONIUM 238; PLUTONIUM 239; GLOVE BOXES; PUMPS; TANKS; FILTERS; TRITIUM; WASTES, LIQUID; WASTES, RADIOACTIVE; PIPES; SOILS; RADIATION MONITORING; DISPLACEMENT; ACTINIUM 227; INCINERATION; REACTORS, HOMOGENEOUS; CONCRETES; SODIUM; STORAGE; VALVES

310
Lunning, W.H. International Atomic Energy Agency, Vienna, Austria

Decommissioning of Nuclear Facilities. International Conference on Nuclear Power and Its Fuel Cycles, Salzburg, Austria, May 2-13, 1977, (10 pp.). (1977)

Collaborative studies are in progress in the U.K. between the U.K.a.E.A., the generating boards and other outside bodies, to identify the development issues and practical aspects of decommissioning redundant nuclear facilities. The various types of U.K.a.E.A. experimental reactors (D.F.R., W.A.G.R., S.G.H.W.R.) in support of the nuclear power development program, together with the currently operating commercial 26 Magnox reactors in 11 stations, totalling some 5 gw will be retired before the end of the century and attention is focussed on these. The actual timing of withdrawal from service will be dictated by development program requirements in the case of experimental reactors and by commercial and technical considerations in the case of electricity production reactors. Decommissioning studies have so far been confined to technical appraisals including the sequence logic of achieving specific objectives and are based on the generally accepted three stage progression. Stage 1, which is essentially a defuelling and coolant removal operation, is an interim phase. Stage 2 is a storage situation, the duration of which will be influenced by environmental pressures or economic factors including the re-use of existing sites. Stage 3, which implies removal of all active and non-active waste material and returning the site to general use, must be the ultimate objective. The engineering features and the radioactive inventory of the system must be assessed in detail to avoid personnel or environmental hazards during stage 2. These factors will also influence decisions on the degree of stage 2 decommissioning and its duration, bearing in mind that for stage 3 activation may govern the waste disposal route and the associated radiation man-rem exposure during dismantling. Ideally, planning for decommissioning should be considered at the design stage of the facility. An objective of present studies is to identify features which would assist decommissioning of future systems.

CONTAMINATION; RADIOACTIVE MATERIALS; REACTOR DECOMMISSIONING; REACTOR DISMANTLING

311
Lunning, W.H.

Decommissioning Nuclear Reactors. Atom 265:295-300. (1978, November)

Decommissioning carries with it the idea of complete withdrawal of a nuclear reactor from service and a reinstatement of unrestricted use of the site. Though experience in decommissioning nuclear reactors is limited, it is thought that there are no unsurmountable technical problems. Within the European Community a Commission proposal for a collaborative RD program on topics specific to decommissioning is currently under consideration. Decommissioning aspects were not primary concerns in the design of some of the present facilities, but future designs will attempt to reduce the complexity of decommissioning problems. The Windscale Advanced Gas Cooled Reactor (WAGR) was selected by UKAEA as the initial reactor for decommissioning studies and a similar study is being undertaken by CEGB of a typical steel pressure vessel Magnox station. Three generally accepted stages of decommissioning have been identified from national and international studies. For the current classes of UK reactors these have been interpreted as: Stage 1-Shut down, remove coolant and make safe. Maintain under surveillance. Stage 2-Reduce installation to the minimum practical size without penetrating into those parts which have high levels of induced radioactivity. Maintain under surveillance. Stage 3-Complete removal of the reactor and all other plant and waste off-site followed by the return of the site for redevelopment of general use by the public. Sites of radioactivity in plants are: (1) Neutron-induced activity in the fixed structure of the plant; (2) neutron-induced activity of removable components remaining in the reactor after defuelling, e.g. control rods; (3) contamination around the primary cooling circuit arising from activated corrosion products or burst fuel; and (4) contaminated/activated operational waste arising during the life of the reactor and stored in designated facilities. Effort will be applied during decommissioning to salvage the maximum quantities of materials suitable for recycling or reuse from all areas of the site. Such materials will be subject to rigorous monitoring before release. There will however be large quantities of materials which due to their radioactive content cannot be released and will require controlled disposal. The removal of fuel from a reactor, which is the initial operation leading to a refined decommissioning stage, will in the case of WAGR extend over a period of about three years. The time required beyond this period to complete Stages 1 and 2 will be of the order of a further one and three years respectively, and in the case of continuing progression to Stage 3 from reactor closure the corresponding extension is about five years. Indicative costs, excluding the cost of defuelling and with no allowance made for the value of recovered plant and scrap, have been assessed. For Stages 2 and 3 these costs represent less than 10% and 15% respectively of the current replacement cost for WAGR. (Auth)(JMF)

The document contains a graph of radioactive decay within a shutdown reactor over time. The document contains photographs of a reactor site and a scheme of the type reactor to be decommissioned.

DECOMMISSIONING; REACTORS; COSTS; DESIGN; MONITORING; RADIOACTIVITY; EXPOSURE, POPULATION

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Maestas, E.

Experience and Plans for the Decommissioning of Nuclear Reactors in Organization for Economic Co-operation and Development - Nuclear Energy Agency Countries. CONF-790923; Decontamination and Decommissioning of Nuclear Facilities, Proceedings of a Conference, Sun Valley, ID, September 16-20, 1979. Session III-B, (p. 1-2), 90 pp. (CONF-790923). (1979)

The decommissioning of nuclear reactors in OECD Nuclear Energy Agency member countries up to the present time has been limited primarily to research and prototype reactors. The number of such plants, which have been dismantled through the various decommissioning options, that is stages I, II, and III, have been quite small in comparison to the total number of nuclear reactors now in service and which might be expected to be dismantled in the next decade or two. However, the experience gained in the decommissioning of these nuclear reactors, regardless of what option has been chosen, has demonstrated that existing technology can be adapted in decommissioning facilities even up to stage of complete demolition and removal. A review of the principal programs for decommissioning nuclear reactors which have been undertaken in NEA member countries, excluding the United States and Canada will be presented. Characteristics data will be reported so that a comparison of the programs can be made. In almost all NEA countries with developed nuclear programs, planning and the preparation for the decommissioning of nuclear reactors is under way in various stages of advancement. A review of the most important decommissioning projects, which will be initiated in the near term will be discussed along with their expected schedule. (Auth)(JMF)

This paper is only an abstract of the actual paper which is to be published later.

DECOMMISSIONING; NUCLEAR FACILITIES; RADIOACTIVE DECAY; REVIEWS; PROGRAMS

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Manion, W.J. Nuclear Energy Services, Inc., Danbury, CT

Generic Approaches to Decommissioning Commercial Nuclear Power Reactors. American Nuclear Society Annual Meeting, San Diego, CA, June 18, 1978; Transactions of the American Nuclear Society 28:665-666, (1978, June)

EVALUATION; COSTS; FEASIBILITY STUDIES; NUCLEAR POWER PLANTS; REACTOR DECOMMISSIONING; REACTOR DISMANTLING

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Manion, W.J.

A Review of Recent Decontamination and Decommissioning Program Activities in the International Community. CONF-790923; Decontamination and Decommissioning of Nuclear Facilities, Proceedings of a Conference, Sun Valley, ID, September 16-20, 1979. Session I, (pp. 1-3), 90 pp. (CONF-790923). (1979)

This paper includes a review of two major international activities pertinent to decontamination and decommissioning: the First International Symposium on the Decommissioning of Nuclear Facilities held in Vienna, Austria during November 1978, and the development of a technical report on decommissioning which will be issued by the International Atomic Energy Agency (IAEA) in calendar year 1979. Major concerns and conclusions of the participants of the symposium were suprisingly consistent: (1) The decommissioning of any nuclear facility, including complete removal, is technically feasible. (2) The greatest concern is the lack of defined criteria for the unstricted release of activated material, exemplified by Madame Ann Marie Chapuis' paper entitled "Criteria for Admissible Residual Activity". (3) There is also concern as to what is meant by decommissioning. The technical report on decommissioning, presently being prepared by the IAEA, includes the development of a Code of Practice and Guide to the Code in Decommissioning of Nuclear Reactors. It will be, in effect, in a "Recommendations" category. The paper concludes with a summary of on-going decommissioning programmatic activities in the international community as described by leading experts in the community. (Auth)(JMF)

This paper is only an abstract of the actual paper which is to be published later; the paper includes a review of two major international activities pertinent to decontamination and decommissioning.

DECONTAMINATION; DECOMMISSIONING; NUCLEAR FACILITIES; RECOMMENDATIONS; STANDARDS, INTERNATIONAL; EXPOSURE, POPULATION; WASHING; REVIEWS; PROGRAMS

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Manion, W.J. Nuclear Energy Services, Inc., Danbury, CT

Summary of a Decommissioning Handbook for Nuclear Facilities. IAEA-SM-234/44; Decommissioning of Nuclear Facilities, Proceedings of an International Symposium, Vienna, Austria, November 13-17, 1978. International Atomic Energy Agency, Vienna, (pp. 203-216), 694 pp. (IAEA-SM-234/44). (1979)

This paper summarizes the information compiled to date for a handbook on decommissioning of surplus nuclear facilities being prepared by Nuclear Energy Services for the United States Department of Energy. This handbook is intended to describe all stages of the decommissioning process including selection of the end product; estimation of the radioactive inventory; estimation of occupational exposures; description of the state-of-the-art in re-decontamination, remote cutting of heavy metal components and structures, and segmenting thick reinforced concrete structures; disposition of wastes; and estimation of program costs. Presentation of state-of-the-art technology and related data pertinent to decommissioning will aid in consistent and efficient program planning and performance. Particular attention is focussed on the available technology applicable to those decommissioning activities which have not been accomplished before, such as remote segmenting and handling the highly activated 1100 MWe light water reactor vessel internals and thick-walled reactor vessels. Mechanical and torch cutting techniques will be described, including recent developments in 'arc saw' technology. Applicability of the methods as a function of material composition, thickness and configuration is discussed, cutting rates defined, and equipment and procedures described. Other pertinent factors covered include in-air and underwater applications, contamination control and personnel protection. Similar information is presented for the fracturing, segmenting and rebar-cutting of thick concrete sections and for the removal of contaminated piping systems. A summary of available information associated with the planning and estimating of a decommissioning program is also presented. In particular, the methodologies associated with the calculation and measurement of activated material inventory, distribution and surface dose level; system contamination inventory and distribution; and work area dose levels are summarized. Cost estimating techniques are also presented and the manner in which to account for variations in labor costs as impacting the labor-intensive work activities is explained. (Auth)

DECOMMISSIONING; NUCLEAR FACILITIES; INVENTORIES; EXPOSURE, OCCUPATIONAL; DECONTAMINATION; CUTTING; METALS; CONCRETES; WASTE DISPOSAL; COSTS; PLANNING; REMOTE HANDLING; REACTORS, LIGHT-WATER; REACTOR VESSELS; PERSONNEL; SAFETY; PIPES; REVIEWS

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Manion, W.J., T.S. Laguardia, and P. Garrett Atomic Industrial Forum, Washington, DC; Automation Industries Inc.

An Engineering Evaluation of Nuclear Power Reactor Decommissioning Alternatives - Summary Report. AIF/NESP-009SR; 35 pp. (1976, November)

The purpose of this generic study is to provide detailed engineering information that will permit utilities to evaluate reactor decommissioning. This study addressed PWRs, BWRs, and HTGRs looking at 3 primary decommissioning alternatives and 2 combination alternatives - mothballing; entombing; prompt removal/dismantling; mothballing-delayed removal/dismantling combination; and entombing-delayed/dismantling combination. For each of the 3 primary alternatives, the objectives of the study were: detailed descriptions of work procedures and end products; estimates of costs including sensitivity and reliability analyses; estimates of occupational exposures; identification of generic environmental effects, and identification of regulations and guidelines.

DECOMMISSIONING; REACTORS, BWR; REACTORS, PWR; REACTORS, HTGR; ECONOMICS; PERSONNEL; EXPOSURE, OCCUPATIONAL; ENVIRONMENT; REGULATIONS; JACOBS; SOCIAL ASPECTS

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Marcus, F.R. U.S. Energy Research and Development Administration, Washington, DC; Oak Ridge National Laboratory, Oak Ridge, TN; FORATOM, Copenhagen, Sweden

Industrial Aspects of Radioactive Waste Management in Western Europe. International Symposium on Management of Waste from the LWR Fuel Cycle, Denver, CO, July 11, 1976 (pp. 686-695). (1976)

Various aspects of waste management are discussed from the viewpoint of the nuclear industry. Future amounts of waste generated in the 15 Foratom countries in western Europe are estimated. Industrial waste questions–as seen by electricity producers, reprocessors, and waste operators–are discussed; questions concerning decommissioning are also dealt with. A number of recommendations for further action, primarily on the part of national authorities and international organizations, are put forward. One conclusion of the study is that there is no reason for waste-management problems to impede the timely development of nuclear energy as a large-scale industrial activity in western Europe.

REACTORS, BWR; FUEL CYCLES; NUCLEAR INDUSTRY; REACTORS, PWR; WASTE MANAGEMENT; RECOMMENDATIONS; REACTORS, WATER COOLED

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Maritime Administration, Washington, DC

N.S. Savannah Reactor System Status Report. NP-19907; DOCKET 50-238; 38 pp. (1973, December)

This document has been prepared to inform interested parties of the status of equipment and systems on the N.S. Savannah which directly or indirectly affects the health and safety of the general public and its classification as a utilization facility. The report addresses the following subjects: (1) status of the N.S. Savannah's reactor plant, (2) declassification as a utilization facility, and (3) calculated residual byproduct material remaining in the system.

LICENSE STATUS; REACTORS, MARITIME; NS SAVANNAH; DECOMMISSIONING

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Martin, A., D.T. Read, R.W. Milligan, T.F. Kempe, and D.A. Briaris Associated Nuclear Services, Epsom, Surrey, United Kingdom

A Preliminary Study of the Decommissioning of Nuclear Reactor Installations. American Nuclear Society Report No. 155; 92 pp. (1977, July)

The decommissioning of a nuclear power station has far-reaching implications and it is suggested that the approach adopted should be based on national policies rather than on the narrower interests of the licensee. The IAEA has recommended the use of a standard terminology to describe the three possible stages of decommissioning of a nuclear plant. These are: Stage 1: a minimum decommissioning, necessitating continued surveillance. Stage 2: a maximum decommissioning short of complete dismantling. The structure is reduced to minimum size and sealed. Stage 3: complete dismantling and clearance of site. These definitions correspond closely to the terms used in the US; mothballing, entombment and dismantling. An illustrative decommissioning assessment is presented for a typical steel pressure vessel Magnox station.

JACOBS; DECOMMISSIONING; HALLAM REACTOR; PEACH BOTTOM-1 REACTOR; ELK RIVER REACTOR; PIQUA NUCLEAR POWER FACILITY

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Mason, P.J., and W.F. Foster Oak Ridge National Laboratory, Oak Ridge, TN

DOE-Wide Transportation Statistic Data Bank. DOE/EV-0042; Division of Environmental Control Technology Program, 1978, (pp. 110-112), 259 pp. (1979, June)

The objective of this project is to develop and implement a central data base information facility concerning every movement of material to and from every Department of Energy contractor site in the United States, whether the material is moved by commercial or government carrier. A system will be developed by extensive use of traffic management workshops. A review of other data bank systems will be accomplished to prevent duplicate collection of data, and computer programs will be developed to automatically interface with such systems at the Nuclear Materials Management Safeguards and Security (NMMSS) facility. A user's guide was developed to assist contractors in collection of transportation data, and a computer program was developed to interface with the NMMSS data bank to retrieve data on nuclear shipments. A user workshop was conducted to review and answer questions from Chicago, Nevada, Oak Ridge, Richland, and Idaho operations contractors. All computer programs were designed, programmed, and placed in production status. Eight contractor installations have thus far been implemented. Later, programming changes and improvements will be accomplished. Nevada, Richland, and Idaho contractors will begin collecting data and participating in the transportation statistics data bank (TSDB). It is anticipated that 24 contractor sites will be included in the TSDB by the end of FY 1979. Reports will be published as needed by DOE, routinely or on an exception basis. (Auth)(JMF)

COMPUTER PROGRAMS; STATISTICS; TRANSPORTATION; NUCLEAR MATERIALS

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Masters, R.

CEGB Looks at Reactor Life and Decommissioning. Nuclear Engineering International 23(279):37-38. (1978, December)

The technical factors likely to determine the life of Magnox reactors and AGRs are well understood and the original design lives are likely to be much exceeded because of the economic advantages of continuing to operate such low cost power producers. Attention is however already being given to the problems involved in decommissioning. There are strong arguments for leaving the reactor on site. (GTM)

REACTORS, GCR TYPE; OPERATING EXPERIENCE; DECOMMISSIONING; ECONOMICS; DECONTAMINATION; REACTORS, AGR TYPE

322
Mauro, J.J., D. Michlewicz, and A. Letizia Envirosphere Company, New York, NY

Evaluation of Environmental Dosimetry Models for Applicability to Possible Radioactive Waste Repository Discharges. Report; 97 pp. (1977, September)

This report presents the results of a review of the available codes, for application to the national waste terminal storage (NWTS) program. Consideration was given to the types of radionuclides which may be of concern, the possible modes of release of these radionuclides and the various pathways by which members of the general public in the vicinity of a terminal storage facility may be exposed to the releases. Results reveal that the types and quantities of radioactive material requiring disposal will depend on the type of back and fuel cycle adopted. It can be assumed that under normal operating conditions there will be virtually no liquid effluent and inconsequentially small quantities of radioactive gaseous effluent. Under accident conditions during operation, both liquid and gaseous releases could occur resulting in exposures to the general public. Failure of the facility subsequent to decommissioning could also result in exposures but primarily via the aquatic pathways. A review of three atmospheric dispersion models and 32 environmental dosimetry codes presently used by the nuclear industry was performed. A discussion is presented on standard NRC methodologies for determining the dispersion coefficients used as input to the various models and the inherent limitations of many of the techniques routinely used to evaluate site specific atmospheric dispersion. The review of the dosimetry codes reveals that no one code is generally applicable to the NWTS program, but some codes permit radiological assessment of the most important exposure pathways. (DLC)

COMPUTER CODES; DOSIMETRY; ATMOSPHERE; ENVIRONMENT; FISSION PRODUCTS; FUEL CYCLES; HUMAN POPULATIONS; NUCLEAR FACILITIES; ACCIDENTS; RADIATION DOSE; EFFLUENTS, RADIOACTIVE; WASTE STORAGE; RADIOECOLOGY; RADIONUCLIDE MIGRATION; REVIEWS; REACTORS, WATER COOLED

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McConnon, D. United Power Association, Health and Safety Department, Elk River, MN

Health Physics Planning for Dismantlement of the Elk River Reactor. CONF-720614; Proceedings of the 17th Annual Health Physics Society Meeting, Las Vegas, NV, June 12-16, 1972 (18 pp.)(CONF-720614). (1972, May 15)

Dismantlement of the Elk River Reactor (ERR) is scheduled to begin early in 1972. This project is historic in that it marks the first time that a rather large power reactor will be completely dismantled and disposed of. The facility was constructed by the Atomic Energy Commission as part of its power reactor demonstration program and was operated by the rural cooperative power association of Elk River, Minnesota. The ERR, an indirect-cycle natural circulation boiling water type reactor, had a rated electrical capacity of 22.5 megawatts net (58.2 megawatts thermal). Prior to final shutdown on January 31, 1968, the reactor had produced 53,000 MWTh of power during its lifetime. Potentially, the most hazardous phases of dismantling from a radiological standpoint will involve removal and disposal of the reactor internal components, the reactor pressure vessel and the biological shield. The general approach planned for removal of the above structures will be discussed as well as the radiological conditions and problems anticipated during each removal phase. Planned engineering safeguards and procedural controls to limit personnel exposure, internal deposition of radionuclides and release of radioactive materials to the work areas and the environment will be outlined for each removal phase. By June, 1972, most, if not all, of the reactor internal components will have been removed from the facility. Although dismantling of the ERR should not be viewed as setting a precedent for the disposition of other nuclear power plants, it is quite possible that techniques developed here may be useful in the future for planning similar operations. (Auth)(RAF)

HEALTH PHYSICS; REACTOR DISMANTLING; ELK RIVER REACTOR; REACTORS, BWR; REACTOR COMPONENTS; DISPLACEMENT; BIOLOGICAL SHIELDS; PRESSURE VESSELS; SAFEGUARDS, PLANNING; EXPOSURE, OCCUPATIONAL; ENVIRONMENTAL IMPACTS

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Merlini, R.J., A.F. Younger, and R. Garcia Oak Ridge National Laboratory, Oak Ridge, TN; Rockwell International, Golden, CO

Assessment of Plutonium Decontamination Technology. ORNL/CFRP-79/14; 37 pp. (1979, April)

Identifies and documents the current state of technology for aiding the removal of plutonium-base contaminants from structure interiors and glovebox/cell processing equipment. An additional purpose is to identify research required to advance decontamination technology. This work was primarily accomplished through review and analysis of four decontamination technology areas: (1) design, (2) contaminant-surface interaction, (3) surface preparation, and (4) decontamination methods.

DESIGN; DECONTAMINATION; DECOMMISSIONING; REGULATIONS; CONTAMINATION, SURFACE; SURFACE CLEANING; PLUTONIUM; HOT CELLS; GLOVE BOXES

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Mori, M. Kansai Electric Power Company, Inc., Osaka, Japan

Decommissioning of Nuclear Power Plants.
Genshiryoku Kogyo 22(4):26-28. (1976, April)

It is preferable to grasp the possible selection of disposing method and the extent of expense in decommissioning nuclear power plants after their durable years have expired, and also to establish the countermeasure if necessary. The following discussion is made mainly on light water reactors. As the measures for the reactors after the durable years have expired, (1) mothballing, (2) in-place entombment, and (3) dismantling are considered in the Regulatory Guide 1.86 of US AEC. Mothballing is advantageous in case that the administration of a reactor is not a heavy burden after mothballing as, for example other reactor facilities are still in operation at that site. In-place entombment is superior in the point that the dismantling of a pressure vessel and biological shields is avoidable, which is most difficult in the whole station dismantling. Dismantling is the most satisfactory method but most expensive. More than 10,000 million yen will be needed in the complete dismantling of a large light water reactor. The dismantling techniques for in-reactor construction, a pressure vessel and biological shields are instructed together with the disposal of waste material and radiation exposure by dismantling works. However, exposure is supposed to be the same as that in normal reactor operation or less.

BIOLOGICAL SHIELDS; REACTORS, BWR; COSTS; PRESSURE VESSELS; REACTORS, PWR; WASTE DISPOSAL; REACTOR COMPONENTS; REACTOR DECOMMISSIONING; REACTOR DISMANTLING

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Mound Laboratory, Miamisburg, OH

DASMP Decommissioning and Decontamination Plan. (1979)

The decontamination and decommissioning of the inactive DASMP areas at the Mound Facility by the Monsanto Research Corporation, is a result of operations in these areas not being required after FY-1976 and a consideration to size reduction and/or decontamination particularly with respect to gloveboxes and other equipment and to defer the use of foam. Disposition modes considered were the following: (1) Readiness which permits full operation of a laboratory within a quarter calendar year. Using this mode, all operating equipment remains in place and routine maintenance is performed. No wipeable contamination exists in the laboratory's areas and wipe levels in access corridors and building system equipment areas are reduced to 2200 dpm/100 sq cm. (2) partial decontamination (standby) which permits full operation within one year. Using this mode, the average wipe levels in the high risk areas would be reduced to 200 dpm/100 sq cm. Gloveboxes would be in place and laboratory areas would be left with no wipeable contamination. (3) Extensive decontamination which includes removal of gloveboxes and contaminated services and an intensive decontamination of the facility. The facility will then be left "tainted"; i.e., small amounts of residual contamination would remain. This would remain under control and negative pressure. The final exposed average contamination levels in the facility after this decontamination and restoration will be: wipe - less than or equal to 3000 d/m/60 sq cm; external radiation - less than or equal to 1 mr/hr at surface. It was decided in FY-1978 to place these areas in an "extensive decontamination" condition. Complete decommissioning and decontamination was not considered, except for the waste transfer system, since this would require demolition of the PP and R-buildings which are used for other on-going programs and could be used for future programs. Planning and evaluation continues as D and D "State of the Art" technology improves. Total FY-1980 budget submission costs were estimated to be $15.3 million while the current total estimated costs (FY-1978) are $24.1 million, a difference of $7.8 million. A breakdown of cost and personnel involvement by year are included as well as intended procedures and precautions. Uncertainties that presently exist or may exist in the future with respect to the D and D function are: (1) estimation of resources required due to absence of earlier similar D and D projects. (2) Impact of the WIPP criteria on the interim storage waste acceptance criteria at INEL in the areas of acceptability of waste packaging materials and the acceptability of waste form within containers.

(3) Maximum authorized size for TRU packages. (4) Use of foam in TRU packages. (5) Erection of a size reduction facility for radioactive wastes. (6) To minimize environmental impact and personnel exposures resulting from D and D activities, development must lead implementation of new techniques by several months. (7) Transportation modes for TRU wastes. (8) Availability of commercial shallow-land burial sites for non-TRU wastes. (9) More restrictive radiation exposure and emission standards. (10) Announced legislation impacting transportation of radioactive materials. (JMF)

This report is intended as an engineering study. It is divided into sections on costs, controls, organization, responsibilities and uncertainties. It includes diagrams and blueprints outlining proposed work.

DECONTAMINATION; DECOMMISSIONING; WASHING; COSTS; NUCLEAR FACILITIES; CONTAMINATION; COST ESTIMATES; GLOVE BOXES; DISPOSAL SITE; MAINTENANCE; SAMPLES; SAMPLING; PERSONNEL; ENVIRONMENT; EXPOSURE, OCCUPATIONAL; EXPOSURE, POPULATION; WASTE DISPOSAL; WASTE PROCESSING; WASTE STORAGE; WASTE VOLUME; WASTES, RADIOACTIVE; WASTES, TRANSURANIC; WASTES, SOLID; WASTES, HIGH-LEVEL; WASTES, LOW-LEVEL; WASTES, INTERMEDIATE-LEVEL; CONTAINERS; PACKAGING; BURIAL, SHALLOW; EMISSIONS; STANDARDS, FEDERAL; TRANSPORTATION

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Mullarkey, T.B., T.L. Jentz, J.M. Connelly, and J.P. Kane NUS Corporation, Rockville, MD

Current Land Burial Techniques for Radioactive Wastes and Alternative Methods of Disposal. AIF/NESP-008; A Survey and Evaluation of Handling and Disposal of Solid Low-Level Nuclear Fuel Cycle Wastes, Section 6, (pp. 47-65), 143 pp. (AIF/NESP-008). (1976, October)

At present there are six licensed shallow-land burial sites in the United States and they are: West Valley, New York; Barnwell, South Carolina; Maxey Flats, Kentucky; Sheffield, Illinois; Beatty, Nevada; and Richland, Washington. Each of these sites has specific requirements for burial of liquid, gaseous, and solid wastes. At present specifications and restrictions for packaging and shipping commercially generated low-gamma TRU solid wastes to a government site are in draft form. Burial site criteria are not hard and fast and there are few regulations by either the state or federal governments. Burial techniques include excavating, rain water control and removal, package placement in trenches, and backfilling. Retrievable storage techniques for transuranic wastes are also discussed. The technique provides for aboveground storage of low-gamma, solid TRU waste with a 20 year retrieval capability. Recommendations for improving burial practices are: 1) burial sites be on flat terrain for maximum use; 2) trenches be as deep as the hydrology and soil characteristics allow; 3) trench water removal systems where necessary; 4) efficient use of trench volume by careful package placement; and 5) containers and transport shields be designed to allow a minimum of handling. The two alternative disposal methods are sea disposal and onsite burial. Sea disposal is under a moratorium. For onsite burial a decommissioned facility could be used. Projected waste volumes will fill the existing sites by 1990 but with alternative volume reduction and alternative disposal methods this could be put off until 2000. (NDV)

An extensive table documenting the requirements for burial of solid, liquid, and gaseous wastes for the six sites is included. (ESIC NDV)

BACKFILLING; BURIAL; COMPACTION; CONCRETES; DISPOSAL SITE; EXCAVATION; GROUND WATER; LEAKAGE; STANDARDS, FEDERAL; STANDARDS, STATE; WASTE DISPOSAL; WASTE MANAGEMENT; WASTES, GASEOUS; WASTES, LIQUID; WASTES, SOLID; WASTES, TRANSURANIC; WASTES, RADIOACTIVE

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Mullarkey, T.B., T.L. Jentz, J.M. Connelly, and J.P. Kane NUS Corporation, Rockville, MD

Summary of Nuclear Fuel Cycle Waste Projections. AIF/NESP-008; A Survey and Evaluation of Handling and Disposal of Solid Low-Level Nuclear Fuel Cycle Wastes, Section 5, (pp. 43-46), 143 pp. (AIF/NESP-008). (1976, October)

Significant quantities of radioactive waste are being produced by commercial LWR's (light-water reactors); government installations and operations; and industrial, institutional and private users. Additional power reactor fuel cycle wastes will be from high temperature gas cooled reactor waste, fast breeder waste and decommissioning waste (from LWR's) by late in this century. Industrial, institutional and private users have annually disposed of 1 x 10(E+6) cu ft and this value will remain constant through the year 2000. Government installations and operations input 2 x 10(E+5) cu ft yr and this will remain the same until the end of the century. Waste from HTGR's will be negligible because only one is in operation and no new plants are planned. Also, fast breeder reactors have not been included in the estimate because they will not be significant before the end of the century. If one reactor facility is decommissioned every five years between 1985 and 2000, 540,000 cu ft of radioactive waste will be added with each decommissioning. Therefore by the year 2000, 52.6 x 10(E+6) cu ft will be generated by all processes except LWR's. With high growth of LWR's the total waste produced will be 456.6 x 10(E+6) and with low growth of LWR's it will be 285.6 x 10(E+6) cu ft. Using alternative methods without backfitting the LWR's the waste production will be 193.6 and 162.8 x 10(E+6) cu ft for high and low growth of the LWR's, respectively. Using alternative methods with backfitting the wastes will be 120.6 and 98.4 x 10(E+6) cu ft for high and low growth of the LWR's, respectively. All wastes other than LWR remain the same, only the LWR varies. (NDV)

Projected waste volumes are presented tabularly and graphically. (ESIC/NDV)

BURIAL; FUEL CYCLES; NUCLEAR POWER; NUCLEAR FACILITIES; REACTORS, LIGHT-WATER; WASTES, RADIOACTIVE; REACTORS, HTGR; REACTORS, BREEDER; DECOMMISSIONING

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Mullarkey, T.B., T.L. Jentz, J.M. Connelly, and J.P. Kane NUS Corporation, Rockville, MD

Current LWR Radwaste Management Practices. AIF/NESP-008; A Survey and Evaluation of Handling and Disposal of Solid Low-Level Nuclear Fuel Cycle Wastes, Section 1, (pp. 1-17), 143 pp. (AIF/NESP-008). (1976, October)

Types of radwaste and their contributions to the total waste for operating plants and projection of solid radwaste are compiled. For BWR reactors, wastes from the filter/demin plants generate 31.6 cu ft/MWe yr while deep bed resin plants produce 45.6. In fact the deep bed resin plants produce more total waste than do the filter/demin plants. The major sources of waste are from the sludge and precoat (70%) and the BWR produces about 41% (trash) as a major waste. Future BWR plants are expected to reduce their solid wastes. For PWR reactors the waste generated from CPS (condensate polishing system) is 36.7 cu ft/MWe yr of solid waste and for non-CPS 26.9. Solidified wastes account for 56% of the total annual waste volume. Included in the paper is analysis of the standard reactor radwaste volumes which has an exponential predictive function. Finally, for deep bed resin BWR reactors it will cost $898,000 per annum. The CPS PWR reactor will have an annual cost of $425,000 for waste disposal. (NDV)

Extensive tabular data present radwaste volumes by various breakdowns including cost analysis. (ESIC/NDV)

WASTES, LOW-LEVEL; WASTES, SOLID; COMPACTION; CONTAINERS; CONTAINMENT; CONCRETES; DECOMMISSIONING; EQUATIONS; DEMINERALIZATION; FILTERS; MODELS, MATHEMATICAL; REPOSITORY; FUEL REPROCESSING; RESINS; SLUDGES; SOLIDIFICATION; VOLUME REDUCTION; WASTE DISPOSAL; WASTE MANAGEMENT; WASTE STORAGE; WASTES, LIQUID; WASTES, RADIOACTIVE; REACTORS, BWR; REACTORS, LIGHT-WATER; REACTORS, PWR

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Mundis, R.L., M.J. Kikta, G.J. Marmer, J.H. Opelka, J.M. Peterson, and B. Siskind Argonne National Laboratory, Argonne, IL

Health Physics Considerations in Accelerator Decommissioning and Disposal. EPA 520/3-79-002; Low-Level Radioactive Waste Management, J.E. Watson, Jr., (Ed), Proceedings of Health Physics Society Twelfth Midyear Topical Symposium, Williamsburg, VA, February 11-15, 1979. U.S. Environmental Protection Agency, Washington, DC, (pp. 39-48), 540 pp. (1979, May)

The Division of Environmental Impact Studies at Argonne National Laboratory was requested to perform a comprehensive study of the portion of the decommissioning problem that concerns the dismantling and disposal of all types of particle accelerators in the United States. The pertinent factors are as follows: (1) Species of particle(s) accelerated. Generally deuterons and tritions generate more secondary neutrons than protons, while electrons generate much fewer, other factors being equal. (2) Energy of the accelerated particles. The induced activity is a function of the particle energy and the appropriate reaction cross sections once the threshold energy is exceeded. (3) Beam intensity of current Induced activity is proportional to the number of particles accelerated. (4) Duty factor. The ratio of operation time to shutdown time determines the actual value of the effective long-term average beam intensity. (5) Primary usage of the accelerator. This has a direct impact on other parameters, e.g., a high energy research accelerator or an isotope production facility is generally run at maximum attainable currents and as continuously as operational and fiscal constraints allow. At the other extreme, some research accelerators are used exclusively for short-term intermittent sample irradiations or for low intensity scattering experiments. Methods of estimation of quantity of radioactive material and of isotopes produced are given both in the text and in tables. In keeping with the philosophy of maintaining all radiation exposure to levels which are As Low As Reasonably Achievable (ALAEA), it can be argued that any radioactivity which would add to natural background should not be released to the world at large for unrestricted use. It can also be argued that dwindling natural resources, including metals such as copper and iron, need to be reutilized to the maximum extent possible for both ecologic and economic reasons. It seems that it would be pocsible to mothball in place or temporarily store the accelerator components long enough to allow the induced activity to decay to levels which are essentially indistinguishable from natural background by sensitive detectors such as gas proportional counters or muR meters. Based on the results of this study, it is probable that this period of time would not be longer than 100 years for the major components of the present high intensity machines. Millions of tons of material would be a definite burden to bury perhaps be a treasure worth eventual recycle. (Auth)(JMF)

The paper contains tables showing induced radioactivity, radioactive isotopes produced, and expected amounts of radioactive wastes produced upon decommissioning. The paper contains graphs showing mass yield curves for protons on bismuth, and decay times for accelerator induced radioactivity.

DECOMMISSIONING; NUCLEAR FACILITIES; ISOTOPES; COSTS

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Murphy, E.S.

Decommissioning of Commercial Shallow Land Burial Site. CONF-790923; Decontamination of Nuclear Facilities, Proceedings of a Conference, Sun Valley, ID, September 16-20, 1979. Session 11-B, (pp. 1-2), 90 pp. (CONF-790923). (1979)

The results, reported here of a study carried out by U.S. Nuclear Regulatory Commission are intended for use as background data in the formulation of decommissioning regulations and in the development of improved waste burial and site maintenance procedures at operating burial grounds. The basic decommissioning options considered in the study are site waste stabilization followed by long-term care of the site and waste relocation. Two stabilization plans are evaluated for each of the reference sites: a relatively modest plan and a more complex and costly plan. The plans are based on potential release agents and critical release pathways identified for the sites. The modest stabilization plan for the western site includes increased capping thickness over the burial trenches, revegetation of the site and vegetation management. The more complex plan for the western site includes installation of a subsurface rock layer with a hard top, increased capping thickness over the burial trenches, revegetation and vegetation management. The modest stabilization plan for the eastern site includes increased capping thickness over the burial trenches, modification of capping soil properties, improvement in capping drainage, revegetation, and vegetation management. The more complex plan for the eastern site includes peripheral drainage and diversion, sump pumping of water that accumulates in trenches, installation of a subsurface hard layer, an increase in the capping thickness over the trenches, revegetation and vegetation management. Specific site conditions may make it necessary to combine partial waste relocation, (i.e., relocation of the waste from part or all of a particular trench or trenches) with stabilization of the rest of the site. The waste relocation cases considered in this study are: (1) Relocation of high beta-gamma activity waste from a slit trench. (2) Retrieval of a package of transuranic-contaminated (TRU) waste from a section of burial trench. (3) Relocation of all the waste from a single burial trench. An estimate is made of the cost and time requirements to relocate the waste from an entire LLW burial ground. Long-term care activities include inspection and maintenance, environmental monitoring, and site administration. For this study, long-term care of a site is assumed to continue for 200 years after stabilization operations are completed. For each of the site waste stabilization and waste relocation decommissioning options listed above, estimates are made of manpower requirements, time schedules and costs. Radiological and nonradiological safety impacts from normal decommissioning operations and from potential decommissioning accidents are identified and evaluated. Environmental monitoring and records maintenance requirement for site/waste stabilization, waste relocation, and long-term care are also evaluated. (Auth)(JMF)

This paper is only an abstract of the actual paper which is to be published later.

DECONTAMINATION; WASHING; NUCLEAR FACILITIES; DECOMMISSIONING; REGULATIONS, FEDERAL; STANDARDS, FEDERAL; WASTES, TRANSURANIC; WASTES, RADIOACTIVE; WASTE STORAGE; WASTE MANAGEMENT; CONTAMINATION; MAINTENANCE; BURIAL; COSTS; SOILS; TRENCHES; ENVIRONMENT; MONITORING; VEGETATION; REVEGETATION; STABILIZATION, PHYSICAL

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Nelson, D.C. Atlantic Richfield Hanford Company, Richland, WA

Hanford Radiochemical Site Decommissioning Demonstration Program. Report; 67 pp. (1971, August 9)

A program is proposed for the innovation, development, and demonstration of technologies necessary to decommission the Hanford radiochemical plant area to the extent that the sites can have unrestricted public access. The five tasks selected for development and demonstration of restoration techniques were restoration of a burial ground, decommissioning of a separations plant, restoration of a separations plant waste interim storage tank farm, restoration of a liquid disposal area, and disposal of large contaminated equipment. Process development requirements are tabulated and discussed. A proposed schedule and estimated costs are given. GRA)

NUCLEAR FACILITIES; DECOMMISSIONING; WASTE MANAGEMENT

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Nemec, J.F. United Nuclear Industries, Inc., Nuclear Operations Division, Richland, WA

An Engineered Approach to Decommissioning. IAEA-SM-234/15; Decommissioning of Nuclear Facilities, Proceedings of an International Symposium, Vienna, Austria, November 13-17, 1978. International Atomic Energy Agency, Vienna, (pp. 67-72), 694 pp. (IAEA-SM-234/15). (1978, November)

In recent years, the retirement and decommissioning of obsolete nuclear facilities has increased. A variety of decommissioning alternatives has been successfully demonstrated on a number of projects in the United States. From these experiences, a useful disposition planning system has evolved. This system provides all necessary technical information to enable the facility owner to single out the optimum alternative from a variety of possible choices. However, what has become increasingly apparent in practical field application of this planning system is that decommissioning concerns are being addressed far to late in the life cycle of nuclear facilities. Indeed, this life cycle must be viewed as encompassing design, construction, operation, deactivation, and decommissioning. It is essential that disposition planning be continually addressed from design through deactivation in order to measurably reduce inevitable decommissioning costs. Practical application of the disposition planning system has brought several problem areas to light. In most cases, the planning system has been applied several years following the final shutdown of a facility. The problem areas include: loss of experienced personnel; loss of records and base data; deterioration of the facility and equipment; and performance of near-term deactivation activities which adversely impact subsequent decommissioning. (Auth)(RAF)

NUCLEAR FACILITIES; DECOMMISSIONING; PLANNING; DESIGN; THEORETICAL STUDIES; COSTS; WASTES, RADIOACTIVE; DOCUMENTATION; RECOMMENDATIONS

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NERVA Test Operations, Jackass Flats, NV

XECF Engine Disassembly. Report; 21 pp. (1968, July 22)

The disassembly and post test examination of the XECF engine are to be conducted under clean area conditions with purge til disassembly. Any damaged components are to be photographed. Special efforts are required to prevent damage during disassembly. Notations are to be made of material discrepancies noted. Then all components are to be stored for possible future use. (LTN)

XE-PRIME REACTOR; REACTOR DISMANTLING; SPECIFICATIONS; STORAGE; REACTORS, TEST

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North Carolina State University, Raleigh, NC

Dismantling Plan for North Carolina State University Research Reactor (NCSUR-3). Letter with Attachment to NRC Division of Operating Reactors; DOCKET 50-111; 59 pp. (1977, February 2)

This report provides a dismantling plan to facilitate the disassembly of the 10 kw NCSUR-3 and its relocation. This report only addresses itself to the dismantling phase of the relocation operation and is intended to support a request to the NRC for authorization to perform the dismantling and subsequent termination of the NRC Reactor License R-63. Presently, it is planned that the R-3 reactor will be packaged and shipped to the Bolivian Nuclear Energy Commission at Viachi, Bolivia. All plans are not complete yet, however, dismantling operations will be performed by the Institute for Resource Management. The reactor was shutdown in 1973 and the fuel unloaded and stored.

DECOMMISSIONING; REACTORS, RESEARCH; COLLEGES AND UNIVERSITIES; LICENSE STATUS; REACTOR OPERATION; LICENSING

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Nuclear Energy Services, Inc., Danbury, CT

Decommissioning Handbook. First Quarterly Progress Report, May 1-August 27, 1978. 7 pp. (1978)

The objectives for this reporting period were to develop data on facilities and equipment at typical DOE owned operated sites, and to contact individuals and organizations with decommissioning experience to explore state-of-the-art equipment and methods for decontamination and dismantling. Nuclear Energy Services has scheduled meetings in September at the DOE Richland Office to meet with other contractors and discuss D and D methods and equipment available. Also, NES will tour the Hanford Facilities to review unique characteristics which may require special treatment or handling. A tour of the West Valley, NY reprocessing plant has also been scheduled. During this report period, NES prepared drafts of handbook chapters which will be submitted to DOE. Results of the discussions mentioned above will be factored into the draft handbook chapters on metal cutting equipment, concrete demolition methods, and decontamination processes. Four handbook chapters are ready for submission to DOE. These include: estimation of radioactive inventory; removal of radioactive metals; removal of radioactive concrete; and cost estimating procedure.

DECONTAMINATION; PROCEDURES; NUCLEAR FACILITIES; REACTOR DECOMMISSIONING; REACTOR DISMANTLING; DOCUMENTATION

337
Organization for Economic Co-operation and Development, Paris, France

Radiation Waste Management Practices in Western Europe. Report of the Steering Committee for Nuclear Energy; 126 p. (1971, September)

This review gives information on: origin and different types of waste; safety aspects with a discussion on the recommendations of the International Commission on Radiological Protection (ICRP); technological and economic considerations with respect to radioactive wastes; specific western European waste management practices of gaseous, liquid and solid wastes; special problem areas such as high-level liquid wastes from chemical reprocessing of irradiated fuel, long-lived alpha wastes, Kr 85 and tritium, and the decommissioning of nuclear installations. Conclusions of this review are: problems of radioactive waste are complex but manageable; high standards of safety and considerations for the human environment are stressed; at present radioecological aspects are not a limiting factor for radioactive waste management; public interest and information are encouraged; optimum development of nuclear energy need not be impeded by problems of radioactive waste management which will have to be dealt with. (RAF)

REVIEWS; WASTES, RADIOACTIVE; HAZARD ANALYSIS; ECONOMICS; ALPHA PARTICLES; KRYPTON 85; TRITIUM; NUCLEAR FACILITIES; ENVIRONMENT; RADIOECOLOGY; REPROCESSING

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Perello, M. Junta de Energia Nuclear, Departamento de Seguridad Nuclear, Madrid, Spain

The Decommissioning of Nuclear Installations in the Preliminary Safety Report. IAEA-SM-234/28; Decommissioning of Nuclear Facilities, Proceedings of an International Symposium, Vienna, Austria, November 13-17, 1978. International Atomic Energy Agency, (pp. 121-139), 694 pp. (IAEA-SM-234/28). (1979)

The final closure or decommissioning of a nuclear installation, regarded as the event which occurs when it ceases to fulfil the purpose for which it was originally constructed, is a matter of some concern in view of the serious difficulties that have been encountered in the case of small installations such as research reactors. Until quite recently, the decommissioning of commercial nuclear power stations was seen as a problem for the distant future. However, thanks to rapid progress in nuclear technology and improvements in the quality of components and equipment in nuclear power stations, such power stations are often amortized in a much shorter time than was originally foreseen at the design and construction stage. Unlike the situation in other industries, the final closing down of a nuclear reactor requires strict controls which are adequate to guarantee the radiological protection of the workers in the installation and of the general public. The main purpose of this paper is to justify the inclusion in the preliminary safety report of a chapter on the decommissioning of the nuclear installation in question. The problem is looked at, in principle, from the point of view of nuclear safety, after which the customary methods of decommissioning are considered; finally, a format is suggested for the proposed chapter in the safety report. (Auth)

NUCLEAR FACILITIES; DECOMMISSIONING; SAFETY

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Philadelphia Electric Company

Decommissioning Plan and Safety Analysis Report - Peach Bottom 1. DOCKET 50171-71; Peach Bottom 1 Report; 137 pp. (1974, August 29)

Describes the plan for decommissioning the Peach Bottom-1 Atomic Power Station, and presents a safety analysis which demonstrates that the facility will be placed in a status which is not hazardous to the health and safety of the public. Once all fuel is removed from the reactor and canned, the Part 50 Utilization License (DPR-12) will be surrendered and a Part 50 Possession Only License will go into effect as approved by the Atmoic Energy Commission

PEACH BOTTOM-1 REACTOR; PROCEDURES; DECOMMISSIONING; SAFETY; REACTORS, HTGR; DOCUMENTATION

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Powers, E.W., and E.A. Wegener United Nuclear Industries, Inc., Richland, WA

Hanford Production Reactor Decommissioning Study: 100-F Area Disposition Plan and Activities Definition. Report; 98 pp. (1978, April 28)

The report is the third in a series of preparatory documents necessary for accomplishing the ultimate demolition of the 100-F Plutonium Production Reactor and its related facilities. The disposition plan and activities definition is the key planning document since it is here that the first effort is made to describe the mode to be applied, the end product to be achieved, and the management system to be employed in carrying out the disposition project. The document also identifies the major tasks necessary to accomplish complete dismantlement and demolition of the 100-F Area facilities, and proposed techniques for performing these activities and tasks. Although conceptual, these methods and procedures provide the basis for preparation of the major activity descriptions and detailed work procedure documents.

DECONTAMINATION; REACTORS, HANFORD PRODUCTION; PLANNING; REACTOR DECOMMISSIONING; REACTOR DISMANTLING

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Preuss, H.J., D. Brosche, and R. Lukes (Ed.) Muenster University, Institut fuer Arbeits- und Wirtschaftsrecht, Muenster, German Federal Republic

Technical Problems in Connection with the Decommissioning of Nuclear Facilities. 5th Symposium on Nuclear Law, Muenster, German Federal Republic, December 8, 1976 (pp. 121-131). (1977)

Brief survey of decommissioning variants (e.g. containment, dismantling), of nuclear power plants decommissioned so far, working techniques concerning decontamination and disposal and storage of activated components, r+d activities.

DECONTAMINATION; NUCLEAR POWER PLANTS; WASTE STORAGE; REACTOR DECOMMISSIONING; REACTOR DISMANTLING; REVIEWS

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Puget Sound Power Light Company, Bellevue, WA

Response to Question 331.6 - Radiation Exposure Problems During Decommissioning. STI/PUB/465; Supplement 5 to Skagit 1 2 License Application, (1 p.). (1975, March 7)

The National Environmental Studies Project under the sponsorship of the Atomic Industrial Forum is presently undertaking a study to identify the design considerations involved in reactor decommissioning. The detailed work scope of this study has been reviewed by the AEC. It is anticipated that the utility owners will utilize the results of this study in the development of their decommissioning procedures.

REACTORS, BWR; DECOMMISSIONING; EXPOSURE, OCCUPATIONAL; GESSAR-251 REACTOR; SKAGIT-2 REACTOR; SKAGIT-1 REACTOR

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Ramsey, R.W.

Department of Energy Programs for Decontamination and Decommissioning. CONF-790923; Decontamination and Decommissioning of Nuclear Facilities, Proceedings of a Conference, Sun Valley, ID, September 16-20, 1979. Session I, (pp. 4-5), 90 pp. (CONF-790923). (1979)

The Department of Energy has four primary objectives in its decontamination and decommissioning program: (1) To properly manage surplus facilities to assure they do not become a hazard through neglect; (2) To progressively reduce the inventory of facilities or sites that are restricted in their use due to the presence of radioactive contamination; (3) To provide RD, planning and project support for activities to decontaminate and decommission facilities as they become surplus; (4) To take remedial action at uranium mill tailings sites, former contractor or government-owned sites, or private property where residual contamination is found to exist and restricts the future use of the property in an unacceptable manner. Significant problems that must receive attention include the techniques for decision making among alternative D and D modes (including doing nothing); the development of criteria, standards and specifications; measurement techniques to render judgments about the adequacy of decontamination; the potential for salvage or recycle of materials and equipment and the practical disposal of enormous quantities of low-level waste, particularly soil materials that will arise if total dismantlement and restoration to unrestricted condition is the chosen alternative. (Auth)(JMF)

This paper is only an abstract of the actual paper which is to be published later.

DECONTAMINATION; DECOMMISSIONING; NUCLEAR FACILITIES; STANDARDS, FEDERAL; REGULATIONS, FEDERAL; WASHING; PROGRAMS

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Rao, M.K. Bhabha Atomic Research Center, Trombay, Bombay, India

Decommissioning Aspects of a Nuclear Chemical Plant. IAEA-SM-234/4; Decommissioning of Nuclear Facilities, Proceedings of an International Symposium, Vienna, Austria, November 13-17, 1978. International Atomic Energy Agency, (pp. 597-608), 694 pp. (IAEA-SM-234/4). (1979)

The need for decommissioning of nuclear installations at the end of their useful lives is beginning to be felt. A brief discussion on the various considerations relevant for the decommissioning effort is included in the paper. Decommissioning work could be minimized if suitable provisions were incorporated at the design stage. Experience with the partial decommissioning of the Trombay Fuel Reprocessing Plant prior to reconstruction to extend its life is touched upon. (Auth)

DECOMMISSIONING; FUEL REPROCESSING PLANTS; NUCLEAR FACILITIES; DESIGN

345
Reckman, B.J.

Planning and Licensing for the Decommissioning of the Saxton Nuclear Experimental Facility. ASME Paper No. 73-WA/NE-8; Winter Meeting of the American Society of Mechanical Engineers, Detroit, MI, November 11, 1973, (12 pp.). (1973)

The factors considered were minimum decommissioning with and without onsite storage, onsite entombment and total removal of all radioactivity from the site. These evaluations lead to the decision to proceed with the minimum decommissioning option.

REACTORS, PWR; SAXTON REACTOR; DECOMMISSIONING; LICENSING

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Reddy, D.V., and T.W Kierans

Dynamic Analysis for Design Criteria for Underground Nuclear Reactor Containments. International Seminar on Extreme Load Conditions and Limit Analysis Procedures for Structural Reactor Safeguards and Containment Structures, Berlin, German Federal Republic, September 8, 1975; Nuclear Engineering and Design 38(2):177-205. (1976, August)

The paper is based on i) the recent input of the authors for the underground containment subsection of the seismic task group report of the ASCE committee for nuclear structures and materials, and ii) parametric studies carried out by the first author on the principal undergound concepts. The extensive work on aseismic design of above-ground reactors and recent studies on missile impact effects, aircraft impact, blast effects due to chemical explosions, reactor core melt-down and tornadoes indicate the advantages of underground siting with inherent general reduction of complexity of seismic amplification and benefits of structural and biological integrity. Other advantages are possibilities of urban siting, ecological considerations, reduced effects on the landscape, ability to design three-dimensionally, separation of component facilities, support capability to equipment, reduced power transmission costs, increased number of acceptable units and power capability from a single location, and reduction of decommissioning problems. In view of the limited actual experience in the structural design of underground containments (only four European reactors), the proposals are based on a) the transposition of applicable design specifications, constraints and criteria from existing surface nuclear power plants to underground, and b) the use of many years of experience in the structural design of large underground cavities and cavity complexes for other purposes such as mining, hydropower stations etc.

BUILDINGS, CONTAINMENT; DESIGN; ROCKS; SEISMOLOGY; SITE SELECTION; SOILS; SPECIFICATIONS; UNDERGROUND NUCLEAR STATIONS; VOLCANIC REGIONS

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Remark, J.F.

Plant Decontamination Methods Review. CONF-790923; Decontamination and Decommissioning of Nuclear Facilities. Proceedings of a Conference, Sun Valley, ID, September 16-20, 1979. Session II-A, (pp. 1-2), 90 pp. (CONF-790923). (1979)

The Nuclear Regulatory Commission (NRC) has found that increasing emphasis on plant availability, increasing repairs, backfitting and inspection, and decontamination techniques are becoming increasingly important in the operation of a commercial nuclear plant because of pressure to lower the maximum man-rem exposure limits. Commercial nuclear sites employ various techniques for decontamination, some of which are successful and some are not. A few decontamination techniques in the past have created a greater contamination or exposure problem than the original contamination. Much time could be saved by plant personnel and costly errors avoided if up-to-date decontamination information were available. Recognizing this need, Electric Power Research Institute (EPRI) has contracted with the Babcock Wilcox Company to conduct a decontamination survey of techniques used by light water reactor operators. The survey identified the successful and unsuccessful decontamination techniques currently employed at operating LWRs. In areas where the activated corrosion products have been incorporated into tightly adherent corrosion films, more severe methods of decontamination, such as grit blasting or high concentration chemical decontamination; have been utilized. In March, 1979, electropolishing was used in the decontamination of the primary coolant piping at Surry during the steam generation replacement outage. Components that have been decontaminated at operating nuclear plants range from a simple hand tool to the entire reactor coolant system at Dresden 1. (Auth)(JMF)

This paper is only an abstract of the actual paper which is to be published later; The paper presents an overview of decontamination techniques.

DECONTAMINATION; REACTORS; NUCLEAR FACILITIES; REGULATIONS, FEDERAL; REACTORS, LIGHT-WATER; NUCLEAR POWER; WASHING; REVIEWS

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Rhoads, R.E., W.B. Andrews, and H.K. Elder Battelle-Pacific Northwest Laboratories, Richland, WA

Transportation Safety Studies. DOE/EV-0042; Division of Environmental Control Technology Program-1978, (pp. 110-112), 259 pp. (1979, June)

To ensure adequate protection of humans and the environment in the transport of energy material, it is necessary to understand the safety and potential environmental effects of the shipments of energy materials, both in normal transport and under accident conditions. The objective of the transportation safety studies project is to assess these potential effects in terms of risk. Risk is defined as the probability that an undesirable event will occur, multiplied by the type and degree of consequences. Final reports were published this fiscal year on the risk of shipping uranium hexafluoride (UF6) by truck and train, the safety and economics of shipping spent fuel in special trains, the consequences of the loss at sea of spent fuel and plutonium shipping packages, and the results of two surveys of receivers of plutonium shipping packages. The assessment of the risk of transporting uranium hexafluoride by truck and train showed the UF6 shipment risks were comparable to the risks (...)mated in previous studies for shipment of plutonium by these transport modes, and much less than other risks in society. The study of shipments of spent fuel in special trains showed that special trains had a limited potential to reduce the frequency of involvement of spent fuel casks in rail accidents when compared to regular train service. However, the frequency or involvement in regular train service is already quite low. The use of special trains was also shown to substantially increase transportation costs for spent fuel in most circumstances, although economic and logistical advantages could result for some shippers. The assessment of the consequences of the loss of spent fuel and plutonium shipping packages at sea showed that the radiation doses to the public from consumption of seafood contaminated by postulated accidents were relatively low when compared to the exposure from natural background. The surveys of receivers of plutonium shipping packages, conducted in 1974 and 1976, showed that the incidence of non-standard package closure conditions was small and that the rate appeared to be declining because of new quality control measures that had been introduced. The results of the assessment of the risk of shipping spent fuel by truck is seen to be comparable to the risk of transporting plutonium and much less than other risks in society. Sensitivity studies showed that the spent fuel shipment risk could be reduced by 80 percent if the fuel were shipped only after it had cooled more than 2 years after discharge from the reactor. The conceptual design for a rail cask for shipping high-level waste has the capacity to transport waste produced from reprocessing about 30 megatons of spent fuel. The cask is shipped with dry air in the cavity and cooled by natural convection from the cooling fins on the cask surface. (Auth)(JMF)

The study contains a photograph of a model conceptual cask and railcar for transporting solidified high-level waste and a graph comparing risks involved in shipping spent fuel by truck and those encountered in everyday life.

ENVIRONMENT; HAZARD ANALYSIS; EXPOSURE, POPULATION; TRANSPORTATION, RAIL; TRANSPORTATION, TRUCK; ECONOMICS; PLUTONIUM; SPENT FUELS

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Rickard, W.H., and E.L. Klepper Battelle-Pacific Northwest Laboratories, Richland, WA

Ecological Aspects of Decommissioning and Decontamination of Facilities on the Hanford Reservation. Report; 67 pp. (1976, June)

The Hanford environment and biota are described in relation to decommissioning of obsolescent facilities contaminated with low levels of radioactive materials. The aridity at Hanford limits both the productivity and diversity of biota. Both productivity and diversity are increased when water is added, as for example on the

margins of ponds. Certain plants, especially SALSOLA KALI (Russian thistle or tumbleweed), are avid accumulators of minerals and will accumulate radioactive materials if their roots come into contact with contaminated soils. Data on concentration ratios (pCi per gdw of plant/pCi per gdw soil) are given for several native plants for long-lived radionuclides. Plants are generally more resistant than animals to ionizing radiation so that impacts of high-level radiation sources would be expected to occur primarily in the animals. Mammals and birds are discussed along with information on where they are to be found on the reservation and what role they may play in the long-term management of radioactive wastes. Food habits of animals are discussed and plants which are palatable to common herbivores are listed. Food chains leading to man are shown to be very limited, including a soil-plant-mule deer-man path for terrestrial sites and a pond-waterfowl-man pathway for pond sites. Retention basins are discussed as an example of how an ecologically sound decommissioning program might be planned. Finally, burial of large volumes of low-level wastes can probably be done if barriers to biological invasion are provided.

ECOSYSTEMS, AQUATIC; BIRDS; CESIUM 137; DECOMMISSIONING; DECONTAMINATION; ENVIRONMENT; FOOD CHAINS; IODINE 131; LAND USE; WASTES, LIQUID; PLUTONIUM 239; WASTE MANAGEMENT; RADIOACTIVITY; RADIOECOLOGY; RADIONUCLIDE KINETICS; RADIONUCLIDE MIGRATION; SOILS; WASTES, SOLID; STRONTIUM 90; SURFACE WATERS; ECOSYSTEMS, TERRESTRIAL; ANIMALS; VEGETATION

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Rickard, W.H., and E.L. Klepper Battelle-Pacific Northwest Laboratories, Richland, WA

Burial Strategies. BNWL-2033; Ecological Aspects of Decommissioning and Decontamination, (pp. 50-53), 61 pp. (BNWL-2033). (1976, June)

Decommissioning and decontamination procedures will produce large volumes of low-level waste, such as rubble from building materials. Disposal of these high-volume, low-level wastes can most effectively be done by shallow burial. Properly engineered burial potentially has the following advantages: 1) overburden provides effective shielding from ionizing radiation, 2) wastes are covered sufficiently well to prevent resuspension by wind, and 3) wastes will not be available to leaching by precipitation wastes into groundwaters. Techniques currently in use involve digging a large trench, placing wastes in the bottom of the trench and covering the wastes with backfill material which consists of a mixture of cobbles and topsoil. These techniques permit shielding and protection from resuspension by wind, however, no barriers to root or burrowing mammal penetration are provided. A modified burial technique that provides a barrier to biological invasion of wastes involves stockpiling the cobbles separate from the topsoil. Gravels are laid into the waste trench in a deep layer in order to discourage biological penetration. Sufficient soil is laid over the cobbles to hold water provided by annual precipitation. This topsoil is planted to a stable vegetation cover which will transpire the stored soil water each year and prevent wetting and leaching of the burial wastes. Other buried barriers to prevent biological invasion of buried wastes include buried asphalt or concrete layers and layers of soil treated with materials toxic to roots. Surface barriers can also be constructed. (Auth)(HT)

Burial site engineering for wastes to be produced by the decommissioning and decontamination of facilities is discussed. (DM/HT)

OVERBURDEN; LEACHING; PRECIPITATION, METEOROLOGICAL; GROUND WATER; SOILS; BACKFILLING; TRENCHES; BURIAL; BIOTA; WASTES, LOW-LEVEL; VEGETATION

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Rockwell Hanford Operations, Richland, WA

Decontamination and Decommissioning Program Plan. DOIPRCPOOO1; 51 pp. (1978, April)

The program plan represents the top level guidance document for stating and performing the objectives of the D and D program. The program objectives, historical data, and program description are presented, along with the top level planning. The planning includes a statement of the funding basis and the corresponding first level activity network schedule. The management plan is included which describes the procedures to be used for cost and schedule control and reporting, purchasing and subcontract control, and program and engineering data control. The requirements for the quality assurance plan, operational safety plan, and training plan are presented. (Auth)

DECONTAMINATION; DECOMMISSIONING; EQUIPMENT; RADIOLOGICAL SURVEYS;

WASTES, RADIOACTIVE; BURIAL; DOCUMENTATION; VOLUME REDUCTION; MELTDOWN; STEELS; TOOLS; SAWS; COSTS; SAFETY

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Royl, P., D. Billington, G. Evrard, R. De Fremont, D. De Lapparent, W. Maschek, and J. Penet Kernforschungszentrum Karlsruhe, Karlsruhe, German Federal Republic

Comparative Analysis of a Hypothetical Loss of Flow Accident in a LMFBR Using Different Computer Models for a Common Benchmark Problem. EUR 5946 EN; 186 pp. (1978)

Special report: a committee of the European communities commission examined the problem of core disruptive accidents in LMFBR's. Using four computer models, a hypothetical loss of flow type accident was simulated for a common benchmark problem, and the results of different analyses were compared. Conditions and assumptions for a fictitious reactor are given. Results are compared in terms of: voiding dynamics; reactivity feedbacks and transient power changes after boiling initiation; slumping dynamics and local fuel dispersion; the state of the core at the onset of disassembly; and the disassembly phase. Good agreement between different core predictions was obtained. (Numerous graphs, tables.)

NUCLEAR POWER; REACTORS, LMFBR; ACCIDENTS, LOSS OF COOLANT; NUCLEAR POWER; NUCLEAR POWER PLANTS; DECOMMISSIONING; SODIUM; TEMPERATURE; MODELS, MATHEMATICAL

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Russell, J.L. U.S. Environmental Protection Agency, Office of Radiation Programs, Washington, DC

Potential Environmental Advantages from Partitioning of Radioactive Wastes. NR-CONF-001; CONF-760642; PB-254 737; Management of Radioactive Waste: Waste Partitioning as an Alternative, Proceedings of the Nuclear Regulatory Commission Partitioning Workshop, Seattle, WA, June 8-10, 1975, (pp. 81-94), 523 pp. (NR-CONF-001, CONF-760642, PB-254 737). (1976)

Partitioning of radwastes (transuranics from both high- and low-level wastes) allows more options for environmentally safe management. Activities requiring attention to deal with the problem are: the need for environmental criteria or standards; source term data, including waste form and packaging; environmental transport information; potential dose delivered to man; the availability and suitability of disposition alternatives; possible remedial actions and their costs; perpetual care consideration; and monitoring, with action levels. Partitioning of low-level wastes is primarily a management problem. Most of the wastes that should be kept isolated will come from reprocessing and fuel recycle plants and I 129 and C 14 will come from the off-gas stream at these plants. Mixed oxide fabrication will also produce low-level waste that is transuranium contaminated. For sound management all transuranium contaminated wastes should be delivered to a federal repository instead of to a shallow land burial site. From the limited experience at West Valley, the total plutonium present in the light-water reactor recycle may be greater that that in high-level waste. Hence, a greater effort is justified for partitioning low-level waste than for high-level wastes. Partitioning and the costs should be investigated with respect to the radon produced by uranium mill tailings. With partitioning, waste classes and disposition alternative can be paired. The expected sources of wastes are: high-level, low-level, and transuranium-contaminated low-level from the nuclear power industry; decommissioning waste; and a variety of wastes used in medicine, research, and industry. Disposal alternatives include: shallow land burial, emplacement-entombment, geological disposal, extraterrestial and ice cap disposal. Classification of radwastes should emphasize half-life as well as wastes source and toxicity. (NDV)

FUEL REPROCESSING; MILLING; PARTITIONING; HALF-LIFE, RADIOLOGICAL; WASTE TREATMENT; WASTES, HIGH-LEVEL; WASTES, LOW-LEVEL; WASTES, RADIOACTIVE; WASTES, TRANSURANIC; REACTORS, LIGHT-WATER

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Sakata, S.

Status of Management of Radioactive Wastes from Nuclear Power Plants. Nenryo Kyokai-shi 54(577):306-313. (1975)

The cognition for dealing with the radioactive waste has reached the waste management concept through the treatment and disposal from the simple disposal of the early stage. In nuclear-electric power generation systems, many sorts of radioactive waste are generated from not only

power stations but their related nuclear fuel cycle facilities. Two technical objectives in the waste treatment step are: the diminution of the release rate of radioactivity into the environment in fluid form, and the conditioning (solidification and packaging) of volume-reduced or concentrated wastes including both solid waste and wastes originated from the decommissioning of nuclear facilities. At this moment, endeavors dedicated for the diminution of release rate gives fairly good performances based on the "As low as practicable" principle, except the conditioning. Hereafter, much effort will be concentrated on the following aspects, for example, diminution of the amount of the wastes to be solidified or packaged, realization of high volume reduction, and establishing the appropriate guidelines for packaging together with the consolidation of responsibility and financial liability. (Auth)

FUEL CYCLES; NUCLEAR POWER; NUCLEAR POWER PLANTS; WASTE MANAGEMENT; WASTE PROCESSING; REPROCESSING; REVIEWS

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Sande, W.E., H.D. Freeman, M.S. Hanson, and R.L. McKeever Battelle-Pacific Northwest Laboratories, Richland, WA

Decontamination and Decommissioning of Nuclear Facilities - A Literature Search. BNWL-1917; 140 pp. (1975, May)

This bibliography includes 429 unclassified references to the decontamination and decommissioning of nuclear facilities. The references are arranged in chronological order and cover the period from 1944 through 1974. Subject and author indexes are provided.

BIBLIOGRAPHIES; DECONTAMINATION; REACTORS, RESEARCH; REACTORS, POWER; CORROSION; DECOMMISSIONING; JACOBS

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Sauter, G.D. Lawrence Livermore Laboratory, Livermore, CA

Energy Dynamics of an Expanding Power Generating System. 22th Nuclear Science Symposium and 7th Nuclear Power Systems Symposium, San Francisco, CA, November 9, 1975; IEEE Trans. Nucl. Sci. NS-23(1):60-64. (1976, February)

A computer program was developed to study the magnitude and time dependence of the net power and net energy generated by an expanding system of identical power plants. Application of the program to several expansion modes over a range of values for the rate of expansion, the net energy generated by an individual plant, and the construction time for each plant has led to some interesting results concerning the impact of the expanding system on the overall energy picture. In particular, during a rapid expansion phase, the system of power plants may be a better means of energy storage than of energy generation.

CONSTRUCTION; DECOMMISSIONING; ECONOMICS; MODELS, MATHEMATICAL; NUCLEAR POWER PLANTS; REACTOR OPERATION; PLANNING; POWER PLANTS; REACTOR DECOMMISSIONING

357
Schmidt-Kuester, W.J. Bundesministerium fuer Forschung und Technologie, Bonn, German Federal Republic

The Disposal System in the Nuclear Fuel Cycle. Atomwirtschaft-Atomtechnik 19(7):340-345. (1974, July)

COSTS; REACTORS, FBR TYPE; FORECASTING; FUEL CYCLES; PLUTONIUM; WASTE DISPOSAL; WASTE MANAGEMENT; WASTE STORAGE; REACTOR DISMANTLING; REPROCESSING; SPENT FUELS; REACTORS, WATER COOLED; REACTORS, HTGR; REACTORS, WATER MODERATED

358
Schneider, K. Transnuklear G.m.b.H., Hanau, German Federal Republic

Transportation Problems in Nuclear Power Plant Shutdown Due to Age. Reactor Congress, Hannover, German Federal Republic, April 4, 1978, (pp. 971-974). (1978)

Transport variables for the parameters: organizational types of working, decay times of 15 and 40 years respectively and possible types of final storage. Reference plants: 1300-PWR with main coolant pump, pressure vessels and internals and steam generators, 900-BWR with pressure vessel.

REACTORS, BWR; CONTAMINATION; PLANNING; REACTORS, PWR; WASTE STORAGE; REACTOR COMPONENTS; REACTOR DECOMMISSIONING; REACTOR DISMANTLING;

WASTES, SOLID; TRANSPORTATION; REGULATIONS; BURIAL

359
Schwarzwaelder, R. Nuklear-Ingenieur Service G.m.b.H., Hanau, German Federal Republic

Decommissioning of Nuclear Power Stations. 3rd RWE Workshop 'Nuclear Energy', Frankenthal, German Federal Republic, November 12, 1975; Energiewirtschaftliche Tagesfragen 26(7):358-63. (1976, July)

The essential findings about the decommissioning of mainly commercial LWR reactors are: 1) It can said that the decommissioning of the commercial nuclear plants in the Federal Republic which are being built or are already in operation will not bring any insurmountable technical problems. 2) The decommissioning will be carried out within the frame of the safety prescriptions already existing. The personnel carrying out the decommissioning won't be subject to an inadmissible exposure. An increased emission of activity to the environment during the decommissioning is not expected. 3) The costs of the total dismantling of a nuclear plant are rather high in absolute values, but the cost advantage of the nuclear plants compared with other fossile power plants is only negligibly influenced by the decommissioning costs. 4) It is necessary to find a storage site for bulky radioactive waste in the Federal Republic. Transport containers of large volume are to be developed at the same time. 5) the progress of procedures and devices already known for grinding and conditioning of active heavy reactor components, especially of the reactor pressure vessel, should be hastened. 6) The decommissioning of nuclear test plants in the FRG to be carried out during the next years should be used to collect more experience both concerning the technical procedures, costs and concerning the permittance process for later decommissioning of commercial nuclear plants.

COSTS; NUCLEAR ENGINEERING; NUCLEAR POWER PLANTS; REACTOR DECOMMISSIONING; REACTOR DISMANTLING

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Seipel, H.G. Federal Ministry of Research and Technology, German Federal Republic

German Light-Water-Reactor Safety-Research Program. Nuclear Safety 18(6):727-756. (1977, November-December)

Survey report: the LWR safety-research program, part of W. Germany's energy program, is described. The program is divided into four main problem areas: improvement of the operation, safety, and reliability of systems and components; analysis of the consequences of accidents; analysis of radiation exposure during operation, accident, and decommissioning; and analysis of the risk created by the operation of nuclear power plants. Quality assurance, component safety, loss-of-coolant accidents, and risk and reliability are studied. Fission-product transport and radiation exposure and pressure-vessel failure are discussed. International cooperation and the organization of reactor safety research are examined. (3 diagrams, 5 drawings, 8 graphs, 2 maps, 5 photos, 100 references, 3 tables)

NUCLEAR POWER; REACTORS, LIGHT-WATER; REACTOR SAFETY; NUCLEAR FUELS; TRANSPORTATION; RADIATION PROTECTION; NUCLEAR POWER PLANTS; DECOMMISSIONING; ACCIDENTS, LOSS OF COOLANT

361
Servant, J.

Nuclear Safety in France. Journal of the Institution of Nuclear Engineers 17(6):154-162. (1976, November)

The establishment in France in 1975 of an interministerial committee on nuclear safety is described, and the safety aspects with which this committee will be concerned are reviewed. These include general radiation protection, protection of workers, steps to be taken in case of accidents, discharge of radioactive effluents, nuisance, pollution or inconvenience of a non-nuclear nature, safety of nuclear facilities, protection of installations against acts of malice, control and physical protection of nuclear materials, transport of radioactive materials, marine nuclear propulsion, waste management, decommissioning of nuclear installations, and export of nuclear equipment and materials. The main ministries and responsible services involved are listed. It is stated that a higher nuclear safety council is shortly to be established.

GOVERNMENT POLICIES; LEGAL ASPECTS; LEGISLATION; RADIATION PROTECTION; REGULATIONS

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Seyfferth, L. Zentralstelle fuer Atomkernenergie-Dokumentation, Eggenstein-Leopoldshafen, German Federal Republic

Planning for Decommissioning. Meeting on Nuclear Power Plant Project Planning and Implementation, Karlsruhe, F.R. Germany, September 17, 1975 (19 pp.). (1975)

The following conclusions can be drawn: decommissioning of large commercial nuclear power plants is technically feasible. It can be done within the frame of licensing regulations. Costs for decommissioning will be high; however the overall economic advantages of nuclear power are not considerably influenced. Search for suitable storage facilities and transport methods for large quantities and large dimensions should be started in an early stage. Tools and processes for cutting and conditioning of large radioactive components are still to be developed in detail.

COSTS; FEASIBILITY STUDIES; NUCLEAR POWER PLANTS; PLANNING; REACTOR DECOMMISSIONING; REACTOR DISMANTLING; REACTORS; LICENSING; REGULATIONS

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Seyfrit, K.V.

Application for a Dismantlement Order for the Piqua Nuclear Power Facility (Letter to P. A. Morris from Seyfrit). Letter to P.A. Morris from K.V. Seyfrit; DOCKET 115-2; 4 pp. (1968, September 3)

Conveys supporting documents providing basis for the conclusion that dismantling will be safe, requests present operating authorization be cancelled, and describes administrative controls to be followed.

REACTORS, ORGANIC COOLED; DECOMMISSIONING; PIQUA NUCLEAR POWER FACILITY

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Smith, R.I., and K.J. Schneider Battelle-Pacific Northwest Laboratories, Richland, WA

Analyses of the Decommissioning of a Pressurized Water Reactor and a Fuel Reprocessing Plant. IAEA-SM-234/16; Decommissioning of Nuclear Facilities, Proceedings of an International Symposium, Vienna, Austria, November 13-17, 1978. International Atomic Energy Agency. (pp. 217-235), 694 pp. (IAEA-SM-234/16). (1979)

Safety and cost information was developed for the conceptual decommissioning of a large (1175 MWe) pressurized water reactor (PWR) and a large nuclear fuel reprocessing plant (FRP). Two approaches to decommissioning, immediate dismantlement and safe storage with deferred dismantlement, were studied to obtain comparisons between costs, occupational radiation doses, potential radiation dose to the public, and other safety impact. For the PWR, immediate dismantlement was estimated to require about six years to complete, including two years of planning and preparation prior to final reactor shutdown, at a cost of US $42 million, and an accumulated occupational radiation dose of about 1326 man-rem. Prepa rations for safe storage were estimated to require about three years to complete, including 1 1/2 years for planning and preparation prior to final reactor shutdown, at a cost of US $13 million and an accumulated occupational radiation dose of about 430 man/rem. The annual cost during the safe storage period was estimated to be about US $80 thousand. Deferred dismantlement following a 30-year period of safe storage was estimated to require about US $47 million and an occupational dose of about 24 man/rem. For the FRP, immediate dismantlement was estimated to require about seven years to complete, including two years of planning and preparation prior to final plant shutdown, at a cost of US $67 million, and an accumulated occupational radiation dose of about 532 man/rem. Preparations for safe storage were estimated to require about four years, including about 1 1/2 years for planning and preparation prior to final plant shutdown, at a cost of US $22 million and an accumulated occupational radiation dose of 72 to 84 man/rem for the custodial and passive modes, respectively. The annual cost during the safe storage period was estimated to be about US $880 thousand for the custodial mode and about US $182 thousand for the passive mode. Deferred dismantlement following a 30-year period of safe storage was estimated to require about US $50 million and an accumulated occupational radiation dose of about 226 man rem. (Auth)

THEORETICAL STUDIES; SAFETY; COST ESTIMATES; REACTOR DECOMMISSIONING; REACTORS, PWR; FUEL REPROCESSING PLANTS; DISMANTLING; STORAGE; EXPOSURE, OCCUPATIONAL; RADIATION DOSE; EXPOSURE, POPULATION; PLANNING; TIME FACTOR

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Steger, J., E. Albenesius, J.O. Duguid, G. Hanson, and L. Johnson U.S. Energy Research and Development Administration, Steering Committee on Land Burial

The ERDA Plan to Develop a Technology for the Shallow Land Burial of Solid Low-Level Radioactive Waste. Report; 29 pp. (1976, June)

The U.S. Energy Research and Development Administration's steering committee on land burial presents in this report its initial plan which establishes program goals, outlines the procedures which will be followed during the program, guides the organization of activities, and coordinates the activities with other responsible agencies. The goal of the program is to define what technical information is presently available, identify data needs, initiate the appropriate need investigations, to assemble and evaluate all relevant information into a technology including cost/benefit considerations, to construct a demonstration facility to field test the developed technology, and to disseminate the appropriate information to site operators, environmental scientists, and policy/decision makers. The chief areas of concern for the steering committee are data acquisition, burial site selection, waste criteria, site engineering, operational assessment, and validation/demonstration. The existing state of knowledge on these topics is reviewed and a schedule of the program through 1982 is presented. (JC)

BURIAL; WASTES, LOW-LEVEL; DEMONSTRATION FACILITIES; SITE SELECTION; WASTE MANAGEMENT; RADIONUCLIDES; GEOLOGY; HYDROLOGY; DECOMMISSIONING; SORPTION

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Steindler, M.J., and L.W. Trevorrow U.S. Energy Research and Development Administration, Washington, DC; Oak Ridge National Laboratory, Oak Ridge, TN; Argonne National Laboratory, Argonne, IL

Description of the Fuel Cycle and Nature of the Wastes. International Symposium on Management of Waste from the LWR Fuel Cycle, Denver, CO, July 11, 1976 (pp. 80-95). (1976)

A description of the LWR fuel cycle and the nature of the wastes is basic to a discussion of the technologies applicable to the effective disposition of those wastes. For this review, the fuel cycle is represented, in the minimum detail necessary to indicate the origin of the wastes, as a system of operations that are typical of those proposed for various commercial ventures related to the back end of the LWR fuel cycle. The primary wastes before any treatment are described in terms of form, volume, radioactivity, chemical composition, weight, and combustibility (in anticipation of volume-reduction treatments). Quantitative properties of the wastes expected from the operation of reactors, fuel-reprocessing plants, mixed-oxide fuel fabrication plants, and also from the decommissioning of those facilities, are expressed in terms of amounts per unit of nuclear energy produced.

FUEL CYCLES; WASTES, GASEOUS; WASTES, LIQUID; FABRICATION PLANTS, MIXED OXIDE FUEL; WASTES, RADIOACTIVE; REPROCESSING; WASTES, SOLID; REACTORS, WATER COOLED

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Stouky, R.J.

Planned Decommissioning of the Peach Bottom Unit No. 1 High Temperature Gas Cooled Reactor. ASME Paper No. 73-WA/NE-7; Winter Meeting of the American Society of Mechanical Engineers, Detroit, Michigan, Nov. 11, 1973, (8 pp.). (1973)

The plant is to be decommissioned to assure safety of the facility and public in an unmanned status, but with periodic surveillance inspections of the site. All fuel and source material will be removed from the site. All radioactive material outside of the containment will be removed and buried at AEC or state licensed burial sites. All remaining radioactive material inside the containment will remain within the biological shielding. All areas of greater than 1.0 mr/hr or where contamination is found will be physically secured and locked. Soon after shutdown, the plant will be placed under new technical specifications and in Part 50 Possession Only status. Manning will be minimized, consistent with maintaining the facility in a safe status and the shipment undertaken as rapidly as possible.

PEACH BOTTOM-1 REACTOR; DECOMMISSIONING; REACTORS, HTGR

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Suta, B.E., S.J. Mara, S.B. Radding, and L.W. Weisbecker SRI International, Menlo Park, CA

Annotated Bibliography: Hazard Assessments for the Geologic Isolation of Nuclear Wastes. Final Report. Center for Resource and Environmental Systems Studies Report No. 41. (1977, November)

This report presents an annotated bibliography of risk assessments that are pertinent to constructing, operating, and decommissioning a federal repository for the underground storage of radioactive waste. This might be considered as a first phase in an assessment of the risks associated with radioactive waste storage. Only those documents judged to be the more pertinent are abstracted. The abstracts are grouped under 13 classifications. A subject and author index is provided.

BIBLIOGRAPHIES; HAZARD ANALYSIS; WASTE DISPOSAL; WASTE STORAGE; STORAGE, GEOLOGIC

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Svasek, A.J. Westinghouse Electric Corporation, Astronuclear Laboratory, Pittsburgh, PA

Comments on E-MAD Phase 2 Drawings Received February 6, 1963. Report; 4 pp. (1963, February 13)

Comments on drawings and design information received by WANL on the E-MAD Facility are presented. (TFD)

NERVA REACTOR; MAINTENANCE; DESIGN; DIAGRAMS; HOT CELLS; NUCLEAR FACILITIES; REACTOR DISMANTLING

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Tamura, T., O.M. Sealand, and J.O. Duguid Oak Ridge National Laboratory, Oak Ridge, TN

Preliminary Inventory of Plutonium 239, 240, Sr 90, and Cs 137 in Waste Pond. ORNL/TM-5802; 38 pp. (1977, June)

Preliminary inventory of the actinides and fission products was taken in preparation of decommissioning facility 3513. Based on the activity in the recovered cores and the area distribution of bottom sediments, the inventory of Pu 239, 240 was approximately 80 g equivalent to 5 Ci. The Sr 90 inventory was 0.24 g equivalent to 33.6 Ci. The Cs 137 inventory was 2.3 g or 200 Ci. The least squares fit of the power curve y = ax(Exp b) shows that significant relationships exist among the three nuclides in the pond.

JACOBS; PLUTONIUM; STRONTIUM; CESIUM; SAMPLING; SEDIMENTS; WASTE STORAGE; DECOMMISSIONING

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Tennessee Valley Authority, Chattanooga, TN

Bellefonte Nuclear Plant, Units 1 and 2. State of Alabama, Department of Public Health's Comments on the Draft Environmental Statement. (1974, March 28)

PRECIPITATION, METEOROLOGICAL; BELLEFONTE-1 REACTOR; BELLEFONTE-2 REACTOR; ENVIRONMENT; RADIUM 226; REACTOR DISMANTLING; STRONTIUM 90

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Tomlinson, M., S.A. Mayman, H.Y. Tammemagi, W.F. Merritt, J.A. Morrison, H.S. Irvine, G.A. Vivian, J. Gale, B. Sanford, and P.J. Dyne International Atomic Energy Agency, Vienna, Austria

Management of Radioactive Wastes from Nuclear Fuels and Power Plants in Canada. International Conference on Nuclear Power and Its Fuel Cycles. Salzburg. Austria. May 2-13. 1977. (1977)

The nature of Canadian nuclear fuel and nuclear generating plant radioactive wastes is summarized. The status of the development and construction program is indicated. We plan to select a site in either a hard rock formation or in a suitable salt bed by 1981 so that a repository can be constructed to begin a demonstration phase in 1986. The repository is to be capable of eventual expansion to accommodate all Canadian nuclear wastes to at least 2050 when in full-scale operation. Extensive geotechnical studies have been initiated in order to select a site, and design and test the repository. We have demonstrated incorporation of fission products in solids that in the short term (17 years) dissolve more slowly than plutonium decays. A demonstration of dry storage of fuel in concrete containers is in progress. The quantities of CANDU generating-station wastes and the principles and methods for managing them are summarized. Methods for volume reduction and immobilization by solidification are well advanced. A radioactive-waste operations site is being developed with several different types of surface storage, each with multiple barriers against leakage. A reactor decommissioning study has been completed. Estimated costs of the various waste management operations are summarized.

REACTORS, CANDU TYPE; COSTS; GEOLOGIC STRUCTURES; IGNEOUS ROCKS; WASTE DISPOSAL; WASTES, RADIOACTIVE; WASTE MANAGEMENT; WASTE PROCESSING; WASTE STORAGE; WASTES, RADIOACTIVE; REACTOR DECOMMISSIONING; WASTES, SOLID; SOLIDIFICATION; SPENT FUELS; STORAGE; VITRIFICATION; BURIAL; NUCLEAR FACILITIES

373

Torikai, K., Y. Endo, and T. Wajima Japan Atomic Energy Research Institute, Tokai Research Establishment, Tokai, Ibaraki, Japan

Status of Decommissioning of Nuclear Power Facilities. Genshiryoku Kogyo 22(4):15-25. (1976, April)

Present status of nuclear facility decommissioning is widely reviewed on the basis of the discussions in IAEA meeting held in October 1975. The first part of this report defines three stages of decommissioning. The physical states of plants and components and the required surveillance, inspections and tests are defined for each stage. The second part recommends principally some regulatory guides for both restricted and unrestricted site release on the basis of ICRP recommendations. The third part reviews studies and evaluations being performed in each member country. The fourth part explains the necessity of taking into account the decommissioning of facilities at the design stage. The key points are discussed from the viewpoints of component arrangement, construction, deconstruction during operation and dismantling, and the recording of plant history. The fifth part discusses the development of tools and technology for decommissioning from the viewpoints of decontamination, dismantling, conditioning, transportation and disposal, and exposure prevention. The remaining parts of this report treat problems of waste disposal, the methods of estimating decommissioning costs, and the role of IAEA for international cooperation. The present status and future problems of Japanese atomic industry are also discussed. In the final part, the decommissionings of JRR-1 and Fermi Reactor are reviewed as examples.

COSTS; ENRICO FERMI-1 REACTOR; JRR-1 REACTOR; MAXIMUM PERMISSIBLE DOSE; NUCLEAR FACILITIES; NUCLEAR POWER PLANTS; PLANNING; RADIATION DOSE; RADIATION PROTECTION; WASTE DISPOSAL; REACTOR COMPONENTS; REACTOR DECOMMISSIONING; REACTOR DISMANTLING; SAFETY; STANDARDS, INTERNATIONAL; SPECIFICATIONS; REVIEWS

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Tretiakoff O., M. Barberger, and J. Boyer General Electric Company, Breeder Reactor Department, Sunnyvale, CA

Southwest Experimental Fast Oxide Reactor. Modification Proposed for Decommissioning Plan. Report; 5 pp. (1972, June 28)

REACTOR COMMISSIONING; REACTOR DISMANTLING; SEFOR REACTOR

375

U.S. Atomic Energy Commission

Lack of Progress in Complying with Facility Disposition Order. Letter to M. Panic, International Chemical and Nuclear Corporation; 2 pp. (1969, March 13)

Referring to AEC denial of application for license renewal and order for disposition of special nuclear material issued 6/1/68, this letter inquires about the lack of progress, as indicated by an inspection on 12/19/68. The facility to be decommissioned has been vacated and locked while investigating for an outside firm to decontaminate facility, thus causing further delay lack of compliance with Section 4 of the June 1968 order. May warrant further enforcement action.

ADMINISTRATIVE CONTROL; LICENSE STATUS, PLUTONIUM; COMPLIANCE; DECOMMISSIONING; NUCLEAR MATERIALS

376
U.S. Atomic Energy Commission, Region V Division of Compliance

Removal and Burial of Glove Boxes. Letter - Region V Division of Compliance to International Chemical and Nuclear Corporation; 1 p. (1970)

Approves the removal of the glove-box train for burial as described in letter of October 9. The glove boxes are highly contaminated with Pu-Be material (neutron fluxes up to 120 millirems/hr at 8 in.).

GLOVE BOXES; REGULATIONS, FEDERAL; CONTAMINATION; RADIATION PROTECTION; DECOMMISSIONING; BURIAL

377
U.S. Atomic Energy Commission, Washington, DC

Liquid Metal Fast Breeder Reactor Program. Volume III. Implication of LMFBR Program Implementation. Environmental Statement. WASH-1535-DR (Vol.3); 526 pp. (1974, March)

COST BENEFIT ANALYSIS; ECOLOGY; ECONOMICS; ELECTRIC POWER; ENVIRONMENT; FUEL CYCLES; FUEL FABRICATION PLANTS; FUEL REPROCESSING PLANTS; WASTES, RADIOACTIVE; REACTOR DECOMMISSIONING; TRANSPORTATION; WASTE MANAGEMENT; REACTORS, LMFBR; SOCIAL ASPECTS

378
U.S. Atomic Energy Commission, Washington, DC

Experimental Beryllium Oxide Reactor (EBOR) Terminated Before Completion. Atomic Energy Clearing House 12(52); (December 26, 1966). (1966, December 26)

AEC is terminating EBOR because of diminished contribution to US current high-temperature gas-cooled reactor program, as good graphite operating experience has reduced importance of developing beryllium oxide. Various delays since construction began in May 1963 delayed the startup of the 10 MWTh reactor, including a 5 months strike and a main coolant circulator bearing failure which contaminated the reactor internals with lube oil.

BERYLLIUM; FAILURES; REACTORS, GCR TYPE; CONTAMINATION; REACTORS, BEO MODERATED; DECOMMISSIONING; PUMPS; REACTOR COMPONENTS; EXPERIMENTAL BERYLLIUM OXIDE REACTOR

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U.S. Atomic Energy Commission, Washington, DC

Environmental Statement - Elk River Reactor Dismantling. WASH-1516; 119 pp. (1972, May)

The environmental impact includes: (A) Some radioactivity release but none in excess of applicable limits. (B) The operation is expected to require about two years, during which time an average of about 50 men are expected to be on the job. The transportation impact should not be significant. (C) Increased noise levels are not expected to be significant.

REACTORS, BWR; DECOMMISSIONING; ENVIRONMENTAL IMPACT STATEMENTS; JACOBS; ELK RIVER REACTOR

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U.S. Atomic Energy Commission, Washington, DC

A Survey of Unique Technical Features of the Floating Nuclear Power Plant Concept. WASH-1304; 100 pp. (1974, March)

The manufacture, installation, operation, and decommissioning of floating nuclear power plants at offshore sites is examined with respect to the major technical differences between such plants and land-based nuclear power plants. Anticipated environmental effects of activities associated with offshore nuclear plants are discussed. Possible accidents, both in-plant and during the transport of radioactive materials to and from an offshore plant, are described and an initial estimate of their relative significance presented.

ACCIDENTS; DECOMMISSIONING; REVIEWS; LICENSING; JACOBS; SITE SELECTION; NUCLEAR POWER PLANTS, OFFSHORE

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U.S. Atomic Energy Commission, Washington, DC

Elk River Reactor Dismantling, Elk River, Minnesota. Draft Environmental Impact Statement. WASH-1516 (DRAFT); 44 pp. (1971, December 23)

The environmental statement addresses the potential environmental impact of an administrative action for the dismantling of the Elk River Reactor (ERR). The ERR was constructed by the U.S. Atomic Energy Commission at Elk River, Minnesota, as part of its power reactor demonstration program. The unavoidable environmental impacts which might be considered adverse are essentially those of a construction (i.e. dismantling) nature, increased traffic (vehicular and rail), and disposal of the materials and wastes resulting from the dismantling. (Author)(GRA)

RADIOLOGICAL SURVEYS; REACTORS, POWER; REACTOR DISMANTLING; TRAFFIC; WASTE DISPOSAL; RADIOACTIVE MATERIALS; ENVIRONMENTAL IMPACT STATEMENTS; ELK RIVER REACTOR; REACTORS, BWR

382
U.S. Atomic Energy Commission, Washington, DC

HTGR Fuel Refabrication Pilot Plant, Oak Ridge National Laboratory, Oak Ridge, Tennessee. Report; 159 pp. (1974, February 5)

The proposed project consists of the design, construction, operation, and decommissioning of a pilot plant to demonstrate the technology for fabrication of high-temperature gas-cooled reactor (HTGR) fuel elements from recycled fuel. The pilot plant is to be installed within an existing facility, the thorium-uranium fuel cycle development facility at Oak Ridge National Laboratory in Roane County, Tennessee. The estimated cost of the project is $10 million and is scheduled to operate for two years, beginning in 1978. Environmental impacts are discussed. (GRA)

ENVIRONMENTAL IMPACT STATEMENTS; REACTORS, HTGR; COSTS; REPROCESSING; URANIUM; THORIUM; WASTES, RADIOACTIVE; RADIATION HAZARDS; RADIATION EFFECTS

383
U.S. Atomic Energy Commission, Washington, DC

Liquid Metal Fast Breeder Reactor Program. Environmental Statement. Volume IV; 556 pp. (1974, December)

A broad overview is presented of the many implications of LMFBR program implementation, up to and encompassing a fully developed LMFBR power plant economy, including the secondary impacts, the unavoidable adverse environmental impacts, cumulative environmental impacts, and cost-benefit analyses, and alternative energy strategies. Under the heading of secondary impacts, the national implications of the availability of electricity from LMFBRS, and the specific economic impacts of the LMFBR program are examined. The currently feasible alternatives and potential future alternatives for mitigating adverse environmental impacts of the LMFBR fuel cycle are described. The problems of safeguarding special nuclear material from potential diversion to unauthorized purposes are analyzed. The cumulative environmental effects of LMFBR operation to the year 2020, the decommissioning of LMFBRs and fuel cycle facilities upon the completion of their useful life, the irreversible and irretrievable commitments of resources that will accompany implementation of an LMFBR economy, and an analysis of the costs and benefits of implementing the LMFBR program are included. (GRA)

REACTORS, LMFBR; ENVIRONMENTAL EFFECTS; COST BENEFIT ANALYSIS; ECONOMICS; ENVIRONMENT; ENVIRONMENTAL IMPACT STATEMENTS; FUEL CYCLES; NUCLEAR MATERIALS MANAGEMENT; REACTOR DECOMMISSIONING; SAFEGUARDS

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U.S. Atomic Energy Commission, Washington, DC

Proposed Final Environmental Statement. Liquid Metal Fast Breeder Reactor Program-Vol. 4. WASH-1535 (Vol.4); 541 pp. (1974, December)

The subjects covered in this volume are (1) mitigation of adverse environmental impacts, (2) unavoidable adverse environmental impacts, (3) short term benefits and long term losses, (4) irreversible and irretrievable commitments of resources, and (5) cost-benefit analysis. Includes the cumulative environmental effects to the year 2020, and the decommissioning of LMFBR's and fuel cycle facilities.

DECOMMISSIONING; REACTORS, LMFBR; COST BENEFIT ANALYSIS; ENVIRONMENTAL IMPACT STATEMENTS; HAZARD ANALYSIS

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U.S. Congress, House of Representatives

Low-Level Radioactive Wastes-Hearings before a Subcommittee of the Committee on Government Operations, House of Representatives, February 23, March 12, and April 6, 1976. Low-Level Radioactive Waste Disposal. Hearings before a Subcommittee on Government Operations, House of Representatives. U.S. Government Printing Office, Washington, DC. (1976)

Verbal testimony presented to the House Subcommittee on Government Operations concerning low-level radioactive waste disposal is recorded of individuals representing the Illinois Dept. of Public Health, U.S. Nuclear Regulatory Commission, U.S. Geological Survey, U.S. General Accounting Office, U.S. Energy Research and Development Administration, U.S. Environmental Protection Agency, South Carolina Dept. of Health and Environmental Control, Nevada Dept. of Human Resources, and Nuclear Engineering Co., Incorporated. Also included are letter statements, and other written material submitted to the congressional record by these representatives. The appendix consists of (1) a report on improvements needed in the land disposal of radioactive wastes (GAO Report RED-76-54) with comment by the U.S. Energy Research and Development Administration and the U.S. Nuclear Regulatory Commission, (2) on April 9, 1976, a letter from Mr. Henry Escharge (Director, Resources and Economic Development Division, U.S. General Accounting Office) to Mr. Robert Seamans, Jr. (Administrator, U.S. Energy Research and Development Administration) concerning funding of a proposal ERDA radiological safety study on some early decommissioned nuclear facility sites, and (3) a statement submitted for the hearing record from a private citizen residing near the Maxey Flats disposal site in Kentucky. (HT)

The technical, legal, and problematic aspects of shallow waste burial are reviewed. The rules of the various government agencies involved in shallow waste burial are also discussed. (DM/HT)

WASTE DISPOSAL; WASTE MANAGEMENT; GEOLOGY; HYDROLOGY; LEGISLATION; BURIAL; RADIONUCLIDE MIGRATION; ENVIRONMENT; WASTES, RADIOACTIVE; WASTE TREATMENT; DISPOSAL SITE; WASTES, LOW-LEVEL

386
U.S. Congress, House of Representatives

Public Works for Water and Power Development and Energy Research Appropriation Bill, 1979: Part 7. Hearings of the House Appropriations Committee, March 20-22, April 13, 1978; 913 pp. (1978)

Hearing transcript: hearings were held to consider the U.S. Dept. of Energy's FY 79 budget request under the public works for water and power development and energy research appropriations bill for 1979. DOE requested $1.532 billion for its atomic energy defense activities, which include the department's nuclear weapons program, intelligence and verification program, and nuclear materials safeguards program. Requests for DOE's program management and support and special nuclear materials production (naval reactors) program were also considered. DOE officials testified. (2 graphs, 1 map, numerous tables)

NUCLEAR POWER; LEGISLATION; ECONOMICS; REACTORS, BREEDER; SAFEGUARDS; NUCLEAR WEAPONS; NUCLEAR POWER PLANTS; DECOMMISSIONING; COSTS; HEARINGS; PROGRAMS; HEARINGS

387
U.S. Department of Energy

Report of Task Force for Review of Nuclear Waste Management. DOE/ER-0005/D; 166 pp. (1978, February)

Some of the findings of the task force are: (1) A majority of independent technical experts have concluded that high-level waste (HLW) can be safely disposed in geological media, but validation of the specific technical choices will be an important element in the licensing process. (2) The target for initial operation in 1985 of a national waste repository for the permanent disposal of commercial HLW or spent fuel may not be met; this does not affect the early 1980's schedule for waste isolation pilot plant. (3) Policy and program management responsibility for waste management should be raised to a higher level in DOE.

JACOBS; WASTE MANAGEMENT; WASTE TREATMENT; WASTE DISPOSAL; TRANSURANICS; DECONTAMINATION; DECOMMISSIONING; SPENT FUELS; GEOLOGY; MILLING; MINING

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U.S. Department of Energy, Office of Energy Technology, Division of Nuclear Power Development

Barnwell Nuclear Fuel Plant Applicability Study, Volume 3, Appendices. DOE/ET-0040/3; 638 pp. (1978, March)

This volume is intended to supply supporting information toward the objective of using the Barnwell Nuclear Fuel Plant in support of the nonproliferation objectives of the United States. The categoreis outlined below were discussed in detail: Applicable International Fuel Cycle Policies-Expresses the position of the United States in the prevention of nuclear proliferation. Included were (1) a statement delivered by President Ford on October 26, 1976; a statement on Nuclear Power Policy by President Carter on April 7, 1977; the Nonproliferation Act of 1978; the Final Communique of the Organizing Conference of the International Nuclear Fuel Cycle Evaluation (October 21, 1977); and the International Nuclear Fuel Cycle Economic Scope and Methods of Work (October 21, 1977). Properties of Reference Fuels--Fuels that were used as references in developing reprocessing and refabrication flowsheets and other design data for the Barnwell Applicability Study. Alternate Operational Modes - LEU Fuels-Seven alternate operational modes for uranium-plutonium fuel reprocessing are compared to the BNFP reference flow-sheet (standard Purex). Alternate Operational Modes - Thorium Base Fuels-Adapting the facility to reprocess uranium-thorium fuels from light water reactors. To do this changes will be needed as equipment installed that is chemically compatible, piping changes in the solvent extraction area, and radon and ammonia removal steps in the BNFP off-gas treating system. There are processing options that might be employed to produce material that is unsuitable for making a weapon as the recovery of fissile and fertile materials in the same product stream, permitting selected fission products (low decontamination option) to accompany the fissile nuclide, or a combination of low decontamination and coprocessing, which requires the fewest changes in existing equipment. The incorporation into fissile material of radioactive isotope is refered to as spiking and may be done with low, medium, or high levels of radiation. At moderate levels (around 0.1 to 1 Ci/kg heavy metal) the cost of processing rises abruptly because all fuel cycle operations must be carried out and maintained remotely, but costs rise very little at still higher levels. The increase in total electrical generating costs is believed to be no more than 2%. Waste and Waste Solidification-It is concluded that the existing facilities can be used to treat Purex wastes after a high-level waste solidification facility and a solid waste storage area are constructed. However, the existing and proposed facilities could not manage the Zirflex waste generated by the Thorex cases should this decladding method be selected. DOE Programs Relating to Nonproliferation-The FY 1979 budget request is presented for reactor technology, the fuel cycle, advanced isotope separation, waste management, and nuclear energy assessments. (Auth)(JMF)

PUREX PROCESS; PROLIFERATION; REACTORS, LIGHT-WATER; REGULATIONS, FEDERAL; STANDARDS, FEDERAL; COSTS; CONTAMINATION; FUEL CYCLES; EQUIPMENT; FUEL REPROCESSING; ISOTOPES; WEAPONS; RADIOACTIVITY; WASTE MANAGEMENT; REACTORS

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U.S. Department of Energy, Office of Environment, Environmental Control Technology Division, Washington, DC; U.S. Department of Energy, Office of Environment, Technology Assessments Division, Washington, DC

Environmental Development Plan - Decontamination and Decommissioning. DOE/EDP-0055; 61 pp. (1979, July)

Decontamination and decommissioning of nuclear facilities is an ever developing plan dependent on changing technologies and environmental concerns. Current needs center around development of disposition criteria, adequate waste receiving sites, overall decontamination and decommissioning planning and coordination of interagency guidelines, standards and criteria. The overview of the Department of Energy's decontamination and decommissioning program discloses three principal modes that are currently in use for nuclear reactors: mothballing or removing all nuclear fuel and selected radioactive components and placing the facility in protective storage; entombment, consisting of removing all nuclear fuel and selected components, followed by the sealing of the remaining radioactive and contaminated components within the shielding structive; and removal/dismantling or removing from the site all nuclear fuel and components having radioactivity above predetermined acceptable levels. Under this program, surveillance, planning for disposition, and disposition R and D for surplus radioactively contaminated DOE facilities are carried out. DOE's program also provides for remedial action for formerly utilized facilities and uranium mill tailings remedial action such as at Grand Junction, Colorado. The program also provides for inactive uranium mill tailings sites by determining existing radiation levels, exposures to the public and projected public health implications, practicable remedial alternatives, and costs of cleanup. The Marshall Islands radiological safety program is an example of DOE's program in cleanup and rehabilitation after nuclear weapons tests. (JMF) This report is an update of the 1977-78 document. Future updates are planned. Tables and figures showing milestones, completed projects, history, and environmental, health, and safety concerns are included. A listing of formerly utilized nuclear facilities which DOE believes may require additional remedial action is included.

ENVIRONMENT; REGULATIONS, FEDERAL; SITE SELECTION; STANDARDS, FEDERAL; WASTES, RADIOACTIVE; WASTE DISPOSAL; WASTE STORAGE; CONTAINMENT; COSTS; CONTAMINATION; DECOMMISSIONING; DECONTAMINATION; ENVIRONMENT; EXPOSURE, POPULATION; RADIOACTIVITY; REACTORS; REGULATIONS, FEDERAL; STANDARDS, FEDERAL; TAILINGS; URANIUM; WASTE MANAGEMENT

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U.S. Deparment of Energy, Washington, DC

Environmental Impact Assessment for Decommissioning the Ames Laboratory Research Reactor. DOE/EA-0026; 37 pp. (1978, March)

This assessment deals with the decontamination and decommissioning of the Ames Laboratory Research Reactor (ALRR) within its containment building and the removal from the site of all radioactive material which had its origin in the operation of the ALRR. Funding to use the facility as a research reactor does not appear to be available in the near future. At some point the facility becomes more of a liability because of its radioactive nature than an asset as a location for future research. It is considered preferable to remove the reactor from the building in a prompt but orderly manner and thus to remove the reactor-related radioactivity from the site and make the building available for other types of research. Prompt decommissioning to the point of complete removal of the reactor and of all radioactivity of reactor origin is to be preferred over other alternatives. The solid radioactive wastes, consisting of radioactivity such as Co 60 induced in components, materials with surface contamination, and solids such as filters, ion exchange beds, rags, etc., generated in the decommissioning process, will constitute a potential long-term environmental impact due to the radiological nature of the materials. Disposal will be in an approved manner at approved sites and will result in lower cumulative environmental effects than if the radioactive material were allowed to remain at its present site. The radioactive waste generated in the decommissioning will be buried in land considered irretrievable and dedicated to that purpose. The non-radioactive waste will be used as fill material or placed in local areas committed for the burial of wastes. No known conflicts exist with federal, state, regional or local programs and rules, and all authorities which may have an interest in this operation will be kept informed of the plans and progress of the process. A comprehensive review of the environmental considerations contained in this environmental assessment reveals that the decommissioning of the ALRR will result in no undesirable land use patterns, damage to life systems or significant threats to human health. The beneficial impact on the environment outweighs any adverse effects. It is recommended that an environmental impact statement is not necessary and should not be prepared. (Auth)(JMF)

The document contains maps of the facilities.

DECONTAMINATION; DECOMMISSIONING; WASHING; NUCLEAR FACILITIES; REACTORS; STANDARDS, FEDERAL; STANDARDS, STATE; COBALT; ENVIRONMENT; CONTAMINATION; RADIOACTIVITY; BURIAL; HAZARD ANALYSIS; RADIONUCLIDES

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U.S. Energy Research and Development Administration, Savannah River Operations Office, Aiken, SC

Plan for the Management of Radioactive Waste, Savannah River Plant. Report; 71 pp. (1975, July)

The following areas are covered in the Savannah River Plant's radioactive waste management plan: program administration; description of waste generating processes; waste management facilities; radioactive wastes stored; plans and budget projections; and description of decontamination and decommissioning . (LK)

DECOMMISSIONING; DECONTAMINATION; WASTES, LIQUID; PLANNING; WASTE MANAGEMENT; WASTE PROCESSING; WASTE STORAGE; WASTES, RADIOACTIVE

392
U.S. Energy Research and Development Administration, Washington, DC

Final Environmental Statement. Waste Management Operations, Hanford Reservation, Richland, Washington. ERDA-1538 (Vol. 1): 593 pp. (1975, December)

The impacts and alternatives available to the ongoing Hanford Waste Management Operations Program are presented. Environmental effects of routine operation of plant facilities are considered. Reasonable alternatives to the current program for treatment of high-level liquid radioactive waste, other radioactive liquid waste, radioactive gaseous wastes, radioactive solid waste, nonradioactive waste, and other potential environmental pollutants are given. (GRA)

WASTE MANAGEMENT; ENVIRONMENTAL IMPACT STATEMENTS; EFFLUENTS, CHEMICAL; DECOMMISSIONING; DECONTAMINATION; ENVIRONMENTAL EFFECTS; WASTES, GASEOUS; WASTES, LIQUID; WASTE DISPOSAL; WASTE PROCESSING; WASTES, RADIOACTIVE; WASTES, SOLID; SOLIDIFICATION

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U.S. Environmental Protection Agency, Office of Radiation Programs, Washington, DC

Assessment of Potential Radiological Health Effects from Radon in Natural Gas. EPA 520/1-73-004; 49 pp. (1973, November)

Natural gas contains amounts of radon 222 which becomes dispersed in homes when natural gas is used in unvented appliances. Radon decays to alpha-emitting daughter products which can contribute to lung cancer when inhaled and deposited in the respiratory system. For the average use of unvented kitchen ranges and space heaters, the tracheobronchial dose equivalent to individuals was estimated as 15 and 54 mrem/yr, respectively, or 2.73 million person-rems/yr to the United States population. A review of exposure conditions, lung model parameters, dose conversion factors, and health effect factors indicated this population dose equivalent could potentially lead to 15 deaths a year from lung cancer. This represents only 0.03 to 0.08 percent of normal lung cancer mortality. Since control of radon levels in gas would cost over $100 million for each reduction of one health effect, it was concluded that a requirement for such controls would not be cost effective on a national basis. (Auth)

NATURAL GAS; RADON 222; BUILDINGS; ALPHA PARTICLES; DAUGHTER PRODUCTS; NEOPLASMS; LUNGS; INHALATION; RADIATION DOSE; HEALTH EFFECTS

394
U.S. Nuclear Regulatory Commission, Washington, DC

AGN Training Reactor Dismantling Plan for Colorado State University. Letter w/rpt to Colorado State University; 10 pp. (1975, December 31)

The commission has issued an order authorizing dismantling of the AGN 201 training reactor. The dismantling plan replaces the tech specs in their entirety.

LICENSE STATUS; REACTORS, TRAINING; REACTORS, AGN; DECOMMISSIONING; COLLEGES AND UNIVERSITIES; REACTOR OPERATION; LICENSING

395
Union Carbide Corporation, Office of Waste Isolation, Oak Ridge, TN

Contribution to Draft Generic Environmental Impact Statement on Commercial Waste Management: Radioactive Waste Isolation in Geologic Formations. Report; 455 pp. (1978, April)

This document concentrates on deep geologic isolation of wastes in bedded salt, granite, shale, and basalt with emphasis on wastes from three fuel cycles: reprocessing wastes from uranium and plutonium recycling, reprocessing wastes from uranium-only recycling, and spent unreprocessed fuel with no recycling. The analyses presented in this document are based on preconceptual repository designs. As the repository designs progress through future phases, refinements will occur which might modify some of these results. The 12 sections in the report are: introduction; selection and description of generic repository sites; LWR wastes to be isolated in geologic formations; description of waste isolation facilities; effluents from the waste isolation facility; assessment of environment impacts for various geographical locations of a waste isolation facility; environmental monitoring; decommissioning; mine decommissioning site restoration; deep geologic alternative actions; potential mechanisms of containment failure; and considerations relevant to provisional versus final storage.

BASALTS; DECOMMISSIONING; ENVIRONMENTAL IMPACT STATEMENTS; ENVIRONMENTAL IMPACTS; GEOLOGIC DEPOSITS; GRANITES; WASTE DISPOSAL; WASTES, RADIOACTIVE; NUCLEAR FACILITIES; SALT DEPOSITS; SHALES; SITE SELECTION

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Union Carbide Corporation, Office of Waste Isolation, Oak Ridge, TN

Proposed Quality Assurance Manual for the Office of Waste Isolation. Report; 52 pp. (1977, September 26)

The manual provides guidelines for assuring safe and reliable siting, design, procurement and construction, operation, and decommissioning of a radioactive waste repository. The organization of the program is given and the program itself is defined. The program includes the site evaluation, site selection, design, procurement, fabrication, installation, and testing of any system or component that is safety related. It also included all necessary documentation and auditing. (JSR)

PROCEDURES; QUALITY ASSURANCE; WASTES, RADIOACTIVE; WASTE STORAGE; STORAGE, GEOLOGIC; NUCLEAR FACILITIES; DOCUMENTATION

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Unsworth, G.N. Atomic Energy of Canada Limited, Whiteshell Nuclear Research Establishment, Pinawa, Manitoba

Decommissioning of CANDU Nuclear Stations. AECL-5687; 72 pp. (1977, April)

This report contains the results of a study of various aspects of decommissioning of reactors. The study places in perspective the size of the job, the hazards involved, the cost and the environmental impact. The three internationally agreed "stages" of decommissioning, namely, mothballing, entombment and dismantling are defined and discussed. The single unit 600 MWe CANDU is chosen as the type of reactor on which the discussion is focused but the conclusions reached will provide a basis for judgement of the costs and problems associated with decommissioning reactors of other sizes and types. Assuming that satisfactory provisions are made for disposal of the fuel, D2O and radwaste, and active components, the environmental impact of decommissioning a reactor will be no greater than that of any large construction project. (Auth)

REACTORS, CANDU TYPE; COSTS; DECONTAMINATION; RADIATION DOSE; WASTE STORAGE; RADIOACTIVITY; REACTOR DECOMMISSIONING; REACTOR DISMANTLING

398
Unsworth, G.N.

Decommissioning of the CANDU-PHW Reactor. Report; 77 pp. (1977)

Results are presented of a study of various aspects of decommissioning of reactors. The study places in perspective the size of the job, the hazards involved, the cost, and the environmental impact. The three internationally agreed "stages" of decommissioning, namely, mothballing, entombment, and dismantling are defined and discussed. Single unit 600 MWe Candu is chosen as the type of reactor on which the discussion is focused but the conclusions reached provide a basis for judgement of the costs and problems associated with decommissioning reactors of other sizes and types.

REACTORS, CANDU TYPE; DEUTERIUM COMPOUNDS; ENVIRONMENTAL IMPACTS; WASTE DISPOSAL; REACTOR DECOMMISSIONING; REACTOR DISMANTLING

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Unsworth, G.N. Atomic Energy of Canada Limited, Whiteshell Nuclear Research Establishment, Pinawa, Manitoba, Canada

Decommissioning of the CANDU-PHW Reactor. IAEA-SM-234/29; Decommissioning of Nuclear Facilities, Proceedings of an International Symposium, Vienna, Austria, November 13-17, 1978. International Atomic Energy Agency, Vienna, (pp. 73-87), 694 pp. (IAEA-SM-234/29). (1979)

A generic study has been completed in Canada to assess decommissioning of a typical 600 MWe CANDU-PHW reactor and to obtain estimates of the costs, environmental impact, quantities of radioactive wastes and man-rem exposure associated with each of the three decommissioning stages. The CANDU reactor is designed to facilitate decommissioning. The vessel and other highly radioactive components are comparatively light weight, provision is made for replacement of the pressure tubes and access is provided into the top of the vault that will facilitate the cutting-up and dismantling of the reactor vessel. In addition to the experience and knowledge gained from decommissioning of one reactor in the United States of America (Elk River), the rehabilitation of the NRX and NRU vessels at Chalk River, and the replacement of some pressure tubes in the Pickering reactor have provided confidence that the proposed decommissioning of a large CANDU-PHW reactor is practical. Also, it is expected that research associated with existing programs for management of radioactive waste in Canada will provide sufficient data and the methodology for determining permissible Residual Activity Levels for a decommissioned site to be released for unrestricted use. The radioactive waste resulting from decommissioning will be of relatively low specific activity. The disposal facilities and techniques presently being developed in Canada for power reactor wastes will be used to cope with the wastes from decommissioning. Decommissioning costs are not high when compared to the total value of a nuclear generating station and there is little incentive to provide funding now to handle future decommissioning costs. (Auth)

REACTORS, CANDU TYPE; REACTOR DECOMMISSIONING; COST ESTIMATES; ENVIRONMENTAL IMPACTS; WASTE VOLUME; REACTOR COMPONENTS; RESIDUAL ACTIVITY; WASTE DISPOSAL; WASTES, LOW-LEVEL; THEORETICAL STUDIES

400
Ureda, B.F., and G.W. Meyers

Design Considerations for Facility Decommissioning. CONF-790923; Decontamination and Decommissioning of Nuclear Facilities, Proceedings of a Conference, Sun Valley, ID, September 16-20, 1979. Session IV-A, (pp. 3-5), 90 pp. (CONF-790923). (1979)

Decommissioning of any facility is technically feasible today, but some authorities fear that to facilitate the decommissioning by incorporating special features in the original plant design may counter plant safety criteria or increase plant capital costs. However, it seems clear that significant savings can be realized during operation and decommissioning if special features of decommissioning are incorporated. The most important problems were as follows: (1) Decontamination of concrete surfaces. (2) Disposal of massive activated biological shields. (3) Disposal of stainless steel reactor vessels which were highly activated. (4) Leaky valves, pipe, and fittings during removal of buried waste holdup tanks. (5) Removal of process systems equipment. (6) Disposal of radioactive sodium coolant and residues in the vessel and process system. (7) Removal and disposal of asbestos insulation from process system components. (8) Assessment of soil contamination. Except for those related to sodium, these problems are common to all nuclear facilities. Below are ideas which are useful in simplification of avoidance of these problems: (1) The plant should be designed for accessibility for operational maintenance. (2) Concrete surfaces need to be protected. Expansion joints or other crevices should be avoided. (3) Use of other materials (lead shot, blocks, or water) besides massive monolithic concrete should be reconsidered. Where integrated concrete structures are necessary for containment, means for easily removing of spalling the concrete should be included. Local heating elements could be embedded in the concrete. Modular construction of the shields would facilitate handling. Concrete aggregates and rebar should be selected for minimum irradiation effects. Access in the shielding for instrumentation probes should be included. (4) Locations and the attachments of pipe, grid plates, and other reactor vessel internals should consider the limitation of the available cutting equipment. Cutting equipment installation support structure should be included. Penetrations into the reactor vessel should not be made through the biological shield but through the top of the vessel. Cooling coils should be made easily removable and not embedded in concrete unless needed for concrete cooling. Material selection should consider irradiation effects. (5) R/A waste holdup tanks should not be buried in soil but should be contained in isolated vaults with provisions to handle spells. (6) Process equipment, particularly large components such as heat exchangers should be assembled with ease of dismantlément a consideration. (7) Fuel handling machines should be shrouded so that the exteriors can be easily cleaned and the contaminated internals easily removed. (8) Disposal of contaminated coolants could be eased if proper drainage would be included. If sodium is used, a sodium passivation process system should be included. (9) Asbestos should not be used. (10) Building construction should assume that an accidental spill or fire might occur and, therefore, surfaces or crevices where contamination could collect should be protected. (11) Instrumentation probe holes should be included throughout the plant for assessment of the degree of contamination at the time for decommissioning. Generally, a preliminary decommissioning approach should be prepared at the time of plant design. (Auth)(JMF)

This paper is only an abstract of the actual paper which is to be published later.

DECONTAMINATION; WASHING; DECOMMISSIONING; NUCLEAR FACILITIES; COSTS; REACTORS; CONCRETES; DESIGN; EXPOSURE, POPULATION; EXPOSURE, OCCUPATIONAL; PERSONNEL; SHIELDING; WASTE STORAGE; WASTES, RADIOACTIVE; WASTES, TRANSURANIC; TANKS; ASBESTOS; RADIATION EFFECTS; HEAT TRANSFER; HEAT EXCHANGE; ACIDS; FIRE HAZARDS; MAINTENANCE; WASTES, LIQUID

401

Uresk, D.W., J.F. Cline, and B.E. Vaughan Battelle-Pacific Northwest Laboratories, Richland, WA

Decommissioning and Decontamination Studies. BNWL-2500 (Pt. 2); Pacific Northwest Laboratory Annual Report for 1977 to the DOE Assistant Secretary for Environment, Part 2, (pp. 8.7-8.9). (1978, February)

The decommissioning of retired Hanford Facilities requires careful consideration of environmentally-related factors. Applicable ecology programs have been designed to: develop the technology associated with burial ground stabilization, thereby minimizing biotic access and transport of radioactive wastes and, characterize present 300 Area burial grounds to ascertain the potential biotic transport of waste materials away from managed facilities. Results are reported from studies on the role of plants, small mammals, and ants as potential transport vectors of radionuclides from radioactive waste burial grounds.

INSECTS; EFFLUENTS, RADIOACTIVE; WASTE MANAGEMENT; RADIONUCLIDE KINETICS; RODENTS; ECOSYSTEMS, TERRESTRIAL; RADIONUCLIDE MIGRATION; BURIAL; VEGETATION

402
US. Atomic Energy Commission, Division of Reactor Licensing

Decommissioning Plan Approved for AFNEC Reactor, Kirtland Air Force Base. Letter-Division of Reactor Licensing (AEC) to Directorate of Nuclear Safety, Kirtland AFB; 2 pp. (1971, February 8)

The plan provides for removal and shipment of certain radioactive materials, including the reactor core for reprocessing or burial at an AEC licensed burial ground, dismantling and removing noncontaminated equipment, and in-place entombment of the remaining radioactive structures and components. Additional layers of concrete will be placed where necessary to improve existing entombment barriers and to reduce radioactivity to levels consistent with AEC guideline values for unrestricted release of facilities and equipment contaminated with source, special nuclear materials and/or byproduct material. The plan provides that after completion of the decommissioning activities, the area occupied by the facility will be released for utilization as an unrestricted area.

REACTORS, TEST; SPECIFICATIONS; DECOMMISSIONING

403
Vinck, W. Commission of the European Communities, Directorate General for Industrial Technological Affairs, Belgium

European Community-Water Reactor-Safety Research Projects. Report III/578/76-E; 900 pp. (1976, May)

This is the third compilation of community research formats to be produced by the commission. Classification systems are (1) blowdown and emergency core cooling; (2) core meltdown; (3) external influences; (4) power transients; (5) behavior, transport and release of radioactive substances; (6) faults and accident combinations; (7) containment and associated systems; (8) instrumentation, control and computerized protection; (9) other safeguards; (10) core and primary circuit in steady state conditions; (11) materials and mechanical problems; (12) QA; (13) systems optimization standardization; (14) probabilistic methods; (15) interrelation between reactor plant and operating personnel; (16) environmental protection; (17) accident recovery and decommissioning; (18) fuel cycle; and (19) economics.

JACOBS; BLOWDOWN; COOLING SYSTEMS, EMERGENCY CORE; REACTOR CORES; MELTDOWN; TRANSIENTS; RADIOACTIVITY; ACCIDENTS; CONTAINMENT; DESIGN; SAFEGUARDS; ENVIRONMENT; FUEL CYCLES; DECOMMISSIONING; ECONOMICS; COMPUTERS; REACTOR PHYSICS; REACTOR CORES; QUALITY ASSURANCE; PRESSURE VESSELS; STANDARDS, INTERNATIONAL; REACTOR OPERATION; REACTOR SAFETY

404
Voelker, A.H. Oak Ridge National Laboratory, Oak Ridge, TN

A Design for Planning the Cleanup of Formerly Used Radium-Contaminated Sites. ORNL/TM-6298; 48 pp. (1978, April)

The decontamination and decommissioning of radium-contaminated facilities no longer in use have received increased attention in recent years. However, planning cost-effective cleanup solutions that are acceptable to the major groups concerned with nuclear waste management has proved to be a significant stumbling block. Fortunately, new procedures are evolving. The proposed process has the attributes of continuity of responsibility, centralized authority, sensitivity to diverse concerns, flexibility, consensus seeking, alternative plan generation, and objectivity.

DECONTAMINATION; DECOMMISSIONING; RADIUM; IRRADIATION FACILITIES; CONTAMINATION; DESIGN; JACOBS; STANDARDS, FEDERAL

405
Wahlen, R.K.

Hanford Production Reactor Decommissioning. CONF-790923; Decontamination and Decommissioning of Nuclear Facilities, Proceedings of a Conference, Sun Valley, ID, September 16-20, 1979. Session IV-B, (p. 8). 90 pp. (CONF-790923). (1979)

Formalized planning for decontamination and decommissioning (D and D) of the nine Hanford Plutonium Production Reactors was started early in Fiscal Year 1978 with an authorization by the Department of Energy to begin planning the full scale decommissioning of the 100-F Production Reactor complex as a demonstration project. This paper provides a generic description of a Hanford Production Reactor Facility and addresses the progress made to date on planning for the final disposition of the 100-F facilities. The Hanford Site Cleanup Program, which removed all the noncontaminated 100-F Area facilities is reviewed as a preface to discussing the decontamination and dismantling of those facilities that are radioactively contaminated. (Auth)(JMF)

This paper is only an abstract of the actual paper which is to be published later.

DECONTAMINATION; WASHING; DECOMMISSIONING; NUCLEAR FACILITIES; DEPOSITION

406
Wallis, L.R., and C.D. Corbit Douglas United Nuclear, Inc., Richland, WA

Radiological Aspects of the Deactivation of Hanford Production Reactors. DUN-SA-14; CONF-660920; 1st International Congress of the International Radiation Protection Association, Rome, Italy, September 5-10, 1966, (40 pp.). (1966)

The deactivation procedures and monitoring and control programs are reviewed for the deactivation of three Hanford reactors. Experience gained over a one-year period indicates that the radiological criteria adhered to during the deactivation were sufficiently restrictive and that the periodic radiation and contamination surveillance program for the reactors is adequate.

RADIATION MONITORING; RADIATION PROTECTION; DECOMMISSIONING

407
Watson, E.C., W.E. Jr. Kennedy, G.R. Hoenes, and D.A. Waite Battelle-Pacific Northwest Laboratories, Richland, WA

Methodology for Determining Acceptable Residual Radioactive Contamination Levels at Decommissioned Nuclear Facilities/Sites. IAEA-SM-234/18; Decommissioning of Nuclear Facilities, Proceedings of an International Symposium, Vienna, Austria, November 13-17, 1978. International Atomic Energy Agency, Vienna, (pp. 263-283), 694 pp. (IAEA-SM-234/18). (1979)

The ultimate disposition of decommissioned nuclear facilities and their surrounding sites depends upon the degree and type of residual contamination. Examination of existing guidelines and regulations has led to the conclusion that there is a need for a general method to derive residual radioactive contamination levels that are acceptable for public use of any decommissioned nuclear facility or site. This paper describes a methodology for determining acceptable residual radioactive contamination levels based on the concept of limiting the annual dose to members of the public. It is not the purpose of this paper to recommend or even propose dose limits for the exposure of the public to residual radioactive contamination left at decommissioned nuclear facilities or sites. Unrestricted release of facilities and/or land is based on the premise that the potential annual dose to any member of the public using this property from all possible exposure pathways will not exceed appropriate limits as may be defined by Federal regulatory agencies. For decommissioned land areas, consideration should be given to people living directly on previously contaminated areas, growing crops, grazing food animals and using well water. Mixtures of radionuclides in the residual contamination representative of fuel reprocessing plants, light water reactors and their respective sites are presented. These mixtures are then used to demonstrate the methodology. Example acceptable residual radioactive contamination levels, based on an assumed maximum annual dose of one millirem, are calculated for several selected times following shutdown of a facility. It is concluded that the methodology presented in this paper results in defensible acceptable residual contamination levels that are directly relatable to risk assessment with the proviso that an acceptable limit to the maximum annual dose will be established. (Auth)

NUCLEAR FACILITIES; DECOMMISSIONING; RESIDUAL ACTIVITY; RADIATION DOSE; EXPOSURE, POPULATION; RADIONUCLIDES; ENVIRONMENTAL EXPOSURE PATHWAY; FUEL REPROCESSING PLANTS; REACTORS, LIGHT-WATER; CALCULATIONS

408
Watson, E.C., W.E. Kennedy, Jr., G.R. Hoenes, R.B. McPherson, and W.F. Sandusky Battelle-Pacific Northwest Laboratories, Richland, WA

Radiation Exposure Pathways of Primary Importance to Nuclear Facility Decommissioning Planners. Transactions of the American Nuclear Society 30:605-607. (1978)

REVIEWS; DECOMMISSIONING; NUCLEAR FACILITIES; SAFETY; HEALTH PHYSICS; DECOMMISSIONING

409
Watzel, G.V.P. Rheinisch-Westfaelisches Elektrizitaetswerk AG, German Federal Republic; Hamburgische Electricitaets-Werke AG, German Federal Republic; Vereinigte Elektrizitaetswerke Westfalen AG, Dortmund, German Federal Republic

Shutdown Concepts for LWR Nuclear Power Plants. Reactor Congress, Hannover, German Federal Republic, April 4, 1978, (pp. 967-970). (1978)

REACTORS, BWR; PLANNING; REACTORS, PWR; REACTOR DECOMMISSIONING; REACTOR DISMANTLING

410
Weinstein, A.A., F.R. Nakache, and H. Soodak

Nuclear Reactor Plant with Integral Entombment. U.S. Patent 3,755,079. (1973, August 28)

Describes a nuclear reactor installation having a reactor chamber, a burial chamber communicating with the reactor chamber, and means for moving a pressure vessel at the expiration of its operational life from the reactor chamber into the burial chamber.

CONTAINMENT; DECOMMISSIONING; PATENTS; REACTOR SHUTDOWN; BURIAL

411
Wood, R.S. U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, Antitrust and Endemnity Group, Washington, DC

Assuring the Availability of Funds for Decommissioning Nuclear Facilities. NUREG-0584; 51 pp. (1979, July)

The Nuclear Regulatory Commission (NRC) is concerned that adequate funds will be available to shut down a nuclear facility after its operating life has ended. It is assumed that if applicants for a reactor operating license are financially qualified to operate it they are also qualified to decommission it. However, financial solvency cannot be assured over the 30 to 40 year period to decommissioning. To safeguard the decommissioning process, the NRC has determined that there are six basic alternatives for assuring the availability of funds for decommissioning: (1) Prepayment of decommissioning costs - funds set aside sufficient to pay the decommissioning costs. (2) A funded reserve accumulated over the estimated life of the plant - funds set aside annually which, plus the interest drawn, would be sufficient for decommissioning. (3) An unfunded reserve or funding at decommissioning - using net salvage value depreciation allowing decommissioning costs to be depreciated over the life of the facility. (4) Surety bonds. (5) Decommissioning insurance - instituting some form of pooled approach. (6) Funding from general revenues - tax revenues, either at state or federal level. Of all the alternatives, a deposit at time of start-up provides the greatest assurance that funds will actually be available. To guard against a shortfall of funds, should there be a premature reactor shut-down, there could be a deposit covering the total decommissioning costs at reactor start-up. Given that the cost for decommissioning a PWR is $50 million in 1978 dollars: the interest rate is 8% on invested funds, the utility's discount rate is 10%, the inflation rate is 8%, and the tax rate is 48%, where each of these rates is the average annual rate over the expected life of the facility; and the actual facility life is 32 years, at which time the facility will be immediately dismantled; the cost in constant dollars of the funding option "deposit at facility start-up with earnings returned to the utility" would be $79 million. (JMF)

DECOMMISSIONING; NUCLEAR FACILITIES; REACTORS, PWR; COSTS

412
Woolam, P.B., and I.G. Pugh Central Electricity Generating Board, Research Division, Berkeley Nuclear Laboratories, Berkeley, Gloucestershire,

United Kingdom; Central Electricity Generating Board, Generation Development and Construction Division, Barnwood, Gloucester, United Kingdom

Neutron Industrial Activation, Waste Disposal and Radiation Levels for the Reactor Island Structure of a Decommissioned Magnox Power Station. IAEA-SM-234/10; Decommissioning of Nuclear Facilities, Proceedings of an International Symposium, Vienna, Austria, November 13-17, 1978. International Atomic Energy Agency, Vienna, (pp. 353-378), 694 pp. (IAEA-SM-234/10). (1979)

A program of theoretical and experimental work has been completed with the aim of providing a best estimate of the radioactive inventory in the structure of a Magnox reactor at 10 and 100 years after a planned retirement. The inventory includes up to 13 isotopes in 80 different reactor components; an analysis of all long-lived isotopes shows that no unidentified nuclide could be present in the structure which would significantly affect the results. The inventory is used to assess the major radiological consequences of decommissioning a Magnox reactor: waste disposal and radiation exposure to occupationally exposed personnel during dismantling operations. Calculations of whole-body dose equivalent rates show that, although unlimited access to core areas will not be possible, limited access after a 100 year decay period is likely for times sufficient for setting-up or maintenance of semi-automatic machinery. After a 100 year decay period airborne problems from concrete or graphite dust will be limited by conventional hazards rather than radioactivity control. (Auth)

THEORETICAL STUDIES; INVENTORIES; RADIONUCLIDES; TIME FACTOR; REACTORS, MAGNOX TYPE; REACTOR COMPONENTS; REACTOR DECOMMISSIONING; WASTE DISPOSAL; EXPOSURE, OCCUPATIONAL; PERSONNEL; DISMANTLING; CALCULATIONS; RADIATION DOSE; RADIOACTIVE DECAY

413
Worden, W.P.

Decontamination - The Utility Viewpoint. CONF-790923; Decontamination and Decommissioning of Nuclear Facilities, Proceedings of a Conference, Sun Valley, ID, September 16-20, 1979. Session I, (p. 1), 90 pp. (CONF-790923). (1979)

Decontamination has always been a controversial topic, but in the early years of the industry, it was taken by some vendors to be a fact of life and was considered in reactor design. During the 60's and much of the 70's, it became a non-issue in this country largely because of the emphasis on rapid expansion in the industry. Then, as operating experience grew and problems in plant operation, maintenance and testing developed, interest in decontamination was reborn. The first serious decontamination program since the early 60's in the United States was begun in Dresden Unit 1 in 1973, undertaken to allow for plant modification and inservice inspection. Others which have made significant progress are the Commonwealth Edison - Department of Energy, Low-Level, BWR primary system and the Consolidated Edison PWR Steam Generator Chemical Cleaning project at the Indian Point Plant. Some are convinced that decontamination will be found safe and cost effective. (Auth)(JMF)

This paper offers a history of decontamination. This paper is only an abstract of the actual paper which is to be published later.

DECONTAMINATION; CONTAMINATION; DESIGN; COSTS; ECONOMICS; EXPOSURE, OCCUPATIONAL; MAINTENANCE; NUCLEAR FACILITIES; REACTORS; RECOMMENDATIONS; REVIEWS; WASHING

414
World Health Organization (WHO), Regional Office for Europe, Copenhagen, Denmark

Health Implications of Nuclear Power Production. WHO Regional Publications European Series No. 3, Report on a Working Group, Brussels, Belgium, December 1-5, 1978; 75 pp. (1978)

The Regional Office for Europe of the World Health Organization (WHO), in collaboration with the government of Belgium, convened a working group in Brussels, December 1-5, 1975, to study, discuss, and appraise the effects of nuclear power industry on man and the environment. The meeting was attended by 19 temporary advisors from 12 European countries and from the USA. The working group reviewed the experience gained from building and operating nuclear facilities and made estimates of the attendent health risks and considered risks from the generation of electrical power from other types of fuels. Attention was focused on (a) the radiation risks to man, both somatic and genetic, and the environmental aspects of the nuclear fuel cycle, from the mining of uranium to the final stages of decommissioning a nuclear plant and the storage and disposal of radioactive waste products; (b) the likelihood and consequences of nuclear and non-nuclear accidents, sabotage, and theft of nuclear material. The working group considered measures to protect the population, (including safety regulations and emergency procedures following an accident); technical and administrative procedures on both the national and international levels; education and training of personnel in the nuclear power industry; and public information. A quantitative evaluation of radiation risks for workers and the general population, as well as non-radiation occupational fatalities in the various stages of the nuclear fuel cycle, was incorporated in a summary table as a function of power output. (MCW)

ACCIDENTS; EMPLOYMENT; FUEL CYCLES; FUEL REPROCESSING PLANTS; RADIATION HAZARDS; MAN; MEETINGS; EXPLOSIONS, NUCLEAR; NUCLEAR POWER PLANTS; PROLIFERATION; PUBLIC HEALTH; RADIATION HAZARDS; WASTE MANAGEMENT; REACTOR DECOMMISSIONING; REGULATIONS; SABOTAGE; SAFETY; SITE SELECTION; PERSONNEL

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Zaloudek, F.R. Battelle-Pacific Northwest Laboratories, Richland, WA

Conceptual Design Study Advanced Concepts Test (ACT) Facility. Report; 126 pp. (1978, September)

The Advanced Concepts Test (ACT) project is part of a program for developing improved power plant dry cooling systems in which ammonia is used as a heat transfer fluid between the power plant and the heat rejection tower. The test facility will be designed to condense 60,000 lb/hr of exhaust steam from the No. 1 turbine in the Kern Power Plant at Bakersfield, CA, transport the heat of condensation from the condenser to the cooling tower by an ammonia phase-change heat transport system, and dissipate this heat to the environs by a dry/wet deluge tower. The design and construction of the test facility will be the responsibility of the Electric Power Research Institute. The DOE, UCC/Linde, and the Pacific Northwest Laboratories will be involved in other phases of the project. The planned test facilities, its structures, mechanical and electrical equipment, control systems, codes and standards, decommissioning requirements, safety and environmental aspects, and energy impact are described. Six appendices of related information are included. (LCL)

AMMONIA; COOLING TOWERS; DESIGN; HEAT TRANSFER; PERFORMANCE TESTING; RESEARCH PROGRAMS; STEAM CONDENSERS; TEST FACILITIES; THERMAL POWER PLANTS

FACILITY DECOMMISSIONING EXPERIMENTAL STUDIES

416

Device for Monitoring Shut-Down Nuclear Reactors. Belgian Patent No. 686, 624; 13 pp. (1966, September 8)

A method of preparing a safing wire for use in safe-guarding a nuclear reactor to detect surreptitious use thereof is described. The system consists of a tube of a high melting metal, which pulls one or more strands of a relatively low melting metal, one or more strands of a target metal which will become radioactive in the event of a neutron chain reaction, and one or more strands of a difference metal through the tube, while allowing the strands to kink within the tube, and rotary swaging in the tube to compact the assembly. (Auth)(RAF)

ADMINISTRATIVE CONTROL; COMPLIANCE; SAFEGUARDS; DECOMMISSIONING; EQUIPMENT; DESIGN; PATENTS; RADIATION MONITORING

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SEFOR - Tests a Success, Now Decommissioning. Nuclear News 15(5):34. (1972, May)

Three-year test program at Southwest Experimental Oxide Reactor measured and verified the Doppler Effect in a fast reactor, confirming theoretical predictions of an inherent safety mechanism that acts to shut a fast reactor down if fuel should become overheated. The SEFOR experimental program was performed on 2 reactor cores at power levels up to 20 MW. Transient tests, reaching instantaneous power levels as high as 10,000 MW, permitted the simulation of postulated accident conditions. Had the SEFOR data been at variance with the theoretical work, the design approach for breeder-reactor development throughout the world would have had to be re-evaluated. The program also produced quantitative data that can be used to improve calculational accuracy. The facility will be decommissioned as specified in original agreement.

REACTORS, BREEDER; DOPPLER EFFECT; REACTORS, FAST; REACTORS, TEST; ACCIDENTS; SEFOR REACTOR; DECOMMISSIONING; REACTORS, LMFBR

418

Alford, C.G., J.A. Hayden, R.L. Kochen, R.L. Olsen, and J.R. Stevens

Soil Decontamination at Rocky Flats. CONF-790923; Decontamination and Decommissioning of Nuclear Facilities. Proceedings of a Conference. Sun Valley, ID, September 16-20, 1979. Session II-B. (pp. 2-3), 90 pp. (CONF-790923). (1979)

Four methods (wet screening at high pH; attrition scrubbing with Calgon(* Trade Name) at elevated pH; attrition scrubbing at low pH; cationic floation of clays) have been shown to effectively decontaminate 60 to 84 wt% of the soil containing actinides at Rocky Flats to levels below EPA guidelines. The high pH attrition scrubbing process has been selected for pilot plant testing - producing design criteria for a 10,000 kg hour mobile process plant to be built in FY-1982. It uses Calgon solutions to process the soil in a rotary-type scrubber four times with the fines being decanted each time. Approximately 80% of the soil is decontaminated. This represents a removal of 99.9% of the activity from the decontaminated portion. By incorporating a blender-type scrub at 800 rpm, the weight percent can be further increased. The soil [approximately 2 X 10(E+7) kg] was contaminated with 80 to 90 grams of plutonium. The actual cost to dig, package, and ship soil is $255 per 1,000 kg. Projected costs to decontaminate 90% of the soil and ship 10% is $123 per 1,000 kg. This amounts to a savings of $132 per 1,000 kg if the soil is decontaminated. Tertiary treatment methods are being researched to increase the amount of material that is decontaminated. These include leaching the ceric solutions in HNO3 and high-gradient magnetic separations. (Auth)(JMF)

This paper is only an abstract of the actual paper which is to be published later.

DECONTAMINATION; WASHING; ACTINIDES; PLUTONIUM; SOILS; CONTAMINATION; WASTES, TRANSURANIC; COSTS; CATION CONCENTRATION; ACIDS; PLANTS, WASTE TREATMENT; DESIGN

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Allen, R.P., and H.W. Arrowsmith Battelle-Pacific Northwest Laboratories, Richland, WA

Electropolishing as a Decontamination Technique. BNWL-2245; Nuclear Waste Management Quarterly Report, October-December 1976, A.M. Platt (Comp.), (pp. 12.5-12.5), 60 pp. (1977, April)

The objective of the discussed program is the development of a large scale electroplating decontamination technique for radioactive metal surfaces. During this initial reporting period substantial progress was made in establishing a demonstration decontamination system in the Hanford 231-Z building. A 1500-liter electropolishing tank and the associated rinse tanks and ventilation system were installed, and hot testing of the facility was initiated using low-level beta-gamma-contaminated material. The first items decontaminated were a traveling wire flux monitor (2 mr/hr to background in 15 min) and the interior of a waste sampling tube (2 mr/hr to background in 20 min). A criticality safety analysis of the demonstration facility and of the proposed decontamination procedures was completed. Preparation of the criticality safety specification for operation with plutonium-contaminated material is in progress. Surface contamination-level studies show that even for the restrictive initial safety limits it should be possible to decontaminate more than 0.2 sq m of plutonium-contaminated surface area per liter of electrolyte. (HT)

Information pertinent to metal surface decontamination is presented. (DM/HT)

DECONTAMINATION; METALS; CONTAMINATION, SURFACE; SAFETY; WASTE TREATMENT; CONTAMINATION; PLUTONIUM; SURFACE PROPERTIES; DECOMMISSIONING; ELECTROPOLISHING

420

Allen, R.P., H.W. Arrowsmith, L.A. Charlot, and J.L. Hooper Battelle-Pacific Northwest Laboratories, Richland, WA

Electropolishing as a Decontamination Process: Progress and Applications. PNL-SA-6858; 60 pp. (1978, April)

Laboratory-scale studies by Pacific Northwest Laboratory (PNL) have shown that electropolishing is a rapid and effective technique for removing Pu and other radionuclide contamination from various metal surfaces. As part of the nuclear waste management activities, PNL is developing electropolishing into a large-scale decontamination technique capable of processing large volumes of surface-contaminated metallic waste. Specific activities described in this report include: 1. Establishment and operation of a demonstration decontamination system. 2. Development of in situ electropolishing techniques for the decontamination of surfaces that cannot be transported to or immersed in an electropolishing cell. 3. Installation and operation of a pretreatment facility. 4. Development of solution treatment procedures to external electrolyte life and minimize secondary waste through removal of dissolved metal and contamination from the electrolyte and rinse solutions. 5. Racking studies. 6. Transfer of compatible technology from the commercial electropolishing industry. 7. Development of enhanced removal techniques for contamination incorporated in cut surfaces by the disassembly, sectioning, or shredding procedures used to prepare metal waste for subsequent decontamination operations. 8. Laboratory-scale studies to understand decontamination mechanisms. 9. Establishment of criticality safety limits and operating procedures for work with fissile contaminants. 10. Development of contamination measurement systems needed for criticality safety and process control. 11. Study of the advantages and applications of prepolishing techniques. 12. Investigation of the use of electropolishing to remove oxide layers on various components. 13. Development of electropolishing techniques to facilitate contact maintenance on failed equipment. 14. Development of an electropolishing system for the Hanford N-Reactor to decontaminate valves, fuel spacers, process tube fittings, and other components for repair and reuse. 14. Identification of future applications. (RAF)

ELECTROPOLISHING; DECONTAMINATION; METALS; STEELS; METHODS; EQUIPMENT; LABORATORY STUDIES; REACTOR COMPONENTS; SAFETY; CRITICALITY; ION EXCHANGE; PRECIPITATION, CHEMICAL; OXIDES; SEPARATION PROCESSES; SOLVENTS; CUTTING; ELECTROLYSIS

421

Anderson, K.G.

Experiences in Removing Surfaces with Explosives. Concrete Decontamination Workshop, Seattle, WA, May 28-29, 1980, (10 pp.). (1980, May)

The use of explosives in the demolition of radioactive concrete at both the Elk River and Industrial Reactor Laboratories facilities has demonstrated the safe application of this technology. Some considerations in the use of explosives are blast produced dust, debris, toxic gas, vibration and air overpressures. These adverse blast effects can be minimized and controlled. Explosives use is the most rapid method of removing large concrete sections. They have a wide range of application, are adaptable for removing irregular surfaces and lend themselves to a remote method of operation. With careful planning, explosives can be a useful tool in the nuclear decontamination and dismantling process. (Auth)

CONCRETES; EXPLOSIVES; DEMOLITION; DUSTS; GASES; VIBRATIONS; DISMANTLING; DECONTAMINATION

422
Barbier, M.M., and C.V. Chester Scientific Consulting, Herndon, VA; Oak Ridge National Laboratory, Energy Division, Oak Ridge, TN

Decontamination of Large Horizontal Concrete Surfaces Outdoors. Concrete Decontamination Workshop, Seattle, WA, May 28-29, 1980. (26 pp.). (1980, May)

A study is being conducted of the resources and planning that would be required to clean up an extensive contamination of the outdoor environment. As part of this study, an assessment of the fleet of machines needed for decontaminating large outdoor surfaces of horizontal concrate is attempted. The operations required are described. The performance of applicable existing equipment are analyzed in terms of area cleaned per unit time, and the comprehensive cost of decontamination per unit area is derived. Shielded equipment for measuring directional radiation and continuously monitoring decontamination work is described. Shielding of drivers' cabs and remote control vehicles is addressed. (Auth)(RAF)

CONCRETES; EQUIPMENT; DECONTAMINATION; COSTS; TIME FACTOR; REMOTE HANDLING

423
Beck, H.L., J. DeCampo, and C. Gogolak U.S. Atomic Energy Commission, Health and Safety Laboratory, New York, NY

In Situ Ge(Li) and NaI(Tl) Gamma-Ray Spectrometry. HASL-258; 27 pp. (1972, September)

The IN SITU gamma-ray spectrometric techniques, developed by the Health and Safety Laboratory (HASL) of the Atomic Energy Commission, are used to provide information on the identity of radionuclides in the soil and air, their concentrations in the soil and their individual exposure rate contributions. The techniques utilize large NaI (Tl) crystals and later Ge(Li) diodes. The IN SITU measurements are more sensitive and provide more representative data than data obtained by sample collection and subsequent laboratory analysis. For example, a field spectral analysis for the natural emitters, K 40, U 238, and Th 232 can be carried out in approximately 15 minutes with a 4 in. by 4 in. NaI(Tl) detector. The most important disadvantage of IN SITU spectrometry is that the accuracy of the analysis depends on a separate knowledge of the radioactivity distribution with soil depth, and to a lesser extent a knowledge of the soil density, moisture content and chemical composition. (Auth)(JMF)

The paper contains many equations describing the spectrometric technique used.

SPECTROMETRY; RADIONUCLIDES; RADIATION DETECTORS; RADIOACTIVITY; RADIATION, GAMMA

424
Bertholdt, H.O., and R. Riess

Chemical Decontamination of KWU Reactor Installations. CONF-790923; Decontamination and Decommissioning of Nuclear Facilities, Proceedings of a Conference, Sun Valley, ID, September 16-20, 1979. Session II-A, (p. 2), 90 pp. (CONF-790923). (1979)

KWU has developed decontamination methods for both PWR's and BWR's. These methods can be applied either for single components or complete primary heat transport systems (PHT). They were developed respecting the different materials and operating conditions of the systems to be decontaminated. There is a two-step procedure which is a modified APAC procedure which is preferentially applied for high alloyed materials. Another one-step method is directed to isolated system or components of low-alloyed materials. Also there is a one-step procedure which can be applied to both PWR's and BWR's. These procedures demonstrate that KWU can comply with a wide range of decontamination needs. (Auth)(JMF)

This paper is only an abstract of the actual paper which is to be published later. The paper describes a decontamination procedure.

DECONTAMINATION; NUCLEAR FACILITIES; WASHING; REACTORS, BWR; REACTORS, LIGHT-WATER

425
Brengle, R.G.

The Decontamination of Concrete. CONF-790923; Decontamination and Decommissioning of

Nuclear Facilities, Proceedings of a Conference, Sun Valley, ID, September 16-20, 1979. Session IV-A, (pp. 8-10), 90 pp. (CONF-790923). (1979)

The ability to decontaminate concrete efficiently and effectively is a major challenge for the decontamination and decommissioning of reactor plants. The Sodium Reactor Experiment Facility (SRE) has many below-grade, contaminated concrete vaults. These vaults were unlined except for floor pans which terminated approximately one foot above the vault floor. The remainder of the vaults were bare or painted concrete. Contamination had penetrated the concrete approximately 1/8 in. to 3/8 in. on the average and up to the full thickness of the walls and floors where cracks and joints existed. For removing up to approximately 3/8 in. of contaminated concrete on floors, the multiple head pneumatic hammer with pointed carbide bits equipped with an absolute vacuum cleaner has proved to be the fastest method. When removing concrete to a depth of 1/8 in. to 1/4 in. with the three-headed type, rates of approximately 0.5 sq ft/min are achieved. Larger floor moded units are available with up to 11 heads per machine. These would be effective for large unobstructed floor areas. Bit lift is approximately 500 sq ft. For removal of contaminated concrete up to approximately 2 in. deep, and for chasing contamination in cracks, a pneumatic chipping hammer equipped with a chisel has proven to be an effective removal method. The chipping hammer removes material fairly selectively so the risk of structural damage is not nearly as great as would be for larger demolition-type tools or explosives. Operations using the chipping hammer are usually performed under temporary protective enclosures that are connected to an absolute filter exhaust system. The protective enclosure prevents chips of radioactive material from being scattered out of the controlled area and the exhaust system minimizes the amount of dust within the enclosures. Pre-filters in the exhaust system near the enclosure protect the absolute filters. Supplied air respirators are normally used since the concrete dust tends to rapidly plug canister type respirators. Wet sandblasting has also been used successfully on the SRD D and D program. Water is injected into the abrasive stream at the nozzle. The amount of water used should be limited to that necessary to control dust since greater amounts reduce the velocity of the abrasive stream and hence the effectiveness of the process. Sandblasting is useful for removing contamination that has been fixed by painting or if the contamination in the concrete is less than approximately 1/16 in.. To remove contamination to a depth of 1/16 in. requires approximately one pound of abrasive per square foot which adds to the overall volume of radioactive waste. The selection of a technique can only be as good as the information on which the selection was based. Concrete structures contain joints, cracks, pores, holes, piping penetrations and fastening anchors. (Auth)(JMF)

This paper is only an abstract of the actual paper which is to be published later.

DECONTAMINATION; WASHING; CONCRETES; EQUIPMENT; CONTAMINATION; WASTES, RADIOACTIVE; WASTES, TRANSURANIC; METHODS; REACTORS, SRE

426

Brown, D.J. Isochem, Inc., Richland, WA

Migration Characteristics of Radionuclides through Sediments Underlying the Hanford Reservation. CONF-670512; STI/PUB/156; Disposal of Radioactive Wastes into the Ground, Proceedings of a Symposium, Vienna, Austria, May 29-June 2, 1967. International Atomic Energy Agency, Vienna, Austria (pp. 215-228), 666 pp. (CONF-670512, STI/PUB/156). (1967, June)

The migration characteristics and spatial distribution of radionuclides in the sediments underlying the Hanford Reservation were determined from field monitoring and laboratory studies. Sediment samples that were obtained by core drilling a low- intermediate-level radioactive liquid waste disposal facility at the time of its decommissioning, and repeated ten years later, showed over 99.9% of the long-lived radionuclides to be contained within the upper ten meters of the 60 meter thick vadose zone underlying the facility. All radionuclides with half lives of less than one year except ruthenium 103 and strontium 90, decayed to below minimum detectable limits before they reached the regional groundwater table. The relative permanency of fixation of the long-lived radionuclides was attested to by laboratory leaching studies. Equilibrium coefficient and soil column tests indicated that the trace amounts of strontium 90 and cesium 137 that were leached from sediments underlying the disposal facility were resorbed in the saturated zone below the water table. Ruthenium 106, technetium 99, and tritium were not readily sorbed on sediments. The movement of these nuclides was traced for distances of up to fifteen miles by routine analysis of well water samples. (Auth)(HT)

This study of radionuclide migration characteristics in the sediments underlying the Hanford

Reservation could have applications in predicting similar migration properties of waste nuclides at other low-intermediate-level radioactive liquid disposal sites. (DM/HT)

RADIONUCLIDE MIGRATION; DISTRIBUTION COEFFICIENT; WASTE DISPOSAL; WASTES, LOW-LEVEL; WASTES, INTERMEDIATE-LEVEL; WASTES, LIQUID; SEDIMENTS; VADOSE ZONE; RUTHENIUM; STRONTIUM; TECHNETIUM; TRITIUM; CESIUM; COBALT; IODINE; CARBON; RADIONUCLIDES

427
Cavendish, J.H. National Lead Company of Ohio, Cincinnatti, OH

Treatment of Metallic Wastes by Smelting. IAEA-SM-234/14; Decommissioning of Nuclear Facilities, Proceedings of an International Symposium, Vienna, Austria, November 13-17, 1978. International Atomic Energy Agency, Vienna, (pp. 611-631), 694 pp. (IAEA-SM-234/14). (1979)

A program designed to promote the constructive re-use of metal scrap slightly contaminated with radioactive nuclides is described. This program is being conducted by the Oak Ridge Operations Office of the U.S. Department of Energy. Its primary impetus was the generation of large quantities of potentially valuable metal scrap by an extensive renovation and improvement of the three U.S. gaseous diffusion enrichment plants. The program includes three phases: (1) to characterize the type and quantity of scrap being generated; (2) to develop techniques for decontamination of the scrap to insignificant levels of radioactivity; (3) to obtain amendments to current federal regulations which would permit commercial sale and use of the decontaminated metal. (Auth)

METALS; WASTES, SOLID; SCRAP; CONTAMINATION; RADIONUCLIDES; WASTE VOLUME; METHODS; DECONTAMINATION; REGULATIONS, FEDERAL; RECYCLING

428
Close, D.A., C.J. Umbarger, L. West, W.J. Smith, and M.R. Cates Los Alamos Scientific Laboratory, Los Alamos, NM

Transuranic Waste Assay Instrumentation: New Developments and Directions at the Los Alamos Scientific Laboratory. Institute of Nuclear Materials Management Meeting, Cincinnati, OH, June 27, 1978 (13 pp.). (1978)

The Los Alamos Scientific Laboratory is developing assay instrumentation for the quantitative analysis of transuranic materials found in bulk solid wastes generated by Department of Energy facilities and by the commercial nuclear power industry. This also includes wastes generated in the decontamination and decommissioning of facilities and wastes generated during burial ground exhumation. The assay instrumentation will have a detection capability for the transuranics of less than 10 nCi of activity per gram of waste whenever practicable. (Era citation 03:056629)

WASTE MANAGEMENT; DECOMMISSIONING; DECONTAMINATION; INSTRUMENTS; WASTES, RADIOACTIVE; TRANSURANICS

429
Coles, D.G., J.W.T. Meadows, and C.L. Lindeken Lawrence Livermore Laboratory, Radiochemistry Division, Livermore, CA; Lawrence Livermore Laboratory, Hazards Control Department, Livermore, CA

The Direct Measurement of ppm Levels of Uranium in Soils Using High-Resolution Ge(Li) Gamma-Ray Spectroscopy. The Science of the Total Environment 5(1976):171-179. (1976)

The direct determination of U 238 in various soil samples was done by measuring the 63.3-keV transition from the decay of the first daughter Th 234. Potential errors resulting from the chemical non-equilibrium of U 238 with its daughters are thus avoided. The method sensitivity is 1 ppm compared to the 35 ppm obtainable by employing the 1001-deV gamma ray. A Ge(Li) gamma-ray spectrometer is the only analytical tool required. At uranium concentrations approaching the 50-ppm level, the 1001-keV Th 234 peak can be used for the uranium analysis, but the lower sensitivity of detection of this gamma ray increases the imprecision of the measurement by greater than a factor of two. The method can also be used to obtain the U 238/U 235 isotopic ratio, albeit less precisely than that obtained from mass spectrometric procedures. Clearly this technique is not meant to replace mass spectrometry for very precise uranium isotopic determinations. However, it does provide an inexpensive and routinely convenient method for monitoring environmental samples for natural uranium concentrations regardless of daughter equilibrium and can be used to detect other isotopic uranium compositions without the need for chemical dissolution. Such capabilities allow more complete monitoring of facilities that work with natural, depleted, or enriched uranium. Consequently, leakage from such facilities can be detected with a high degree of sensitivity, and an initial determination of the isotopic composition of this material can be made. It is felt that the technique described here would be able to distinguish samples contaminated with greater than 10-ppm uranium, whether the contaminant be natural, depleted, or enriched uranium. In addition to the direct measurement of U 238, other naturally occurring radionuclides such as K 40, U 235, and Th 232, as well as many of the gamma-ray emitting nuclides made by man and distributed into his environment, can be measured on the same gamma spectra. (Auth)(JMF)

This document contains charts or tables which outline the capabilities of the spectroscopic technique used.

SPECTROMETRY; SOILS; URANIUM; URANIUM COMPOUNDS; RADIONUCLIDES; ENVIRONMENT; CONTAMINATION

430
Commander, J.C. Aerojet Nuclear Company, Idaho Falls, ID

Explosive Hazards Analysis of the Eutectic Solution Sodium-Potassium and Potassium Superoxide. Report; 43 pp. (1975, June)

Planning, preparation, conductance, and evaluation of field tests are reported to determine the explosive hazards associated with the combining of the sodium-potassium eutectic alloy (NaK) with the superoxide of potassium (KO sub 2) under various conditions of state, contamination, and detonation initiation. The planning and preparation was conducted by Aerojet Nuclear Company (ANC) at the Idaho National Engineering Laboratory, and the explosive hazards testing was done by Cook Associates, Inc., at Ireco Chemicals Pelican Point Research and Development Facility in Utah. The test results showed that binary combinations of pure Nak and KO sub 2 could not be made to detonate, although the mixtures will spontaneously ignite and burn. However, tertiary combinations of NaK, KO sub 2 plus a water or hydrocarbon contaminant produced explosive hazards under a variety of conditions. The work was performed as part of the decontamination and decommissioning (D and D) of the first Experimental Breeder Reactor (EBR-1) and was funded by 189c I-215. (GRA)

SODIUM ALLOYS; CHEMICAL REACTIONS; POTASSIUM ALLOYS; POTASSIUM OXIDES; EXPLOSIONS, NON-NUCLEAR; EUTECTICS; HYDROCARBONS; MATERIALS TESTING; SPONTANEOUS COMBUSTION; WATER; HAZARD ANALYSIS

431
Commander, J.C., L. Lewis, and R. Hammer Aerojet Nuclear Company, Idaho Falls, ID; Idaho National Engineering Laboratory, Idaho Falls, ID

Decontamination and Decommissioning of the EBR-1 Complex, Topical Report No. 3. Sodium-Potassium Disposal Pilot Plant Test. Report; 24 pp. (1975, June)

Decontamination and decommissioning of the Experimental Breeder Reactor No. 1 (EBR-1) requires processing of the primary coolant, an eutectic solution of sodium and potassium (NaK), remaining in the EBR-1 primary and secondary coolant systems. While developing design criteria for the NaK processing system, reasonable justification was provided for the development of a pilot test plant for field testing some of the process concepts and proposed hardware. The objective of this activity was to prove the process concept on a low-cost, small-scale test bed. The pilot test plant criteria provided a general description of the test including: the purpose, location, description of test equipment available, waste disposal requirements, and a flow diagram and conceptual equipment layout. The pilot plant test operations procedure provided a detailed step-by-step procedure for operation of the pilot plant to obtain the desired test data and operational experience. It also spelled out the safety precautions to be used by operating personnel, including the requirement for alkali metals training certification, use of protective clothing, availability of fire protection equipment, and caustic handling procedures. The pilot plant test was performed on May 16, 1974. During the test, 32.5 gallons or 240 lb of NaK was successfully converted to caustic by reaction with water in a caustic solution. (GRA)

EBR-1 REACTOR; DECOMMISSIONING; DECONTAMINATION; REACTORS, NAK COOLED; WASTE DISPOSAL

432
Concrete Coring Company, Inc., Vancouver, WA; Concrete Coring Company, Inc., Seattle, WA

Application of Diamond Tools When Decontaminating Concrete. Concrete Decontamination

Workshop, Seattle, WA, May 28-29, 1980. (10 pp.). (1980, May)

The utilization of diamond concrete cutting tools offer new potential approaches to the recurring problems of removing contaminated concrete. Innovative techniques can provide exacting removal within a dust free environment. Present day technology allows remote control operated equipment to perform tasks heretofore considered impossible. Experience gained from years of removing concrete within the construction industry hopefully can contribute new and improved methods to D and D projects. (Auth)

CONCRETES; TOOLS, CUTTING; DIAMONDS; DECONTAMINATION

433

Darras, R., L. Dolle, M. Arod, P. Verdoni, and M. Dubourg

The French Program on Electromagnetic Filtration. CONF-790923; Decontamination and Decommissioning of Nuclear Facilities, Proceedings of a Conference, Sun Valley, ID, September 16-20, 1979. Session V-A, (pp. 10-11), 90 pp. (CONF-790923). (1979)

High temperature electromagnetic filtration can be applied to relatively high water flow rate in light water reactor technology for preventing the harmful contamination of primary circuit components by the deposit of activated corrosion products during their stay in the reactor core. For PWR, the activated corrosion products consists of magnetite, nickel ferrite formed at elevated temperature which contains among others, cobalt 58, cobalt 60, iron 59, manganese 54 and other species which contribute to the activation of internal surfaces. Owing to the very slight solubilities of these various species in the primary coolant at elevated temperature, the major part of activity is carried by particles in suspension. By using high temperature electromagnetic filters placed on a side arm loop of primary circuit, it is possible to compete with the deposit formation of corrosion products and to prevent their activation on the fuel assembly surfaces, by fixing the corrosion products on a magnetized ball matrix in high temperature without any thermal penalties for bypassed primary coolant flow. For demonstrating these anticipated benefits to the water reactor purification system of an electromagnetic filtration CEA and FRAMATOME have jointly undertaken a large R and D program. This program includes the following aspects: (1) Evaluation of an electromagnetic filter prototype on out of pole and on in pole test loops. (2) Long range testing of an electromagnetic filter prototype located on a bypass circuit of an integrated PWR in Cadarache. The data already obtained from this ongoing experience shows satisfactory mechanical and thermal behavior of the EMF prototype during continuous operation in PWR primary coolant environment, high efficiency of the system even at low concentration of corrosion products (few ppb) in the primary coolant and good fixing capabilities of the major contributors of surface activation. (3) Development of analytical methods (code PACTOLE) and models for predicting surface contamination and the benefit obtained from industrial filters on PWR plant. (4) Design and construction of industrial filters for integration on primary coolant purification loops. (Auth)(JMF)

This paper is only an abstract of the actual paper which is to be published later.

DECONTAMINATION; COBALT; EXPOSURE, OCCUPATIONAL; REACTORS, PWR; MAINTENANCE; CORROSION; ISOTOPES; RADIOACTIVITY; RADIOACTIVE MINERALS; RADIATION HAZARDS; RADIONUCLIDES; WASHING; PARTICLES; NEUTRONS; ACTIVATION PRODUCTS; FILTRATION; FIELD STUDIES; DESIGN

434

Drolet, T.S., and W.B. Stewart

Design Considerations for PHWR Decontamination. CONF-790923; Decontamination and Decommissioning of Nuclear Facilities, Proceedings of a Conference, Sun Valley, ID, September 16-20, 1979. Session II-A, (p. 5), 90 pp. (CONF-790923). (1979)

Increasing radiation fields associated with activated corrosion products deposited on out core system surfaces have the potential to cause significant problems during maintenance. A research and development program, between Atomic Energy of Canada Limited and Ontario Hydro was undertaken to identify the mechanisms of activity production, transportation and deposition and to recommend methods to reduce ambient radiation fields around a complete nuclear steam supply system. A number of options resulted: (1) Improved coolant chemistry to minimize activated corrosion products production and subsequent out core deposition. (2) Increased coolant purification flow to remove both active and inactive corrosion products. (3) Tighter specification of the materials of construction to reduce the source of potential radionuclides. (4) Decontamination of the whole system for stations where radiation has risen to unacceptable levels. When whole decontamination is necessary, the dilute chemical CAN-DECON decontamination has the following advantages over conventional decontamination: (1) Effectively reduces radiation fields. (2) Can be performed by station staff. (3) May be performed utilizing heavy water. (4) Requires short outage times. (5) Little corrosion occurs and hence there are no deleterious after effects. (6) Produces conveniently managed active wastes. This process involves the addition of chemical reagents to the heat transport system of a shutdown reactor, to give a maximum chemical concentration of 1 g/kg D20. The solution of acidic reagents attacks a portion of the corrosion product oxide layer and releases both particulates and dissolved material to the coolant. The complexed corrosion products, some of which are activated, are removed in the high flow purification circuit. Filtration, in the form of submicron cartridge filters, is used to remove the particulate crud. The process is continued until the resin is spent or until the allotted time has expired. The reagents and remaining dissolved cerrosion has been demonstrated by extensive laboratory and loop testing, test applications at NPD, a full scale heat transport system application at Gentilly-1 and a full system decontamination at Douglas Point. Also CAN-DECON purification is presently being designed and procured for the Pickering Generating station. (Auth)(JMF)

This paper is only an abstract of the actual paper which is to be published later.

DECONTAMINATION; WASHING; NUCLEAR FACILITIES; ACIDS; FILTRATION; FILTERS; DEMINERALIZATION; CONTAMINATION; DEPOSITION; RADIOACTIVE MINERALS

435

Hale, D.A., S.A. Wilson, E. Kiss, and A.J Giannuzzi *General Electric Company, San Jose, CA*

Low Cycle Fatigue Evaluation of Primary Piping Materials in a Boiling Water Reactor Environment. Report; 224 pp. (1977, September)

The report presents the results obtained in an investigation aimed at quantitatively evaluating the effects of a high temperature water environment on the performance of materials typically used for light water reactor primary piping and internal structures. Technical incentive for this work centers around the need to better understand the mechanisms of stress-assisted corrosion and corrosion-accelerated fatigue, particularly from the viewpoint of assessing and improving, if required, the applicable design codes. A special test facility was set up at the Dresden 1 nuclear power station, Morris, Illinois, and testing began in 1970. Materials being investigated include carbon steel, types-304 and -304l stainless steel, and Inconel 600 in various metallurgical conditions, simulating as nearly as practicable "as installed" piping. Primary water (500$sup 0$f, 1040 psi) from the Dresden 1 BWR system is piped to the special test loop and circulated at 10 gpm through three test vessels. Each of the test vessels contains test specimens designed to yield the specific test data judged essential to the purpose of quantitatively evaluating environmental effects. Crack initiation under cyclic plastic strain (low cycle fatigue) is studied in test vessel 1, crack initiation and growth under static loading is studied in test vessel 2, and crack growth under cyclic loading is studied in test vessel 3. The Dresden 1 test loop was decommissioned in June 1975 after a total of 35,525 loading cycles had been applied to the fatigue specimens. The primary focus of the report is the low cycle fatigue crack initiation specimens in vessel 1.

REACTORS, BWR; CARBON STEELS; FATIGUE; INCONEL 600; PIPES; COOLING SYSTEMS, REACTOR; REACTOR MATERIALS; STAINLESS STEELS

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Halter, J.M., and R.G. Sullivan Battelle-Pacific Northwest Laboratories, Richland, WA

Equipment for Removal of Contaminated Concrete Surfaces. *Concrete Decontamination Workshop, Seattle, WA, May 28-29, 1980,* (15 pp). (1980, May)

The Pacific Northwest Laboratory is investigating and developing equipment that will rapidly and economically remove contaminated concrete surfaces while producing a minimal amount of contaminated rubble. Evaluation of various methods for removing concrete surfaces shows

that many of the techniques presently used for decontamination require excessive manpower, time, or energy, or they remove more material than is necessary to clean the surface. Excess material removal increases the quantity of waste that must be handled under controlled conditions. Three unique decontamination methods are presented here: the water cannon, the concrete spaller, and the high-pressure wate jet. The water cannon fires a small, high-velocity jet of fluid to spall the concrete surface. The concrete spaller chips away the concrete by exerting radial pressure against the sides of a shallow cylindrical hole drilled into the concrete surface. The high-presusre water jet is a 50,000-psi spray that blasts away the concrete surface. Each method includes means for containing airborne contamination. Results of tests show that these techniques can rapidly and economically remove surfaces, leaving minimal rubble for controlled disposal. Also presented are cost comparisons between the water cannon and the concrete spaller. (Auth)

EQUIPMENT; CONCRETES; DECONTAMINATION; METHODS; WASTES, RADIOACTIVE; WATER CANNONS; WATER JETS; CONCRETE SPALLERS; COST ESTIMATES

437
Hewson, R.A. Atomics International, Canoga Park, CA

Piqua Nuclear Power Facility Retirement Safety Analysis Reevaluation of Residual Nuclides. AI-AEC-MEMO-12708(Suppl. A); 49 pp. (1969, January 15)

Analyses of samples of concrete from the reactor biological shield indicated that the neutron flux levels were significantly lower than those calculated during the design of the reactor and used for the determination of radioactivity content of the shield concrete. The chemical and radiochemical analyses showed different concentrations of some trace elements which are precursors of radioisotopes of potential concern. Neutron flux levels were recalculated using present day shielding analyses techniques and cross section data. Flux levels from these calculations were in good agreement with the results from the shield sample analyses. It was concluded that the source levels were either the same or lower than those predicted in the previous report.

REACTORS, ORGANIC COOLED; PIQUA NUCLEAR POWER FACILITY; DECOMMISSIONING; NEUTRON FLUX; SAFETY; CALCULATIONS

438
Hilaris, J.A., and S.A. Bortz IIT Research Institute, Chicago, IL

High-Pressure Water Jet Applications in Radioactively Contaminated Facilities. Concrete Decontamination Workshop, Seattle, WA, May 28-29, 1980, (10 pp.). (1980, May)

High pressure water jetting is a new tool, which significantly increases productivity while meeting the environmental regulations, for effective removal of radioactively contaminated concrete. A field study program was undertaken to assess the applicability of continuous jets for concrete removal. Performance curves were generated for concrete and reinforced concrete. Jet pressures ranged from 70 to 275 MPa (10 to 40 ksi). Nozzle diameters of 0.4 and 0.5 mm (0.016 and 0.020 in.) with double orifices were studied with linear traversing speeds from 2.54 to 15 cm/sec (1 to 6 ips) and nozzle rotational speeds from 300 to 900 rpm. (Auth)

DECONTAMINATION; CONCRETES; FIELD STUDIES; TOOLS, CUTTING; WATER JETS

439
Holland, M.E. Goodyear Atomic Corporation, Process Technology Department, Technical Division, Pideton, OH

Use of Citric Acid for Large Parts Decontamination. GAT-2000; 40 pp. (1979, September 12)

Laboratory and field studies have been performed to identify and evaluate chemical decontamination agents to replace ammonium carbonate, an environmentally unacceptable compound, in the decontamination facility for large process equipment at the Portsmouth Gaseous Diffusion Plant. Preliminary screening of over 40 possible decontamination agents on the basis of efficiency, availability, toxicity, cost, corrosiveness, and practicality indicated sodium carbonate and citric acid to be the most promising. Use of citric acid instead of ammonium carbonate has markedly reduced the ammonia/ammonium ion level in Little Beaver Creek which receives flow from the S-701-B holding pond. Citric acid is both non-toxic and biodegradable; in fact, it is a metabolite common to most living systems. Corrosiveness of citric acid to either process converters of compressors has not been demonstrated, but heated mixtures of citric and nitric acids were found to corrode mild steel. Monitoring and prevention of such mixing is continuing. Citric acid is compatible with the tributyl phosphate uranium recovery system, and proposed ion exchange process for the removal of Tc 99 from uranium recovery raffinates. More efficient tunnel operations result from use of two acids (citric/nitric) instead of a base/acid (ammonium carbonate/nitric acid) combination: booth carryover no longer results in neutralization and resultant solution degradation. Because it may be used at higher booth temperatures than ammonium carbonate (which, at equivalent temperatures, produces undesirable ammonia fumes), citric acid yields increased cleaning efficiency. It is recommended that development laboratory personnel be notified when Tc 99-contaminated equipment is scheduled for decontamination so that further data and controlled decontamination factor observation for citric acid use can be obtained and analyzed. Also, further study in the cost effectiveness of citric acid use is needed, but appears promising with $1084/month (price for liquid technical grade of 50% wt/wt liquid) as opposed to $1406/month for ammonium carbonate. Estimated reduced manpower requirements due to decreased buffing of decontaminated equipment are approximately equal to $15,000/year because of the superior cleaning properties of citric acid. (Auth)(JMF)

Various flowcharts, graphs, and tables are contained within the report giving comparisons on effectiveness, stability, and safety to equipment of solutions tried for decontamination. A flowchart of the overall process is contained in the document.

DECONTAMINATION; ACIDS, ORGANIC; BASES; COST ESTIMATES; COSTS; CREEKS; DISCHARGE; DISPOSAL SITE; EQUIPMENT; EFFLUENTS, LIQUID; ENVIRONMENT; ESTUARIES; NUCLEAR FACILITIES; POLLUTION, WATER; PONDS; HOLDING PONDS; SURFACE WATERS; WASHING; WASTE MANAGEMENT; WASTES, LIQUID; WASTES, NONRADIOACTIVE; WATER

440

Howes, J.E., R.A. Ewing, and D.L. Morrison Battelle Memorial Institute, Columbus, OH

A Study of the Neutron Activation Products in the Piqua Nuclear Power Facility Concrete Biological Shield. BMI-X-518; 20 pp. (1968, August)

A 2.5 in. core 94.5 in. long was drilled from the shield and analyzed. Fast flux 6 in. into concrete agreed with AI estimate, but thermal flux was one-tenth the estimate. Leaching with Miami River water indicates only 3% of the 0.4 curie/cc would be leached.

REACTORS, ORGANIC COOLED; SURFACE WATERS; ACTIVATION PRODUCTS; SHIELDING; DECOMMISSIONING; NEUTRONS; PIQUA NUCLEAR POWER FACILITY

441

Johnson, A.B., R.L. Dillon, and B. Griggs

Candidate Reagents for Activity Reduction in Boiling Water Reactor and Pressurized Water Reactor Primary Systems. CONF-790923; Decontamination and Decommissioning of Nuclear Facilities, Proceedings of a Conference, Sun Valley, ID, September 16-20, 1979. Session II-A, (p. 3), 90 pp. (CONF-790923). (1979)

Single-stage, dilute-reagent decontamination is gaining popularity as a method to periodically reduce radiation fields adjacent to primary piping and components of water-cooled reactors. The concept involves injection of a reagent into the primary coolant during a normal reactor shutdown. The radioactivity on the coolant system walls is dissolved and/or suspended by the reagent. The circulating radioactivity is removed by the bypass cleanup system until the reactor coolant is back to normal. Such a method has been applied to three Canadian reactors with promising results. However, no applications of the method to light water reactors has yet been attempted. Under a program sponsored by EPRI, Battelle's Pacific Northwest Laboratories have conducted studies to identify reagents which will effectively remove activity from both boiling water reactor (BWR) and pressurized water reactor (PWR) systems. Reactor specimens available for reagent studies include recirculation bypass pipe sections from three BWR's and steam generator tubing from seven PWR's. Chelating agents (e.g., EDTA and NTA) and mixtures of chelating agents and organic acids have been effective in removing up to around 85% of the Co 60 activity from BWR pipe specimens. Solution of the BWR deposits was enhanced at low pH and under reducing conditions. The chelating reagents detach but do not dissolve the crystal layer. It can be washed from the pipe surface with sufficient turbulence. Rates of PWR crud removal are accelerated by reductions in pH and are mildly enhanced by oxidizing conditions (e.g., peroxide additions). Cobalt activity reduction rates were compared on steam generator tube specimens from two PWR's. The reagent was 0.002 M EDTA at 180 C, pH 3.5 and 5.5. For both specimens, the rates were mildly (1.5 to 2 times) faster at the lower pH. (JMF)

This paper is only an abstract of the actual paper which is to be published later. The paper contains a description of the reagent and its use parameters.

DECONTAMINATION; WASHING; NUCLEAR FACILITIES; REACTORS, PWR; REACTORS, BWR; CHELATES; ACIDS, ORGANIC; DEMINERALIZATION; COBALT; CONTAMINATION; DEPOSITION; RADIOACTIVE MINERALS

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Kani, J., H. Koyama, S. Sasaki, and T. Yoshida

TEPCO BWR Decontamination Experience. CONF-790923; Decontamination and Decommissioning of Nuclear Facilities, Proceedings of a Conference, Sun Valley, ID, September 16-20, 1979. Session III-A, (pp. 3-5). 90 pp. (CONF-790923). (1979)

During the research for the decontamination of the reactor primary system at the Fukushima DAI-ICHI plant several domestic and foreign reagents were tested. These reagents were given a preliminary screening by a non-radioactive test and then tested with specimens taken from the primary system to evaluate the decontamination factors and corrosiveness. Tests for evaluation of the effects of residual reagents on structural materials after decontamination and for treatment of decontamination wastes are also progressing. In addition, identification of the major radionuclides contributing to radiation dose rates, characterization of the crud deposits on piping and fuel surfaces, and estimates of future radiation levels are being done. As a step to evaluate various kinds of decontamination processes, the applicability of CAN-DECON process and Dresden process to boiling water reactors are being studied and evaluated. Other evaluations carried out were: (1) Test for radwaste treatment to obtain basic data for the system design. (2) Concentration and drying test where the thermal decomposition characteristics of the wastes were identified. (3) Test for strength and leachability of the solidified wastes. (4) Evaluation of the residual effects of the reagents on the structural materials after decontamination, as well as an acceleration test to evaluate the effects of the selected reagents on the materials (SCC sensitivity). When the applicability of decontamination processes to the actual reactor is evaluated, what must be considered first is whether serious problems will be accompanied with a decontamination operation or not. From this standpoint, the following conditions are considered: (1) Decontamination operation should be performed safely. (2) Decontamination operation should not have a serious effect on the reactor primary system. (3) Radioactive wastes generated from this decontamination operation should be treated and stored safely. Moreover, the other items which must be considered are effectiveness of decontaminaation and decontamination cost. The essential object of decontamination is to reduce the occupational radiation exposures, therefore, the effectiveness should be estimated based on the total man-rem savings during the plant lifetime. The total cost will consist of cost of investment, operation and labor and cost of down time. Accordingly, the decontamination process is evaluated by the use of cost-benefit analysis. At present, various methods have been proposed for reducing radiation exposures, such as chemical or mechanical decontamination, reduction of crud sources and reinforcement of shielding. Thus for the overall evaluation, it is necessary to consider the combination effect of these methods. (Auth)(JMF)

This paper is only an abstract of the actual paper which is to be published later.

DECONTAMINATION; WASHING; NUCLEAR FACILITIES; COSTS; COST BENEFIT ANALYSIS; WASTES, RADIOACTIVE; WASTE TREAT-

MENT; REACTORS, BWR; WASTES, SOLID; LEACHING; EXPOSURE, OCCUPATIONAL; PERSONNEL; SHIELDING; EVALUATION

443
Kissel, P.H. CEA, Institut de protection et de surete nucleaire, Fontenay-aux-Roses, France

Leaktight Remote Handling Equipment for Operations in an Irradiating and Contaminating Environment. IAEA-SM-234/41; Decommissioning of Nuclear Facilities, Proceedings of an International Symposium, Vienna, Austria, November 13-17, 1978. International Atomic Energy Agency. (pp. 633-655), 694 pp. (IAEA-SM-234/41). (1979)

In order to be able to carry out various operations in a highly irradiating and contaminating environment, especially in connection with the decommissioning of nuclear facilities, a P.a.R. 3500 remote handler has been fitted with equipment providing protection against contamination. The cowling of the device is made entirely of stainless steel and PVC and has the appearance of a ventilated protective suit; a ventilating-filtering system keeps the tight enclosure thus created under overpressure, thereby avoiding any contamination of the handler's components. In describing this new version (Tomi), the author reviews the whole range of equipment, devices and accessories to the Mobile Remote Handling Group of the CEA. In particular, two original devices with which the remote handler can be used to prepare charts showing instantaneous absorbed and integrated dose rates are described.

REMOTE HANDLING; EQUIPMENT; DECOMMISSIONING; NUCLEAR FACILITIES; VENTILATION; FILTERS; DOSE RATE

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Kok, K.D., V.D. Linse, and S.J. Basham, Jr. Battelle-Columbus Laboratories, Columbus, OH

Use of Linear-Shaped Explosive Charges for Reactor Dismantling. Transactions of the American Nuclear Society 22:635-636. (1975, November)

BATTELLE RESEARCH REACTOR; EXPLOSIVES, CHEMICAL; REACTOR DISMANTLING

445
LaGuardia, T.S. Nuclear Energy Services, Inc., Danbury, CT

Concrete Decontamination and Demolition Methods. Concrete Decontamination Workshop, Seattle, WA, May 28-29, 1980, (24 pp.). (1980, May)

The U.S. Department of Energy (DOE), Division of Environmental Control Technology, requested Nuclear Energy Services to prepare a handbook for the decontamination and decommissioning (D and D) of DOE-owned and commercially-owned radioactive facilities. The objective of the handbook is to provide the nuclear industry with guidance on the state-of-the-art methods and equipment available for decommissioning and to provide the means to estimate decommissioning costs and environmental impact. This paper will summarize the methods available for concrete decontamination and demolition to provide an overview of some of the state-of-the-art techniques to be discussed at this workshop. The pertinent information on each method will include the selection factors such as the rate of performance in terms of concrete removal per unit time (cubic yards per day), manpower required by craft, unit cost (dollars per cubic yard) and the advantages and disadvantages. The methods included in this overview are those that have been routinely used in nuclear and non-nuclear applications or demonstrated in field tests. These methods include controlled blasting, wrecking ball or slab, backhoe mounted ram, flame torch, thermic lance, rock splitter, demolition compound, sawing, core stitch drilling, explosive cutting, paving breaker and power chisel, drill and spall, scarifying, water cannon and grinding. (Auth)

DECONTAMINATION; DECOMMISSIONING; NUCLEAR FACILITIES; METHODS; EQUIPMENT; REVIEWS; COST ESTIMATES; CONCRETES; DEMOLITION

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Lange, W.S., and T.L. Snyder

Engineering Aspects of Dresden Unit 1 Chemical Cleaning Project. CONF-790923; Decontamination and Decommissioning of Nuclear Facilities, Proceedings of a Conference, Sun Valley, ID, September 16-20, 1979. Session III-A, (pp. 1-2), 90 pp. (CONF-790923). (1979)

The decontamination process for power plant fluid systems should be effective, easy to use, inexpensive and should selectively remove contamination without adversely affecting the surface holding the contamination. The method chosen for performing the decontamination at Dresden Unit 1 was the Dow NS-1 solvent. The design process commenced in 1973 with extensive field investigations to determine the as-built configuration of the existing systems. The location of tie-in points were also determined at this time. The design vintage of Dresden Unit 1 precluded the use of the existing radioactive waste treatment facilities. A decision was made to make use of a temporary facility utilizing the "bath tub" concept for containing liquid wastes. The cost of providing the facilities proved to be significant enough that other longer term uses are being investigated. The facility design consists of: (1) Storage tanks for chemical solvent and rinses. (2) Waste evaporation equipment. (3) Waste solidification equipment. (4) Process equipment and piping for solvent injection, draining, and flushing. (5) Auxiliary equipment such as air compressors, boilers, HVAC, fire protection, etc. to make the facility a complete self-contained operation. The design of temporary piping and equipment utilized within the containment required careful consideration for ALARA health physics concerns while ensuring that the operation of the unit would not be affected. The Dresden decontamination project costs are estimated to be $35,000,000. A significant portion of the costs are due to the fact that it is a first-of-a-kind project. The engineering is essentially complete and the construction is well underway. The decontamination is scheduled to commence on August 15, 1979. (Auth)(JMF)

This paper is only an abstract of the actual paper which is to be published later.

DECONTAMINATION; WASHING; NUCLEAR FACILITIES; WASTE TREATMENT; SOLVENTS; SOLIDIFICATION; WASTES, LIQUID; WASTES, RADIOACTIVE; COSTS; HAZARD ANALYSIS

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Lindsten, D.C., and R.P. Schmitt U.S. Army Mobility Equipment Research and Development Center, Sanitary Sciences Division, Fort Belvoir, VA

Decontamination of Water Containing Radiological Warefare Agents. AD-A020193; Report 2136; 109 pp. (1975, March)

In the event of future war, it is possible that nuclear weapons would be used and, therefore, contamination of water supplied would result. The assigned responsibilities of the Sanitary Sciences Division, U.S. Army Mobility Equipment Research and Development Center, Fort Belvoir, Virginia in the field of water and sanitation require that special consideration be given to the problems associated with the contamination of water supplies. During the studies of water decontamination, the following conclusions were made: (1) The use of nuclear weapons poses a severe threat to water supplies as a result of contamination with fission products, unfissioned plutonium or uranium, or neutron-activated radioisotopes. (2) Fallout from a nuclear weapon varies widely in its water solubility, depending primarily upon the nature of the soil in the vicinity of ground zero. (3) For evaluation of water decontamination processes, a provisional maximum permissible concentration (MPC) of 300,000 picocuries per liter of beta-gamma activity served as an adequate guide. (4) A semiquantitative check of the level of activity in raw or finished water can be made with a standard PDR-27J beta-gamma radiation meter. The probe is protected with a rubber sheath, inserted into the water, and conversion made from the meter reading in milliroentgens/hour to picocuries per liter. (5) The standard Army ERDLator Water Purification Unit is effective for removing radioactive substances from water when present as suspended insoluble turbidity. The ERDLator will not remove radioactive contaminants present as soluble radioisotopes. (6) The efficiency of the standard ERDLator Water Purification Unit in removing soluble radioisotopes can be improved substantially by pretreating the contaminated water with clay or some other radioisotope adsorbent. (7) The standard Army Vapor Compression Distillation Unit is effective in decontaminating water containing radioactive material. (8) A field expedient method consisting of the following steps is effective in removing chemical, biological, radiological (CBR) contaminants from water: super-hypochlorination and activated carbon adsorption in series in a Lister bag, coagulation, filtration, mixed-bed ion exchange demineralization, and post chlorination. (9) The standard Army Ion Exchange Unit, when used as a post treatment device after the standard ERDLator Unit, is effective for removing soluble radioactive substances from water. (10) The reverse osmosis water soluble and insoluble state. (11) Ground water may reasonably be assumed to be free of radioactive substances and should be used whenever the tactical situation permits. (12) Radioactive waste slurries developed as a result of using Army field water purification equipment should be disposed of properly by burial or other appropriate means. (Auth)(JMF)

The document contains photographs of nuclear denotations. Also, photographs, charts, tables, and graphs of the different water decontamination techniques are contained in the document.

DECONTAMINATION; WEAPONS; CONTAMINATION; WATER; PLUTONIUM; URANIUM; RADIONUCLIDES; FALLOUT; SOLUBILITY; ADSORPTION; COAGULATION; FILTRATION; ION EXCHANGE; OSMOSIS; GROUND WATER; WASTE DISPOSAL; SLURRY; BURIAL

448
Lynch, T.W. Nuclear Control Corporation, Anaheim, CA

Diamond Blade Grinding as a Means for Removing Surface Contamination from Concrete. *Concrete Decontamination Workshop.* Seattle, WA, May 28-29, 1980, (6 pp.). (1980, May)

The use of a highway grinding unit for the decontamination of a 5,000 square foot surface is described. The type of equipment presently in use is described. Performance characteristics, waste collection and water usage are commented on. Variables in blade design are discussed. Feasibility of the grinding technique for water soluble contaminants and vertical surfaces is referred to. (Auth)

CONCRETES; DECONTAMINATION; EQUIPMENT; DIAMONDS; GRINDING; WASTE DISPOSAL

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McConnell, J.W., J.N. McFee, and R.F. Vance

Volume Reduction of Radioactive Waste Resulting from Decontamination of Surplus Nuclear Facilities. CONF-790923; Decontamination and Decommissioning of Nuclear Facilities, Proceedings of a Conference, Sun Valley, ID, September 16-20, 1979. *Session II-B*, (pp. 13-15), 90 pp. (CONF-790923). (1979)

A system is being developed which is capable of providing significant volume reduction for radioactively contaminated wastes (wet ion exchange resins, liquid wastes, and dry combustible material from surplus nuclear facilities) while simultaneously placing them in an anhydrous, granular form. The installation of a single radioactive waste drying and volume reduction system could support all D and D projects at one site. A fluidized bed concept for calcining liquid wastes and incinerating combustible wastes in the same process vessel is being developed by Energy Incorporated in Idaho Falls, Idaho, in a partnership with Newport News Industrial Corporation of Newport News, Virginia. The system processes aqueous solutions at a net rate of 35 gph. Resin slurries of 60 to 70 wt% water are accepted by the system at a rate of greater than 100 lb/hr. Dry combustible wastes include paper, cloth rags, anti-contamination clothing, and miscellaneous packaging materials. These materials can be fed to the process at a rate of up to 200 lb/hr. Although sodium sulfate solutions require no pretreatment, boric acid solutions must be neutralized. The liquid wastes are pumped through air atomizing nozzles into the fluidized bed region of the process vessel. The application of a fluidized bed permits the processing of a wide variety of feed types. The fluidized air is preheated for the calcination of liquid wastes. The liquid wastes coat the fluidized bed particles where drying occurs. A layer of dry solid covering the bed particles results. This dry solid is abraded by the scrubbing action of the fluidized bed and is carried from the vessel by the fluidizing gases. Calcination requires a bed temperature of 200 to 400 C. The gases leaving the process vessel are first passed through a cyclone to remove dried calcination salts, or incineration ash, as the system's product. The gases are then passed through a wet scrub system comprised of a quench tank, venturi scrubber wet cyclone, entrainment separator, condenser, and mist eliminator. A heater down stream of the wet scrub assures the relative humidity of the gases is less than 100% prior to passing through the high efficiency particulate air (HEPA) filters. The final piece of equipment through which the gases pass is an off-gas blower. This blower maintains a negative pressure over the entire system, assuring that off-gas cannot leave the system except through the intended gas clean-up equipment. The off-gas clean-up system assures a clean gas effluent which can be safely vented to the atmosphere. (Auth)(JMF)

This paper is only an abstract of the actual paper which is to be published later.

DECONTAMINATION; DECOMMISSIONING; WASHING; NUCLEAR FACILITIES; WASTES, LIQUID; WASTES, SOLID; WASTES, TRANSURANIC; WASTES, RADIOACTIVE; CONTAMINA-

TION; IONIC PROCESSES; CALCINATION; INCINERATION; SLURRY; ION EXCHANGE; SOLIDIFICATION; REACTORS, BWR; FILTERS, HEPA

450
McFarland, J. McFarland Wrecking Corporation. Seattle, WA

Innovative Techniques for Removing Concrete Surfaces. Concrete Decontamination Workshop, Seattle, WA, May 28-29, 1980, (11 pp.). (1980, May)

This report centers on the use of heat to decompose contaminated concrete to facilitate its removal. It discusses the use of electrical resistance heating and induction heating to cause differential expansion between the reinforcing steel and the concrete in order to spall the concrete. It introduces the concept of using induction heating to both decompose and spall steel impregnated concrete, acknowledging the work of Dr. Henegar in this field. The techniques are offered as theoretical and untested possibilities. Their practical application depend upon the effectiveness of alternatives and upon further development of these concepts. (Auth)

THEORETICAL STUDIES; CONCRETES; THERMAL STRESSES; CONCRETE SPALLS; STEELS; METHODS

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McFarland, J.M.

Demolition of Concrete Structures By Heat - A Preliminary Study. CONF-790723; Decontamination and Decommissioning of Nuclear Facilities, Proceedings of a Conference, Sun Valley, ID, September 16-20, 1979. Session IV-A, (pp. 10-12), 90 pp. (CONF-790923). (1979)

Use of heat to weaken massive concrete structures may be a part of the answer to the increasing difficulty of demolishing such structures found in the nuclear energy industry. The most significant means of facilitating demolition, as well as decontamination, remains in the field of design engineering, planning for D and D before the structure is built. The design engineer must have the most complete range of alternatives to design to. Destruction of concrete by heat is one of these possible alternatives. The containment structures, which are most resistant to conventional demolition, appear to be natural conservers of heat and suited to this possibility. Observing that concrete structures involved in fires are weakened to the extent that the intense heat penetrates the concrete, this inquiry attempts to find out exactly what happens to the concrete. The inquiry into the nature of reinforced concrete as related to heat included these areas: (1) The chemical composition of concrete and its reactions when heated and cooled. (2) The thermal conductivity of concrete and reinforcing steel. (3) Heat radiation and convection losses from concrete surfaces. (4) The specific heats of concrete and steel with calculations to raise the masses of the PWR and BWR biological shields to critical temperatures. (5) Fuel heat content, costs and methods of introduction for electricity, gas and oil; applying cost factors to the heat requirement calculations. (6) The coefficients of expansion of steel and concrete. (7) Construction designing to enhance the use of heat for decontamination and demolition. (8) Caveats of the method. The conclusion is that: (1) The need for improved demolition methods is present and urgent. (2) The concept of destruction of massive concrete structures by heat has sufficient support in theory and economics to justify computer modeling, laboratory testing and field testing. The limited practical experience of concrete buildings involved in fires supports the possibility. (3) If validated by testing, the method should add a significant design capability for ease and economy in demolition of the most difficult part of nuclear reactor plants, the reactor containment vessels. (4) "Fallout" from this line of investigation could lead to other lines of thought to improve decontamination and demolition as well as overall plant design. (Auth)(JMF)

This paper is only an abstract of the actual paper which is to be published later.

DECOMMISSIONING; CONCRETES; HEAT CAPACITY; HEAT RESISTANCE; EXPLOSIONS, NON-NUCLEAR; SHIELDING; REACTORS, BWR; REACTORS, PWR; CONTAMINATION; ACCIDENTS; COSTS; DESIGN; CHEMICAL COMPOSITION; THERMAL PROPERTIES; CONVECTION; TEMPERATURE; SPECIFIC HEAT; ECONOMICS; MODELS, MATHEMATICAL; LABORATORY STUDIES; FIELD STUDIES; CONTAINMENT; METHODS; DEMOLITION

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Quinlan, F.B.

Method of Making a Device for Monitoring Shut-Down Nuclear Reactors. U.S. Patent 3,359,621; 4 pp. (1967, December 26)

A method of preparing a safing wire for use in safeg ..rding a nuclear reactor to detect surreptitious use of the reactor is described. Strands of a relatively low melting metal, strands of a metal which will become radioactive when a neutron chain reaction occurs, and strands of a different metal are pulled through a tube, the last-mentioned strands being permitted to kink within the tube, and the tube is rotary swaged.

COMPLIANCE; DECOMMISSIONING; INSTRUMENTS, IN-CORE; PATENTS; RADIATION MONITORING; SAFEGUARDS

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Roche, C.T., J.J. Vronich, F.O. Bellinger, and R B. Perry Argonne National Laboratory, Nondestructive Assay Section, Special Materials Division, Argonne, IL

A Nondestructive Assay System for Use in Decommissioning a Plutonium-Handling Facility. ANL-79-60; 28 pp. (1979, July)

During the fabrication of fuel elements, at the Argonne National Laboratory, equipment was contaminated with alpha emitters at levels up to 10(E+12) dpm/100 sq cm. The facility, Number 250, was operated for 15 years beginning in 1959 to produce fuels for EBR-I, EBR-2, ZPPR and ZPR critical assemblies. Plutonium-metal alloys, mixed-oxide (MOX) powders, and highly enriched uranium were handled at the plant. The total contaminated surface area is about 2.3 x 10(E+3) sq m with contamination levels on the order of mci sq cm. Cost effective decontamination of the equipment required that the transuranic elements' concentrations to be below 10 nCi/g of waste, so an accurate assay system is required. At the Argonne National Laboratory, a portable nondestructive assay system employing NaI(Tl) gamma-spectrometric techniques was tested to measure residual Pu and Am 241 in glove boxes. Assays were taken at various stages of the decontamination procedure to estimate the detection system sensitivity and effectiveness of the cleaning efforts. Both high-level and low-level contamination assay techniques are discussed fully. The system proved adequate for this purpose. (JMF)

The report contains photographs and drawings of the facility, assay procedure and hardware. Graphs and tables of spectrographic data obtained during the assay are given. A flowchart of the assay procedure is given.

ALPHA PARTICLES; CONTAMINATION; DECOMMISSIONING; DECONTAMINATION; DISPERSIVITY; DISPERSION; FABRICATION, FUEL; FISSION PRODUCTS; GLOVE BOXES; HOT CELLS; INSTRUMENTATION; INSTRUMENTS; ISOTOPES; LOGGING, GAMMA; LOGGING, RADIOACTIVITY; PLUTONIUM; RADIONUCLIDES; RADIOACTIVITY; RADIOACTIVE DECAY; RADIATION, GAMMA; RADIATION SOURCES; RADIATION DETECTORS; SPECTROMETRY; WASHING; WASTE MANAGEMENT; WASTE DISPOSAL; WASTES, RADIOACTIVE; WASTES, TRANSURANIC

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Smith, T.H., R.J. Hall, and L.D. Williams Battelle-Pacific Northwest Laboratories, Richland, WA

Analytic Methods for Fuel-Cycle Safety Studies. IEEE Trans. Reliab. R-25 (3):184-190. (1976, August)

Battelle-Northwest (BNW) is conducting safety studies of the following nuclear fuel cycle operations: reprocessing, transportation of radioactive material, decommissioning of facilities, and waste management. Various methods and depths of analysis are used in these studies, but all involve safety quantification in terms of risk, relating probabilities and consequences of potential accidents. This paper describes the methods used for these safety studies. Highlighted are areas in which BNW contributions have extended the analytic methods: a risk-based fault-tree analytic method for identification, preliminary evaluation, and screening of potential release sequences; improved treatment of deposition and resuspension in airborne transport of radionuclides; and groundwater transport models of radionuclide chains in soil columns, including the effects of convection, diffusion, sorption, and generation and decay. Areas needing additional development are identified. 42 refs.

FAULT TREE ANALYSIS; FUEL CYCLES; GROUND WATER; NUCLEAR FUELS; NUCLEAR MATERIALS MANAGEMENT; RADIOACTIVE MATERIALS; WASTE MANAGEMENT; REPROCESSING; SAFETY; TRANSPORTATION; WASTE MANAGEMENT

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Solomon, Y., and J.D. Cohen

Radiation Monitoring and Control in Pressurized Water Reactor Primary Systems. CONF-790923; Decontamination and Decommissioning of Nuclear Facilities, Proceedings of a Conference. Sun Valley, ID, September 16-20, 1979. Session V-A, (pp. 5-7). 90 pp. (CONF-790923). (1979)

Radiation fields from primary coolant loops create difficulties in plant maintenance and repair. Among the approaches taken to alleviate radiation exposure are remote tooling, temporary shielding, close supervision, mock-up training, strict control of access, and local decontamination. However, the best way to eliminate this difficulty is to reduce the source. Previous review of radiation fields in light water reactors revealed that the available data were not consistent. Therefore, the first objective was to develop standard radiation monitoring procedures. Other aspects to be studied include pH control, hydrogen peroxide additions, boric acid control, in-plant shutdown radiation fields, laboratory work regarding corrosion products solubility and mathematical modeling of corrosion product transport and deposition. High releases of Co 58 and Co 60 to reactor coolant have been observed during shutdown operations of PWR plants. The objective is to obtain these releases quickly, while facilities for coolant purification are operable. The oxygenation of the primary system by aeration and by hydrogen peroxide addition have been studied. The general results are that: (1) Some release of the cobalt isotopes occurs as a result of borating the coolant and reducing its temperature. This is due to increasing the coolant activity. (2) A faster release occurs upon oxygenation, peroxide being most effective, and this release terminates quickly. (3) The total release can be cleaned up via system demineralizers. (4) The materials released are primarily from core surface and partly from plant surfaces. (5) The total process appears to neither contaminate nor decontaminate plant surfaces. The basic properties of crud composition are being examined in the laboratory. The existing solubility data base for materials, coolant composition, and temperatures will be extended. The solubility of cobalt from nickel cobalt ferrite materials under differing chemistry, hydrogen, oxygen and other water parameters are being investigated. The low temperature (20 C to 60 C) oxidation is being investigated. To date, the results have indicated that: (1) The Fe solubility from nickel ferrite is less than that in equilibrium with magnetite in a simulated reactor coolant. (2) The Ni solubility is less than that of Fe, and has little, if any, temperature coefficient at greater temperatures. (3) The solubility of both species increases with the increasing acidity that occurs when boric acid is cooled. (4) On oxygenation of the cooled solution, the solubility of Ni (and presumably Co) increases dramatically. (Auth)(JMF) (Complete Text)

This paper is only an abstract of the actual paper which is to be published later.

DECONTAMINATION; NUCLEAR FACILITIES; REACTORS, PWR; MAINTENANCE; REACTORS, LIGHT-WATER; MONITORING; MODELS; COOLANTS; RADIONUCLIDES; COBALT; NICKEL; SOLUBILITY; TEMPERATURE

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Stephens, J.J., Jr., and R.O. Pohl : Cornell University, Laboratory of Atomic and Solid State Physics, Ithaca, NY

Trace Elements in Reactor Steels: Implications for Decommissioning. Nuclear Engineering and Design 47(1):125-134. (1978, May)

Trace elements in stainless steel have been systematically examined for the production of long-lived radioisotopes through neutron activation in reactors. Niobium 94 has been identified as the most important impurity. It is a long-lived (tau sub 1/2=20,000 yr) gamma ray emitter (0.7 and 0.87 MeV), which is produced by the neutron capture reaction Nb 93 (n, gamma) Nb 94. Through X-ray fluorescence Nb concentrations of 160 + or - 20 ppm have been found in type 304 stainless steel which agrees with earlier published values. At this concentration, the gamma radiation dose rate inside the pressure vessel of a reactor would remain close to 1 rem/hr for thousands of years after the Co 60 activity has decayed. This could be important for the delayed dismantling option considered for reactors. Nitrogen as an impurity in stainless steel has been shown to result in the buildup of 100 and 1000 Ci of C 14 over the lifetime of a BWR and a PWR, respectively. Although C 14 is only a beta emitter, its long half-life (5730 yr) and the crucial role of carbon in the biosphere may be important in deciding on the ultimate disposal method of the radioactive reactor components. (Auth)

CARBON 14; DOSE RATE; RADIATION, GAMMA; NIOBIUM; NIOBIUM 94; NITROGEN; PRESSURE VESSELS; REACTOR COMPO-

NENTS; REACTOR DECOMMISSIONING; REACTOR DISMANTLING; REACTOR MATERIALS; STAINLESS STEELS; TRACE ELEMENTS

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Troy, M., and G. Zirps

Effect of High-Temperature Filtration on Pressurized Water Reactor Plant Radiation Levels. CONF-790923; Decontamination and Decommissioning of Nuclear Facilities, Proceedings of a Conference, Sun Valley, ID, September 16-20, 1979. Session V-A, (pp. 9-10), 90 pp. (CONF-790923). (1979)

It has been experimentally demonstrated that filtration can effectively reduce radiation fields in reactor loops. The most important source of radiation exposure to pressurized water reactor (PWR) plant maintenance personnel is associated with the activated corrosion product deposits on plant surfaces. The corrosion product (crud) deposits are a combination of corrosion products formed in place and corrosion products deposited from the fluid stream. The activation of the former depends largely on the cocrystalization of radionuclides from the coolant stream into the growing corroding film. Activation of the latter results from either the precipitation from solution of the activated species as oxides or the deposition of particulate activated oxide species onto the plant surfaces. The transport of crud metallic species from the excore corroding surfaces to the reactor core, their deposit on the core and their subsequent transport as activated species to the excore plant surfaces is a complex process which is still very much under study. A filter of suitable size and design can remove the non-activated crud particulates before they deposit in the neutron flux region and can remove already activated particulates before they can deposit on the excore surfaces. Both of these effects are important in terms of reducing overall plant sources by filtration. Whether or not a significant reduction in overall radiation dose expenditure to PWR plant personnel can be achieved through filtration depends on several factors: (1) The filterable radionuclides must contribute substantially to the exposures. (2) The ultimate disposal of the collected residues must not itself increase the total exposures. (3) The filtration system must not add appreciably to the maintenance of contaminated components. A model of crud transport and deposition for PWR plants has been used to predict reductions in plant radiation source levels due to filtration ranging from 2 to 4 depending on assumptions. The filtration flowrate considered in this case was 0.5% of the total core flowrate. It was assumed in these calculations that all the conditions represented by the above factors would be met. The conclusion to be drawn from the experience and analyses to date is that hot filtration of PWR primary coolant is a very promising technique for radiation exposure reduction and should be subjected to a realistic prototype demonstration. (Auth)(JMF)

This paper is only an abstract of the actual paper which is to be published later.

DECONTAMINATION; EXPOSURE, OCCUPATIONAL; REACTORS, PWR; MAINTENANCE; CORROSION; ISOTOPES; RADIOACTIVITY; MINERALS; RADIATION HAZARDS; RADIONUCLIDES; WASHING; PARTICLES; NEUTRONS; ACTIVATION PRODUCTS; FILTRATION; FIELD STUDIES; DESIGN

458
Tusch, N.N.

Apparatus and Method for Removing or Changing a Nuclear Power Station Reactor. British Patent 1,429,685/B/; 4 pp. (1976, March)

A method whereby the nuclear reactor in a power reactor station may be removed for disposal or replacement is described. Erection of a nuclear power station is usually beside the sea or a river, and in the system described it is arranged that the reactor can be water-borne. A channel leads into the reactor building along which the reactor may be floated into or away from its operating position. Means are provided for isolating the channel and for emptying the water therefrom. The reactor may be housed within a floatable hull that can also act as the biological shield. All the necessary pipework, such as for the heat exchange fluid and for fission product sampling and monitoring, may be provided within the hull, terminating either internally or externally in such manner that connections may be made directly with the pipework of the building. The hull is adapted so that the fuel element charging-/discharging machine is readily accessible to the fuel element channels. Transporting a reactor complete with its biological shield directly into its working position, connecting it to the pipework of the reactor building, and loading it with fuel is thus possible. If desired the hull may be provided with rooms that may be utilized for the siting of ancillary equipment, and chambers may be provided for storage of spent or new fuel elements. The hull may also be sealed for disposal purposes and towed away.

REACTORS, POWER; REACTOR DISMANTLING; MAINTENANCE; REACTORS; RIVERS; REACTORS, TRANSPORTABLE

459

Zimmerman, J.B., and V.C. Armstrong Canada Centre for Mineral and Energy Technology, Mineral Sciences Laboratories, Ottawa, Canada

The Determination of Radium-226 in Uranium Ores and Mill Products by Alpha Energy Spectrometry. CANMET Report 76-11; 27 pp. (1975, December)

A reliable routine procedure for determining Ra 226 by alpha energy spectrometry is described. Radium is isolated as sulfate from the sample matrix by co-precipitation with a small mass of barium and analyzed using a ruggedized silicon surface barrier detector. The method is capable of providing high accuracy over a large Ra 226 concentration range and is applicable to materials such as uranium ores, uranium mill products and effluent streams. Samples resulting from nitric acid leach experiments with Elliot Lake ores were examined using the procedure. The distribution of Ra 223, Ra 224 and Ra 226 between the leach products, (residue and leach liquor), is discussed. (Auth)

RADIUM 226; URANIUM; ORES; MILLING; SPECTROSCOPY, ALPHA; SULFATES; BARIUM; SEPARATION PROCESSES; PRECIPITATION, CHEMICAL; RADIUM 223; RADIUM 224; CHEMICAL ANALYSIS

FACILITY DECOMMISSIONING

ECONOMIC STUDIES

460

AECL Assesses the Cost of Decommissioning. Nuclear Engineering International 22(258):27-28. (1977, June)

Atomic Energy Canada has just published a report describing the measures, expense and possible environmental effects of scrapping obsolete nuclear reactors. According to the report, decommissioning can be conducted with prevailing technology and the construction and operation of nuclear reactors will not present an unmanageable legacy in the future. Mothballing, encasement and dismantling are the three decommissioning stages discussed.

DECOMMISSIONING; COSTS; REACTORS; ENVIRONMENTAL EFFECTS

461

Costing of Nuclear Power. Important for the Future 11(2):9-11. (1977, April)

No generally accepted method for costing nuclear power has been agreed upon. Nuclear power stations also have certain cost items that do not exist for other types of power generation and should not be forgotten in a comparison of nuclear generating costs with non-nuclear generating costs. Therefore, 10 cost items that are higher in the case of nuclear power stations or do not exist in the case of non-nuclear power generation stations are discussed briefly. Some of these cost factors are not always included in nuclear power costs because such costs are borne by governments. The cost items discussed are: capital cost, repair and maintenance, capacity factor, the cost of long construction periods, insurance, land cost, disposal of radioactive wastes, dismantling nuclear power stations, protection, and training. (MCW)

EVALUATION; CONSTRUCTION; COSTS; ECONOMICS; EDUCATION; GOVERNMENT POLICIES; LAND USE; MAINTENANCE; NUCLEAR INSURANCE; NUCLEAR POWER; NUCLEAR POWER PLANTS; PERSONNEL; WASTE DISPOSAL; REACTOR DISMANTLING; MAINTENANCE; SECURITY; COSTS

462

Decommissioning of Nuclear Power Plants. Nuclear News 21(14):24. (1978, November)

Results of detailed decommissioning studies were considered by the NRC. The studies cover alternatives and cost estimates for representative nuclear facilities, including a reprocessing plant (Barnwell was used as the model), a pressurized water reactor (Trojan, the model), and a small mixed-oxide fabrication plant (Kerr-McGee, Cimarron, OK). Decommissioning cost estimates run in the range of 5 to 10 percent of original capital costs for a plant. Trojan, for example, a figure of $42 million (in 1978 dollars) was quoted, and this includes the immediate dismantling of all nuclear components and the demolition of uncontained structures. Model studies were conducted by Battelle Pacific Northwest. (FAH)

DECOMMISSIONING; ECONOMICS; COSTS; MODELS; REPROCESSING; TROJAN REACTOR

463

Economic Evaluation of Bids for Nuclear Power Plants. A Guidebook. Technical Reports Series, Vienna, Austria; 183 pp. (1976)

The purpose of the guidebook is to assist an organization responsible for a nuclear power project in evaluating and establishing an economic order of merit among competing bids. An approximate overall time schedule for a first nuclear power plant project is provided. A schematic outline of technical bid evaluation is given. The basic procedure of economic bid evaluation is outlined, e.g. evaluation of the present worth of all cost items of plant capital investment, of the nuclear cycle, of O and M costs (operation and maintenance costs), and of economic corrections. All these cost items are evaluated for the economic life of the plant and corrected for escalation where applicable.

COSTS; EVALUATION; CONSTRUCTION; COST BENEFIT ANALYSIS; DECOMMISSIONING; ECONOMICS; FUEL CYCLES; MAINTENANCE; PROCEDURES; DOCUMENTATION; NUCLEAR INDUSTRY; NUCLEAR POWER PLANTS; REACTOR OPERATION; PERSONNEL; RECOMMENDATIONS

464
Nuclear Plants - WPPSS Reactor No. 1; Fermi Decommissioning. Atomic Energy Clearing House 18(49):1. (1972, December 4)

Washington Public Supply System negotiated a contract to construct a N-power generating unit and initial core loading for plant to be located at Hanford, Washington. Contract calls for expenditure of over $50 million. The unit, WPPSS reactor Project No. 1, will provide 1200 MWe and is expected to be in operation by 1980. The Power Reactor Development Co. reported its decision to decommission the Enrico Fermi LMFBR reactor. Lack of assured funding for further R and Associated with the installation of a more advanced fuel was given as the reason.

ECONOMICS; ENRICO FERMI REACTOR; DECOMMISSIONING; CONSTRUCTION; NUCLEAR INDUSTRY; NUCLEAR POWER PLANTS; UTILITIES

465
Special Reports: West Valley. NYSERDA Review 4(1): 1-7. (1978, July)

Technical feature: the nuclear fuel reprocessing plant at West Valley, N.Y., was shut down in 1972. Intense public concern about the future of the plant site and facilities, and the nuclear wastes contained at the site has arisen. Nuclear Fuel Services, Inc., operated the plant for six years, during which time federal regulations on reprocessing changed greatly. The costs of expansion rose from $15 million to $600 million from 1970-76; in 1976, NFS informed NRC that it was no longer commercially practicable to remain in business. At least 15 studies of specific problems at West Valley are complete or in progress. In 1975, slightly increased levels of radioactivity were found in water samples from a monitoring station north of the burial trenches. Action has been taken to prevent further leakage. (2 maps, 3 photos)

NUCLEAR POWER; NUCLEAR FACILITIES; NUCLEAR POWER PLANTS; DECOMMISSIONING; REPROCESSING; WASTE DISPOSAL; WASTE STORAGE; DECONTAMINATION

466
Bardtenschlager, R., D. Bottger, A. Gasch, and N. Majohr Nuklear-Ingenieur Service G.m.b.H., Frankfurt am Main, German Federal Republic

Decommissioning of Light-Water Reactor Nuclear Power Plants. Nuclear Engineering and Design 45(1):1-51. (1978, January)

This study deals with the technical and economical questions posed by the decommissioning of light-water reactor nuclear power plants of the 900-1300 MW class, account being taken of the distinctions between boiling- and pressurized-water reactors. Possible decommissioning alternatives and the disposal or confinement of activity are discussed. It emerges from the discussion that decommissioning, and even total dismantlement of these nuclear power plants is in principle feasible. The activity inventory, one year after shutdown, is calculated to be about 3 x 10(E+7) Ci for the BWR and 4 x 10(E+6) Ci for the PWR; 40 years after shutdown these figures are reduced to 2 x 10(E+6) and 4 x 10(E+5) Ci, respectively. The decommissioning costs to be expected are also estimated. This estimate serves as the basis for an economic comparison by the present worth method. The economic comparison shows that total dismantlement after a cooling time of one year is more than four times as expensive as interim confinement followed by total dismantlement waiting period of 40 years. The present worths for immediate total dismantlement are estimated at DM 200 million for the BWR and DM 170 million for the PWR; for the other alternative, they are put at DM 45 million for the BWR and DM 42 million for the PWR. A still open question is posed by the final storage of the large quantities of bulky radioactive waste arising in partial or total dismantlement. Since no decision on the storage method has yet been taken, disposal in casks is stipulated as a boundary condition in the estimation of the costs, although this is an unrealistic assumption. It is to be presumed that the costs of disposal can be reduced given appropriate final storage.

AFTER-HEAT; REACTORS, BWR; CONTAMINATION; COSTS; DOSE RATE; ECONOMICS; NEUTRON FLUX; NUCLEAR POWER PLANTS; PRESSURE VESSELS; REACTORS, PWR; RADIATION MONITORING; WASTE STORAGE; RADIOACTIVITY; REACTOR DECOMMISSIONING; REACTOR DISMANTLING; REACTOR SHUTDOWN

467
Collins, P.A.

Financing and Accounting Alternatives for the Recovery of Nuclear Plant Decommissioning Costs. CONF-790923; Decontamination and Decommissioning of Nuclear Facilities, Proceedings of a Conference, Sun Valley, ID, September 16-20, 1979. Session V-B, (p. 10), 90 pp. (CONF-790923). (1979)

This paper examines and compares the effects of three principle methods of financing decommissioning costs - funding at plant commission, funding the accruals of a decommissioning reserve, and funding at decommissioning - on certain balance sheet and operating accounts including the revenue requirement. It also considers the effect of present tax laws including normalization and flow-through accounting procedures, the effect of taxes on the annual accruals, and the effect of various rates of return of a fund and capital in relation to a given inflation rate. (AUTH)(JMF)

This paper is only an abstract of the actual paper which is to be published later.

DECOMMISSIONING; COSTS; ECONOMICS; NUCLEAR FACILITIES

468
Dangelmaier, P., and R. (Ed.) Lukes Muenster University, Institut fuer Arbeits- und Wirtschaftsrecht, Muenster, German Federal Republic

Economical Problems in Connection with the Decommissioning of Nuclear Facilities. 5th German Symposium on Atomic Law, Muenster, German Federal Republic, December 8, 1976 (pp. 133-139). (1977)

Discussed are: basic questions of financing, to bring in the decommissioning costs with reference to the various types of enterprises, questions of taxes, use of the accumulated liquid means, the economy of nuclear facilities taking into account the decommissioning expenses.

COSTS; ECONOMICS; NUCLEAR POWER PLANTS; REACTOR DECOMMISSIONING

469
Faust, G.R.

Positive Rationale for Negative Net Salvage. Public Utilities Fortnightly 98(3):25-29. (1976, July 29)

The author believes the most satisfactory method of dealing with the net salvage problem is to establish a separate net salvage reserve and adjust the annual accruals to it to reflect current price levels. This will not necessarily improve the forecasting techniques either for life estimates or net salvage estimates, except that it may cause more serious consideration of terminal retirement tasks and obligations. However, the net salvage reserve will be more readily controllable, while at the same time the depreciation reserve at any date will directly reflect the actual amount of invested capital recovered to that date. When, inevitably, the net salvage reserve must be adjusted for overestimates or underestimates of gross salvage or cost of removal, or of both, the adjustment amount can be more readily identified. If the reserve is properly administered and kept current in respect to future requirements at regular intervals, ratepayers should be affected minimally.

DECOMMISSIONING; ECONOMICS; POWER PLANTS; UTILITIES; COSTS; DISPLACEMENT

470
Federal Power Commission

FPC Allows R and D Costs as Operating Expense. Atomic Energy Clearing House 15(1):2-4. (1969, January 6)

Reviews FPC and NSP statements regarding treating as operating expense costs from reasonable R and D. Case in point was $9,525,800 loss following termination of Pathfinder. Following September 1967 shutdown to modify failed steam separators and baffles, that would take longer than 1969, NSP decided to convert to 70 MWe using 3 gas-fired boilers to meet summer load peak.

REACTORS, BWR; ECONOMICS; PATHFINDER REACTOR; REACTORS, INTERNAL SUPERHEAT; DECOMMISSIONING

471
Ferguson, J.S.

Salvage is Also Important. Public Utilities Fortnightly 102(3):19-24. (1978, August 3)

The author stresses the salvage aspect of utility property depreciation accounting, seeing indications that it may have been unduly neglected for some time now as a factor in the determination of depreciation rates for recovery of capital invested in utility property. His comments are pertinent to the decommissioning costs of nuclear power plants and the removal costs of offshore pipeline and gas distribution systems. His discussion concludes with a set of guidelines by depreciation analysts. The guidelines stress the need to allow sufficient time for analysis of data as it applies to the current situation.

COSTS; ECONOMICS; HAZARDOUS MATERIALS; MATERIALS RECOVERY; OFFSHORE PLATFORMS; PIPELINES; UTILITIES; SCRAP; WASTE MANAGEMENT

472
Ferguson, J.S. Middle West Service Company

A Case for Funding Nuclear Plant Decommissioning Cost. Power Engineering 82(12):53-56. (1978, December)

Decommissioning alternatives include initial mothballing with removal after a cooldown period, initial entombment with removal after a cooldown period, and prompt removal at the end of operating life. The last alternative, with funding of the cost during the life of the plant, would provide the greatest benefit to all concerned. Financial considerations result in a strong case for funding nuclear decommissioning cost; but successfully doing so will require enabling income tax regulations and, probably, legislation. (EWH)

DECOMMISSIONING; COSTS; ECONOMICS

473
Ferguson, J.S. Middle West Service Company, Dallas, TX

Financial Aspects of Power Reactor Decommissioning. CONF-790923; Decontamination and Decommissioning of Nuclear Fa ilities, Proceedings of a Conference, Sun Valley, ID, September 16-20, 1979. Session V-B, (pp. 10-11), 90 pp. (CONF-790923). (1979)

In power reactor decommissioning, the purpose of depreciation expense is to provide full recovery of invested capital, and net salvage to be incurred at the time the facilities are decommissioned, over the expected life of the facilities constructed with that capital from those customers receiving benefits for the facilities. There are three essential aspects to the determination of depreciation rates: the amount of capital to be recovered; the period of time for recovery; and the pattern of recovery. Of concern here is the determination of the amount to be recovered. Perhaps one of the least understood aspects of capital recovery economics is the fact that depreciation accounting practices and regulatory commission rules require that the net salvage to be either received or incurred at the end of life (at the price level at the time) is what must be built into the depreciation accrual rates. Utility financial managers and regulators are concerned about the availability of the funds required for decommissioning when the decommissioning process must occur. The financial managers are concerned because they have a responsibility to provide the funds needed for the expenditures, and regulators because they set rates to customers. The impact of inflation and federal income tax regulations on the magnitude of funds required to be collected from customers is very significant. Any collections from customers to build up a fund to accomplish decommissioning are taxable income to the utilities. The following factors combine to make the capital recovery aspects a significant problem for utility financial managers and regulators: (1) The accounting requirements of capital recovery have evolved over a number of years and are well defined, both in terms of generally accepted accounting practices and regulatory precedent and law. (2) Utility financial managers must provide the cash necessary to accomplish decommissioning, and customers are the source of this cash. (3) Income taxes are a significant component of the revenue requirements evaluated by regulators in setting rates. (4) Engineering economic studies often fail to recognize capital recovery requirements, including income tax. (5) Regulators operate under political constraints that make it difficult for them to respond to increased revenue requirements. (Auth)(JMF)(Complete Text)

DECOMMISSIONING; NUCLEAR FACILITIES; REACTORS; COSTS; ECONOMICS

474
Garrett, P. Atomic Industrial Forum, Washington, DC

Nuclear Power Reactor Decommissioning. Chemtech 8(5):297-301. (1978, May)

Technical report: an Atomic Industrial Forum report on the costs, environmental radiation exposures and generic environmental effects of nuclear power reactor decommissioning is summarized. Initial costs for the three major decommissioning alternatives: mothballing, entombing, and prompt removal dismantlingre estimated for the PWR, BWR, and HTGR types.

For mothballing and entombing, the termination of a possession-only license would take from 51,350-505,000 yr, depending on the reactor type. Costs for the combination mothballing-delayed removal/dismantling alternative and for the entombing-delayed removal/dismantling alternative are estimated. Of these five alternatives, either of the two combination alternatives would be the most cost-effective means of terminating a possession-only license. Occupational radiation doses, airborne radiation doses, and generic environmental effects are also predicted for each type of decommissioning scheme. (3 tables)

NUCLEAR POWER; NUCLEAR POWER PLANTS; DECOMMISSIONING; REACTORS; ECONOMICS; COSTS; RADIATION DOSE; DECONTAMINATION; EXPOSURE, OCCUPATIONAL; REACTORS, BWR; REACTORS, PWR; REACTORS, HTGR

475

Goodarzi, L.A., L.D. Kenworthy, M.E. Lapides, and C.A. Negin

Planning Study and Economic Feasibility for Extended Life Operation of Light Water Reactor PLants. CONF-790923; Decontamination and Decommissioning of Nuclear Facilities, Proceedings of a Conference, Sun Valley, ID, September 16-20, 1979. Session IV-A, (pp. 12-13), 90 pp. (CONF-790923). (1979)

A planning study, in the areas of economics, equipment refurbishment, licensing, regulations /codes, and current R and D, on the subject of operation of LWR7s beyond their original operating license was conducted for purposes of identifying potential R and D for EPRI. Case studies were conducted with a straightforward economic model formulated for this purpose. The cases compared the economics of extending operational life with that of decommissioning at the end of the original operation license and replacement-of-capacity costs for the extension period. A generic case was conducted as well as specific cases for San Onofre 1 and Connecticut Yankee. The form of the results is the amount of money which could be invested in refurbishment for extended life that would break even with replacement. Sensitivities to the extended life duration, refurbishment outage time, decommissioning cost and other factors were evaluated. The equipment in a LWR was sorted into the following categories: (1) assumed unlimited service life, (2) highly probable extended service life, (3) extended life requires justification, (4) infrequent replacement, and (5) routinely repaired and replaced. Observations, precedents and general comments were noted. This used to support R and D recommendations by identifying critical items with regard to difficulty of replacement or safety justification. The schedular dependencies between utility generation planning and approval for extending an operating license are presented. An institutional problem is identified relative to decisional lead times and regulatory requirements to demonstrate the safety of extended operation. A review was conducted of Sections III and XI of the BPV Code, 10CFR50, 10CFR51, 10CFR100, and decommissioning rulemaking with respect applicability to life extension. A review was conducted of current R and D by EPRI, DOE and NRC with respect to applicability to life extension. In addition to results of the above topics, candidate R and D topics will be identified and the status of EPRI program discussed. (Auth)(JMF)

This paper is only an abstract of the actual paper which is to be published later.

DECOMMISSIONING; COSTS; REACTORS, LIGHT-WATER; REGULATIONS, FEDERAL; STANDARDS, FEDERAL; ECONOMICS; EQUIPMENT

476

Grant, C., J.C. Hite, and H.G. Shealy

Economic Analysis of Funding Arrangements for Maintenance, Surveillance, and Contingency Costs Associated with Burial of Low-Level Radioactive Waste in South Carolina. Clemson, So. Car. Agr. Exp. Sta. AE379. (1974)

This study was commissioned by the South Carolina State Department of Health and Environmental Control to re-examine the funding arrangements for meeting the state's obligation relative to maintenance, surveillance and contingency costs associated with the operation of a burial site for low-level radioactive waste. The site for such burial facility is in Barnwell County adjacent to the Atomic Energy Commission's Savannah River Plant and the Allied-General Nuclear Services' facility. Two major problems posed for consideration in the study: 1) what should be the charge per cubic foot of radioactive materials to assure that the sinking fund will, in perpetuity, adequately finance all routine and contingency costs associated with managing the Barnwell site so as to pose no threat to man or his environment, and 2) what funding arrangements are needed to protect the State of South Carolina in the event the license ceases operations before the expected decommissioning date.

WASTE DISPOSAL; ECONOMICS; ENVIRONMENT; COSTS

477
Gulf United Nuclear Fuels Corporation, Elsmford, NY

Preliminary Report on Light Water Reactor Decommissioning Costs. GU-5295:69 pp. (1973, January)

Cost estimates have been prepared for decommissioning of a 1100-MWe PWR nuclear power plant and a 1100-MWe BWR nuclear power plant. For both reactor types, complete removal and in-place entombment were considered. The estimates are based on costs incurred during decommissioning of the Bonus and Elk River reactors. The Bonus reactor was a 50-mwt plant located in Punta Higuera, Puerto Rico. It was decommissioned using an entombment concept following cessation of power operations in July 1967. The Elk River reactor was a 58-Mwt indirect cycle BWR plant located in Elk River, Minnesota.

BONUS REACTOR; ECONOMICS; DECOMMISSIONING; REVIEWS; OPERATING EXPERIENCE; ELK RIVER REACTOR

478
Harwood, S., K. May, M. Resnikoff, B. Schlenger, and P. Tames State University of New York, Buffalo, NY

Cost of Turning It Off. Environment 18(10):17-20, 25-26. (1976, December)

The cost of nuclear power must include the as-yet-uncalculated cost of dismantling a commercial power plant. New calculations show that hazardous levels of radioactive nickel will continue for as much as a million years after a power plant ceases to operate. Attention has been concentrated on waste disposal, overlooking disposal of the activation products such as steel and concrete structures. So far only eight small plants have been shut down, but these show considerable variation in the buildup of activation products depending on the number of megawatt-years the reactor was exposed. Commercial reactors with greater amounts of stainless steel and core structure can be expected to develop larger proportions of activation products. Three methods are proposed for shutting down reactors, all of which require removing radioactive wastes: (1) mothballing, which would make the total facility inoperable and would require expensive security measures; (2) entombment, which would remove all external parts to a federal respository or place them inside the vessel, would require minimal security; and (3) dismantling, the only safe method, would be dangerous and expensive, but would shift all radioactive materials to permanent and appropriate burial sites. 6 references. (DCK)

COBALT 60; CONCRETES; ECONOMICS; ENVIRONMENTAL EFFECTS; IRON 55; NICKEL 59; NICKEL 63; NUCLEAR POWER PLANTS; RADIATION HAZARDS; RADIOACTIVITY; REACTOR DECOMMISSIONING; REACTOR SAFETY; SAFEGUARDS; SAFETY; SECURITY; STEELS; WASTE DISPOSAL; ACTIVATION PRODUCTS; HALF-LIFE, RADIOLOGICAL; PIQUA NUCLEAR POWER FACILITY

479
Jersey Central Power and Light Company

Response to Question F19 - Decommissioning. DOCKET 50219-220; Amendment 2 to Oyster Creek Environmental Report, (p. F19-1). (1972, November 17)

Decommissioning cost is estimated at a low of $4,635,000 to a high of $25,215,000, depending upon AEC regulations in force at the time of plant retirement. Details of cost estimates are shown in tables F19-1 F19-2.

REACTORS, BWR; ECONOMICS; OYSTER CREEK-1 REACTOR; DECOMMISSIONING

480
Konzek, G.J.

Optimization of Costs Versus Radiation Exposures in Decommissioning. CONF-790923; Decontamination and Decommissioning of Nuclear Facilities, Proceedings of a Conference, Sun Valley, ID, September 16-20, 1979. Session V-B, (pp. 6-8), 90 pp. (CONF-790923). (1979)

Consistent application of considerations, perspectives, alternatives and opinions will lead to reductions in man-rem exposure as well as in costs of decommissioning. For each decommissioning activity, early attention must be given to the current and applicable technology, procedures and equipment that will make the activity easier, safer, and less costly, yet will not adversely impact conformance to the concept of maintaining radiation exposures as low as reasonably achievable (ALARA). Information should be sought from the radiation workers themselves and early establishment of two-way lines of communication between the workers and the decommissioning planner is an essential ingredient to optimization. There is no surefire formula to guarantee reduction in occupational radiation exposures in every instance. Case-by-case and often in-the-field analysis is the norm. Unfortunately, each of the three standbys for accomplishing reductions in occupational radiation exposure - distance, shielding, and time - has its price. The delicate balance of these three, together with consideration of economic constraints generally results in an optimization of costs versus radiation exposure for each decommissioning activity on a microscopic time frame. The principal areas for improvement in the optimization of costs versus occupational radiation exposure appear to be in the development of remote handling equipment, to reduce personnel exposure. Other broad areas include: (1) Initial design alternatives for improving the safety and facilitation of decommissioning. (2) Secondary design changes/modifications of operating facilities. (3) Constant application of and adherence to ALARA concepts whenever and wherever practicable. (Auth)(JMF)

This paper is only an abstract of the actual paper which is to be published later.

DECOMMISSIONING; NUCLEAR FACILITIES; EXPOSURE, OCCUPATIONAL; COSTS; EQUIPMENT; RADIATION HAZARDS; BURIAL; COST BENEFIT ANALYSIS

481
MacDonald, R.R.

Evaluating Decommissioning Costs of Nuclear Power Plants. CONF-790923; Decontamination and Decommissioning of Nuclear Facilities, Proceedings of a Conference, Sun Valley, ID, September 16-20, 1979. Session V-B, (pp. 1-6) 90 pp. (CONF-790923). (1979)

The economic aspects of decommissioning large nuclear power plants depends on the decommissioning approach selected which, in turn, relies on surveying the work already done while keeping in mind the objectives of minimizing personnel exposure and minimizing cost. Decommissioning alternatives offer viable "interim" solutions at the time of decommissioning. The alternatives offer a wide range of levels of isolation, decontamination, or removal of components or structures within the four options (mothballing, in-place entombment, removal of radioactive components and dismantling, conversion to a new nuclear system or a fossil fuel system) given in the NRC Regulatory Guide 1.86–"Termination of Operating Licenses for Nuclear Reactors". Selecting the appropriate decommissioning approach for a particular plant must be based on a balanced evaluation of personnel exposure (ALARA), safety, environmental impacts, regulatory requirements, land value or potential reuse of the site, level of decommissioning experience, unique utility/site requirements, technological feasibility, and economic analyses. Decommissioning plans should be developed in sufficient detail to enable (a) verification of the technological feasibility of decommissioning the plant, (b) order of magnitude assessment of the costs involved for financial planning, (c) establishment of appropriate development programs, (d) evaluation of potential plant design modifications to facilitate decommissioning. Studies and cost estimates should include consideration of planning, licensing, quality assurance, project management and administration, decontamination, health physics, dismantling and demolition, waste management and disposal, environmental controls, industrial safety, personnel exposure, security, labor productivity effects, and site restoration or redevelopment alternatives. Along with these design provisions for future decommissioning may be thought out. The three primary areas in design provisions which hold the greatest interest are layout, system and equipment design, and structural design. The objectives of a proposed modification should be to minimize personnel exposure, or simplify equipment removal and structural demolition. In this regard, one important conclusion might reasonably be drawn from the work that has been done to date: most measures taken to reduce operation personnel exposure, simplify construction, and facilitate operation of the plant are likely to have a favorable effect on decommissioning costs. (Auth)(JMF)

This paper is only an abstract of the actual paper which is to be published later.

DECOMMISSIONING; DECONTAMINATION; WASHING; NUCLEAR FACILITIES; REACTORS; EXPOSURE, OCCUPATIONAL; STANDARDS, FEDERAL; REGULATIONS, FEDERAL;

COSTS; RADIATION HAZARDS; ENVIRONMENT; LAND USE; ECONOMICS; DESIGN; EQUIPMENT

482
Massachusetts Energy Policy Office

The Economics of Nuclear Power: A New England Perspective. Report; 59 pp. (1975, December)

Special report: the costs of future baseload electricity generation facilities in New England powered by coal, oil, and nuclear energy are compared. The costs of baseload electricity generating facilities from any energy source in the 1980's will be substantially higher than ever before, and construction at the projected rate will divert inordinate amounts of capital from other sectors. Public policy must discourage growth in electricity demand and promote more efficient and reliable electrical systems. Economically, a nuclear moratorium is not good public policy. Capital, operating, and maintenance costs for all three energy sources are presented, and power plant size vs. reliability is considered. The long-term uranium supply and fuel processing outlook is also discussed. (2 diagrams, 2 graphs, 38 references, 5 tables)

NUCLEAR POWER; ECONOMICS; NUCLEAR POWER; ELECTRICITY BLACKOUTS; NUCLEAR POWER PLANTS; DECOMMISSIONING; COSTS; NUCLEAR MORATORIUM; COAL; PETROLEUM

483
McLeod, N.B. NUS Corporation, Rockville, MD

Methods of Power Reactor Decommissioning Cost Recovery. CONF-790923; Decontamination and Decommissioning of Nuclear Facilities, Proceedings of a Conference, Sun Valley, ID, September 16-20, 1979. Session V-B, (pp. 11-13), 90 pp. (CONF-790923). (1979)

The purpose of this paper is: to describe the various factors which must be accommodated including federal income taxes, accounting practices, and rate-regulatory factors; to analyze alternative interim use of accumulated funds; to examine alternative approaches for cost recovery; and to examine one particular alternative that appears to have unique features. A related purpose of the paper is to put decommissioning cost into perspective, as an element of the total cost of nuclear electricity. Finally, parallels are drawn between decommissioning cost recovery and spent fuel disposal cost recovery. Under present federal income tax laws, the revenues received for future decommissioning do not have an offsetting deductible expense and are therefore fully taxable as income in the year received. However, when decommissioning occurs, the costs are fully deductible. The principal regulatory constraints are straightforward: that sufficient funds must be collected to pay for decommissioning when it occurs; and that the method of collection should be equitable to all ratepayers, whether they be earlier or later users of the facility's energy. The various methods of cost recovery can be grouped in accordance with their variation with time and the manner in which they accommodate inflation. At one end of the spectrum is the recovery of end-of-life inflated cost in equal annual amounts. This favors later users of the facility. At the other end of the spectrum is the collection of the remaining current-dollar cost over the remaining years of useful life. This favors the earlier users of the facility. Intermediate to these is the "ideal" case in which net revenues are increased each year at the rate of inflation. A practical method which approaches the latter "most-equitable" method is to make the annual charge the sum of two components: one component equals the amount needed to upgrade the accumulated funds from year-ago dollars to current dollars; and the other component is the prorata share (over the remaining years) of the current-dollar cost. Current plant-specific estimates of decommissioning costs indicate that they are 15 to 20% of total plant investment in year-of-startup dollars. Nonetheless, it is shown that decommissioning costs add only about one part in twenty to the equivalent fixed charge rate in year-of-startup dollars or one part in ten in levelized dollars. The cost recovery approach recommended for decommissioning would have similar advantages if applied to spent fuel cost recovery as well. (Auth)(JMF)

This paper is only an abstract of the actual paper which is to be published later.

DECOMMISSIONING; NUCLEAR FACILITIES; WASTE DISPOSAL; COSTS; EQUIPMENT; REACTORS; REGULATIONS, FEDERAL

484
McLeod, N.B., and Y.M. Park NUS Corporation, Rockville, MD

Methods of Power Reactor Decommissioning Cost Recovery. 14 pp.

The method and cost of decommissioning and the manner in which anticipated costs will be collected during the facilities useful life and used on an interim basis prior to being paid out during decommissioning are basic elements which govern the decommissioning revenues received from ratepayers. Rate-regulatory factors, income taxes, accounting practices, alternative interim use of accumulated funds, and alternative approaches for cost recovery must be considered in revenue management for decommissioning. The basic impact of income taxation is that it reduces the funds available for interim use to about one-half of what they would be otherwise. Not surprisingly, taxation thereby increases the net cost of decommissioning by so reducing the interim earning power of accumulated revenues. In depreciation of electric utility capital investment, the difference between original cost and net salvage value over the useful life of the plant is collected. The accumulated depreciation accounts are subtracted from the original cost accounts to obtain the rate base. This practice is being used to accommodate nuclear plant decommissioning cost recovery by simply treating decommissioning cost as a negative net salvage value. In these circumstances decommissioning cost recovery is accomplished by basing the depreciation rate 115% or 120% of original cost, of which the 15% or 20% excess represents the depreciation cost expressed relative to original plant cost. Because this approach is both logical and compatible with existing accounting practice, it seems to have been widely adopted. One of the principal challenges that must be met by any cost recovery appraoch is to accommodate inflation, and the principal differences between various cost recovery approaches are due to the different ways in which they accommodate inflation. In general, the approaches can be categorized according to the extent to which they 1) favor early ratepayers/users of the facility or 2) favor later ratepayers/users. The basic alternatives for decommissioning cost recovery are: (1) Annual Charge equals Remaining Inflated (End Point) Cost divided by Remaining Years. (2) Annual Charge equals Remaining Current-Dollar Cost divided by Remaining Years. (3) Annual Charge equals (previous year's inflation rate) times (accum. funds) plus Remaining Current-Dollar Cost divided by Remaining Years. In summary, the Alternative 3 cost recovery approach is strongly recommended on the basis of its advantages: (1) It provides the most equitable treatment of both earlier and later ratepayers. (2) It results in an annual charge that escalates approximately as the rate of inflation. (4) It does not require any prediction of future inflation, and relies only on current and past costs. (5) It is compatible with existing accounting practice and in fact corrects for an inflation-induced deficiency in typical current approaches. In conclusion, the internal use of accumulated decommissioning funds is strongly recommended because it results in the lowest net ratepayer cost of decommissioning; and, the most equitable decommissioning cost recovery method is based on current costs and on the prompt and continuous maintenance of the purchasing power of accumulated funds. (Auth)(JMF)

The document contains figures and tables of certain economic aspects of decommissioning.

DECOMMISSIONING; COSTS; ECONOMICS; NUCLEAR FACILITIES

485
Metz, W.

Nuclear Goes Broke. New Republic 178(8):23-25. (1978, February 25)

Feature article: the problems associated with nuclear power, once thought to be the panacea for energy shortages, are discussed. All life signs associated with nuclear power appear weak, and little or no effort to revive them is being evidenced. Nuclear power, intended to be the cheap power of the future, has become the expensive, unrealizable power of the present. The constant need for safety assurances and licensing, the time required for construction, and the huge costs needed to build nuclear plants are reasons why the government-industry partnership has been disintegrating. Cancellations have outnumbered orders since 1975, and there has been a stampede to defer previously planned plants.

NUCLEAR POWER; ECONOMICS; NUCLEAR POWER; REACTOR SAFETY; NUCLEAR POWER PLANTS; CONSTRUCTION; DECOMMISSIONING

486
Mingst, B.C. U.S. Nuclear Regulatory Commission, Office of Nuclear Material Safety and Safeguards, Washington, DC

DECOST-Computer Routine for Decommissioning Cost and Funding Analysis. NUREG-0514; 80 pp. (1979, December)

The DECOST program is a flexible model designed to calculate the costs of and evaluate the payments for decommissioning nuclear facilities, including post-decommissioning costs, under varying economic and planning conditions. The program will currently work for boiling-water reactors, pressurized-water reactors, high-temperature gas-cooled reactors, and low-level waste disposal sites. The decrease in costs over a period of time caused by radioactive decay is included in the model. In this version of DECOST, there are five possible modes of decommissioning power reactors: immediate dismantling, indefinite mothballing, indefinite entombment, mothballing followed by delayed dismantling, and entombment followed by delayed dismantling. There are four possible modes of decommissioning low-level waste sites: no expected trench cap work or water management, periodic trench cap reworking, trench water management, and both trench cap rework and trench water management. All modes of low-level waste disposal site decommissioning include surveillance, monitoring, and minor maintenance of the site. In this version of DECOST there are seven possible methods of funding the decommissioning of the facilities: use of a constant-fee sinking fund; use of an escalating-fee sinking fund; use of a deposit to cover the costs at the expected end-of-life; use of a deposit to cover the decommissioning costs at the time of the deposit; use of the previous method but with net earnings returned to the utility; use of straight-line, negative salvage value depreciation of the facility; and use of adjusted straight-line, negative salvage value depreciation of the facility. (RAF)

COMPUTER PROGRAMS; DECOMMISSIONING; COSTS; NUCLEAR FACILITIES; MODELS, MATHEMATICAL; ECONOMICS; CALCULATIONS; REACTORS, BWR; REACTORS, PWR; REACTORS, HTGR; WASTES, LOW-LEVEL; DISPOSAL SITE

487
Mingst, B.C.

An Analysis of Decommissioning Costs and Funding. CONF-790923; Decontamination and Decommissioning of Nuclear Facilities, Proceedings of a Conference, Sun Valley, ID, September 16-20, 1979. Session V-B, (pp. 9-10), 90 pp. (CONF-790923). (1979)

In this paper, a parametric study of the major economic parameters that affect the final costs is done to both demonstrate the range of costs and assurance that can be expected when decommissioning a facility, and to determine which of these factors are the most important in determining the final costs of decommissioning. One of the problems with discussing the costs of decommissioning is the tendency to misuse out-of-pocket costs that are not the real cost to customers or costs that only reflect a very specific set of circumstances and to use them as cast-in-concrete costs to customers. The major conclusion of this paper is that the funding method, the inflation rate, and the interest rates so greatly affect the real cost to customers that only a few generalizations can be made. Of the three basic methods of funding studied (sinking funds, deposits, and negative-salvage-value depreciation) the negative-salvage-value depreciation funding method is the most expensive. The tax rate, at least in the range of 0 to 60 percent, does not affect the cost ranking of the funding methods. The tax rate has no effect on the net costs of the negative-salvage-value depreciation funding method. The sinking fund costs are more sensitive to the tax rate than are the deposit funding costs, but do not become more expensive in this tax range. The method of deposit funding has the highest level of assurance that decommissioning costs will be paid at an early or late decommissioning. If the facility is in operation longer than originally planned, the sinking fund provides more assurance than does the depreciation funding method. Surety bonds can be purchased to cover the potential shortages in the sinking fund and depreciation funding methods. Another concern in funding arrangements is the equitability of the funding method used. The sinking fund method and the negative-salvage-value depreciation funding method both are easily adjusted to place an equal burden on all users, or even an unequal burden if that is desired. The out-of-the pocket decommissioning costs are useful when comparing different decommissioning methods or different facilities. But the true cost to the customer is as much a function of the chosen funding method and the existing inflation and interest rates as the out-of-the pocket payments at the time of decommissioning. This study uses a cost project computer program-DECOST (NUREG-0514)-developed for use by the NRC in analyses of costs, assurance, and funding of decommissioning. The factors considered by the program as major parameters are the interest rates, inflation rates, tax rates, funding methods used, decommissioning method used, useful facility lifetime, and the planned delay period for a two-stage decommissioning. (Auth)(JMF)

This paper is only an abstract of the actual paper which is to be published later.

DECOMMISSIONING; COSTS; NUCLEAR FACILITIES; REACTORS; REACTORS, PWR; FUEL CYCLES; FUEL REPROCESSING; WASTE DISPOSAL; WASTES, LOW-LEVEL; BURIAL

488

Saddington, K. United Kingdom Atomic Energy Authority, Windscale and Calder Works, Seascale, Cumbria, United Kingdom

National Policies and their International Aspects - Keynote Speech. IAEA-SM-234/47; Decommissioning of Nuclear Facilities, Proceedings of an International Symposium, Vienna, Austria, November 13-17, 1978. International Atomic Energy Agency, (pp. 3-7), 694 pp. (IAEA-SM-234/47). (1979)

Much work has been done on the technical problems associated with the decommissioning of nuclear facilities. However, the topic raises many problems of a political/legal nature. This paper seeks to identify those areas where such problems arise and points to the role of governments in framing national policies within which decommissioning activities can be carried out. The value of international collaboration is emphasized. (Auth)

NUCLEAR FACILITIES; DECOMMISSIONING; LEGAL ASPECTS; GOVERNMENT POLICIES

489

Schmieder, H. Kernforschungszentrum Karlsruhe, Institut fuer Heisse Chemie, Karlsruhe, German Federal Republic

Waste Removal in Nuclear Engineering. Energy Economics and Technical Aspects. Symposium on Waste Disposal in Nuclear Engineering, Mainz, German Federal Republic, January 19, 1976; Brennstoff-Waerme-Kraft 28(5):212-215. (1976, May)

Report on those papers of the DATF symposium concerning the topics Energy Economics and Technical Aspects.

ECONOMICS; FUEL REPROCESSING PLANTS; MEETINGS; NUCLEAR ENGINEERING; WASTE DISPOSAL; WASTE STORAGE; REACTOR DECOMMISSIONING; REVIEWS; WASTES, RADIOACTIVE; NUCLEAR FACILITIES

490

Schneider, K.J., and C.E. Jenkins Battelle-Pacific Northwest Laboratories, Richland, WA

Analysis of the Decommissioning of a Nuclear Fuel Reprocessing Plant. CONF-780622; American Nuclear Society Annual Meeting, San Diego, CA, June 18, 1978; Transactions of the American Nuclear Society 28:366-367. (1978, June)

FUEL REPROCESSING PLANTS; COSTS; DECOMMISSIONING

491

Schneider, K.J., C.E. Jenkins, R.E. Rhoads, P.J. Pelto, and R.I. Smith Battelle-Pacific Northwest Laboratories, Richland, WA; U.S. Nuclear Regulatory Commission, Division of Engineering Standards, Washington, DC; U.S. ERDA, Washington, DC

Technology, Safety, and Costs of Decommissioning a Reference Nuclear Fuel Reprocessing Plant. Volume 2. Final Technical Report Oct 74-Sep 77. Report; 429 pp. (1977, October)

Safety and cost information were developed for the conceptual decommissioning of a fuel reprocessing plant (FRP) with characteristics similar to the Barnwell Nuclear Fuel Plant. The main process building, spent fuel receiving and storage station, liquid radioactive waste storage tank system, and a conceptual high level waste solidification facility were postulated to be decommissioned in this study. The plant was conceptually decommissioned to three decommissioning modes: layaway, protective storage and dismantlement. Safety analyses and cost evaluations were conducted for each mode. Methods for assuring that the licensee has adequate funds for decommissioning were considered.

REPROCESSING; COSTS; SAFETY; RADIATION HAZARDS; FUEL REPROCESSING PLANTS; DECOMMISSIONING

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Schneider, K.J., C.E. Jenkins, R.E. Rhoads, P.J. Pelto, and R.I. Smith Battelle-Pacific Northwest Laboratories, Richland, WA; U.S. Nuclear Regulatory Commission, Division of Engineering Standards, Washington, DC; U.S. Energy and Research Development Administration, Washington, DC

Technology, Safety, and Costs of Decommissioning a Reference Nuclear Fuel Reprocessing Plant. Volume 1. Final Technical Report Oct 74-Sep 77. Report; 373 pp. (1977, October)

Safety and cost information were developed for the conceptual decommissioning of a fuel reprocessing plant (FRP) with characteristics similar to the Barnwell Nuclear Fuel Plant. The main process building, spent fuel receiving and storage station, liquid radioactive waste storage tank system, and a conceptual high level waste solidification facility were postulated to be decommissioned in this study. The plant was conceptually decommissioned to three decommissioning modes: layaway, protective storage and dismantlement. Safety analyses and cost evaluations were conducted for each mode. Methods for assuring that the licensee has adequate funds for decommissioning were considered.

REPROCESSING; WASTES, RADIOACTIVE; WASTE DISPOSAL; COSTS; DECOMMISSIONING; FUEL REPROCESSING PLANTS

493
Schwent, V.

Reactor Decommissioning: Financing Approaches and Their Cost. CONF-790923; Decontamination and Decommissioning of Nuclear Facilties, Proceedings of a Conference, Sun Valley, Idaho, September 16-20, 1979. Session V-B, (p. 8), 90 pp. (CONF-790923). (1979)

The need to take special measures to ensure that the funds necessary will be available to pay the costs of decommissioning today's power reactors is gaining increasing recognition among utilities and their regulators. A variety of financing schemes are being proposed and adopted. The various financing mechanisms can differ substantially in terms of (1) the manner in which they collect and utilize funds, (2) the extent to which they insure that adequate funds will be available when needed, (3) the equity with which they collect decommissioning monies, and (4) the complete costs of utilizing these mechanisms both to the ratepayers and utilities. Even small variations in a funding scheme can, in some instances, produce large changes in effectiveness, equity or costs. The variety of possible financing mechanisms are characterized and related and a uniform nomenclature provided to describe them. Recent utility, state, and federal actions on proposed and adopted financing schemes are reviewed with information provided on the types of mechanisms considered, the rationale for selection, and estimates of proposed implementation costs. Legislation has been introduced in several states making various requirements on the procedures and methods for decommissioning, the methods of financing decommissioning, and the delegation of regulatory responsibilities for decommissioning. The details and outcome of such recent legislative proposals are discussed. Present comparisons of the costs of financing decommissioning often present seemingly contradictory conclusions as to which basic method of financing is least costly. The future tax treatment of monies collected for decommissioning and earnings paid on these monies may be the most important factor in determining overall cost to the public. Attempts will be made to resolve or clarify some of the real or apparent contradictions in present estimates of financing costs. The effect of favorable tax treatment for decommissioning financing is discussed as well as recent actions or decisions by state or federal agencies relevant to the tax issue. Lastly, most financing proposals are predicated on a reactor operating for its full expected lifetime if sufficient monies are to be accumulated. Possible approaches for covering any "short-fall" in funds resulting from premature reactor shutdown are considered with discussion of recent developments in the implementation of certain of these solutions. (Auth)(JMF)

This paper is only an abstract of the actual paper which is to be published later.

DECOMMISSIONING; COSTS; REACTORS; STANDARDS, STATE

494
Science Applications, Inc., Oak Ridge, TN; U.S. Energy Research and Development Administration

Storage Fee Analysis for a Nuclear Waste Terminal Storage Facility. Final Report. YOWI/SUB-76/16503; 61 pp. (1976, September)

A model was developed for determining a pricing schedule designed to recover federal government costs incurred in the development, design, construction, operation, decommissioning, and surveillance of a federal repository for high-level waste generated by the commercial nuclear power industry. As currently constructed, the model computes current dollar prices on a yearly basis for a single unit charge or a split fee based upon two user-provided quantity flows. Over the period of facility operation, the computed-cost schedule

shows variability on a year-to-year basis only within specified ranges. The model uses as basic input data: cost schedule for the federal repository; quantity flow schedule for each factor to be charged; schedule for escalation rate, discount rate, and interest rate; and fraction of costs to be recovered on each quantity flow if the split-fee option is used. The model allows testing of these variables in order to determine the relative significance of each component with regard to cost to, and impact on, the nuclear power industry. Another feature of the model is its versatility. Not only is the user able to specify the percent of total costs to be covered by each method of fee assessment listed above but also the user can specify a revenue-cost ratio, an option that would prove useful in trying to assess the general uncertainty involved when dealing in the future. In addition, the model accepts either current-dollar or constant-dollar cost measures, and in the case of the latter escalates the costs with user-provided assumptions. (ERA citation 02:041142)

WASTE STORAGE; COMPUTER CODES; ECONOMICS; COSTS

495
Sexton, R.A.

Summary of the Development of a Cost /Risk/Benefit Analysis for Decontamination and Decommissioning of the Hanford Z-Plant. CONF-790923; Decontamination and Decommissioning of Nuclear Facilities, Proceedings of a Conference, Sun Valley, ID, September 16-20, 1979. Session IV-B, (pp. 3-4). 90 pp. (CONF-790923). (1979)

Consideration is being given to removing the Hanford Z-Plant from service and initiating decontamination and decommissioning (D and D). Z-Plant consists of a number of processing, reclamation, waste treatment and storage facilities located on the Hanford Site in eastern Washington. Z-Plant was designed to provide Hanford with the capability of further purifying concentrated plutonium metal, and fabricating it into useful parts. Construction of the facility started in 1948, with production beginning in 1949. Several additions have since been made to the plant. There are a number of alternatives to be considered in the planning of any D and D project. The major questions to be addressed in the Cost/Risk/Benefit Analysis are, to what level of residual contamination should the project be carried, and what combination of D and D methods should be used. The D and D "end point" is the state of the facility at the end of D and D. For the purpose of this analysis, four end-points have been defined in terms of residual radioactive contamination. These end-points are defined as follows: 1. Unrestricted Area - Any area to which access is not controlled for purposes of protection of individuals from exposure to radiation and radioactive material. 2. Conditional (Non-Surveillance) - Any areas to which access is controlled for purposes of protection of individuals from long-term exposure to radiation and radioactive materials, but will not require routine radiological surveillance. 3. Restricted Area (Use) - Any area to which access is controlled for purposes of protection of individuals from short- and long-term radiation and radioactive materials, but will not be a hazard to the general population if a major accident occurs. 4. Restricted Area (Non-Use) - Any area which is isolated for purposes of protection of individuals from exposure to radiation and radioactive material. The study will assess the cost and impact of achieving each of the four end-points throughout the entire facility. However various combinations of end-points throughout the facility will also be evaluated. (Auth)(JMF)

This paper is only an abstract of the actual paper which is to be published later.

DECONTAMINATION; WASHING; DECOMMISSIONING; NUCLEAR FACILITIES; COSTS; WASTE TREATMENT; PLUTONIUM; RESIDUES; CONTAMINATION; EXPOSURE, POPULATION; HAZARD ANALYSIS

496
Shurcliff, A.W. Massachusetts Institute of Technology, Cambridge, MA

Local Economic Impact of Nuclear Power. Technology Review 79(3):40-47, (1977, January)

The local economic impact of nuclear installations is examined and the conclusion reached that much of the subsequent area growth may be coincidental to the facility. Nuclear siting criteria favor proximity to a regional power grid, abundant water for cooling, and extensive vacant land with a major access road. These criteria coincide with the characteristics of commuter suburbs, centers for retirement, and recreation areas. Clustering of nuclear units introduces an extraordinary level of new construction, office requirements, and capital. Economic changes will occur at the start and completion of the construction stage and at the time of decommissioning the facility. Past experiences are detailed in terms of employment, payroll, housing, public services, and procurement. When construction is completed, employment falls to a relatively low level. Proximity to the plant offers no advantage in terms of local power rates. While nuclear facilities do not preclude other development in the area, there are restrictions on access, regulatory agencies may reject absorbing the cost of public use as a business expense in the rate structure, and security measures may constrain public use. There is pressure for tax equalization laws to compensate communities for the loss of potential property tax revenues. Some agencies (e.g., the Tennessee Valley Authority) make in-lieu-of-tax payments, while some plants have produced tax benefits large enough to effect significant public improvements. 8 references. (DCK)

ECONOMICS; NUCLEAR POWER PLANTS; PERSONNEL; SECURITY; SITE PREPARATION; SITE SELECTION; SOCIO-ECONOMIC FACTORS; EMPLOYMENT; EFFLUENTS, THERMAL; SOCIAL ASPECTS

497

Smith, R.I. Battelle-Pacific Northwest Laboratories, Richland, WA

Cost and Occupational Radiation Exposure Estimates for Decommissioning Nuclear Power Plants. CONF-780622; American Nuclear Society Annual Meeting, San Diego, CA, June 18, 1978; Transactions of the American Nuclear Society 28:666-667. (1978, June)

COSTS; NUCLEAR POWER PLANTS; RADIATION DOSE; RADIATION HAZARDS; REACTOR DECOMMISSIONING; REACTOR DISMANTLING

498

Smith, R.I., G.J. Konzek, and W.E. Kennedy, Jr. Battelle-Pacific Northwest Laboratories, Richland, WA

Technology, Safety and Costs of Decommissioning a Reference Pressurized Water Reactor Power Station. NUREG/CR-0130 (Vol. 1 2); 800 pps. (1978, June)

Safety and cost information was developed for the conceptual decommissioning of a large 1175 MWe PWR. Two approaches to decommissioning, immediate dismantlement and safe storage with deferred dismantlement, were studied to obtain comparisons between costs, occupational radiation doses, potential radiation dose to the public, and other safety impacts. The safety impacts of the decommissioning operations on the public were found to be small, compared with those of the operating power station. The principal impact on the public is the radiation dose resulting from the transport of radioactive materials to a disposal site.

REACTORS, PWR; DECOMMISSIONING; ECONOMICS; SAFETY; COSTS; PERSONNEL; EXPOSURE, OCCUPATIONAL; EVALUATION; RADIATION DOSE

499

Smith, R.I., G.J. Konzek, and W.E. Kennedy, Jr. Battelle-Pacific Northwest Labsoratories, Richland, WA

Technology, Safety, and Costs of Decommissioning a Reference Pressurized Water Reactor Power Station. Appendices. Report; 494 pp. (1978, May)

Detailed appendices are presented under the following headings: reference PWR facility description, reference PWR site description, estimates of residual radioactivity, alternative methods for financing decommissioning, radiation dose methodology, generic decommissioning activities, intermediate dismantlement activities, safe storage and deferred dismantlement activities, compilation of unit cost factors, and safety assessment details.

COSTS; RADIATION DOSE; RADIATION HAZARDS; REAC[illegible] DECOMMISSIONING; REACTOR DISM[illegible]NG; SAFETY; REACTORS, PWR; HAZARD ANALYSIS; DOCUMENTATION

500

Southern California Edison Company, Rosemead, CA

Response to Item 3 - Estimated Annual Cost to Maintain the Shutdown Facility. DOCKET 50206-368; Amendment 43 to San Onofre 1 License Application, (1 p.). (1975, March 31)

The estimated annual cost to maintain San Onofre Unit 1, once permanently shut down, in a safe condition is $910,000. This cost represents the annual cost of security personnel escalated to the year 2005 using 8% compound interest. The costs associated with routine maintenance to ensure the physical integrity of the shutdown facility and the annual easement charges are comparatively negligible. The funds necessary to cover this annual cost could be obtained from system-wide operating revenues.

REACTORS, PWR; SAN ONOFRE-1 REACTOR; DECOMMISSIONING; REACTOR SHUTDOWN; COSTS; REACTOR OPERATION; LICENSING

501
Stouky, R.J. NUS Corporation, Rockville, MD

Factors Affecting Power Reactor Decommissioning Costs for Complete Removal. American Nuclear Society Annual Meeting, San Diego, CA, June 18, 1978; Transactions of the American Nuclear Society 28:667-669. (1978, June)

REACTORS, BWR; COSTS; NUCLEAR POWER PLANTS; REACTORS, PWR; RADIATION HAZARDS; REACTOR DECOMMISSIONING; REACTOR DISMANTLING

502
U.S. Congress, House of Representatives

Decommissioning and Decontamination. Committee of Science and Technology, June 15-16, 1977; Hearings of the House of Representatives, 279 pp. (1977)

Hearing transcript: hearings were held to consider the problems of decommissioning and decontaminating nuclear facilities and disposing of nuclear wastes. The waste disposal problems at the Nuclear Fuel Services commercial reprocessing plant at West Valley, NY, which operated from 1966-72, were investigated. Technical and institutional aspects of nuclear waste management and disposal and the costs of management and disposal were discussed. Environmental, health, and safety issues associated with decommissioning nuclear facilities, including reactors, were examined. ERDA, GAO, and NRC officials; representatives of the nuclear industry; nuclear energy consultants; and the chairman of the New York State Energy R and D authority testified. Statements are transcribed. (4 photos, 3 tables)

NUCLEAR POWER; NUCLEAR POWER PLANTS; DECOMMISSIONING; DECONTAMINATION; WASTE DISPOSAL; WASTE STORAGE; REPROCESSING; ECONOMICS; NUCLEAR POWER; DISPOSAL SITE; HEARINGS; RADIATION HAZARDS; HEARINGS

503
U.S. Congress, House of Representatives, Committee on Government Operations, Environment, Energy, and Natural Resources Subcommittee, Washington, DC and Natural Resources Subcommittee.

Nuclear Power Costs. Ninety-Fifth Congress, Second Session. House Report No. 95-1090. PB-282 647 7SL; 156 pp. (1978, April 26)

Contrary to widespread belief, nuclear power is no longer a cheap energy source. In fact, when the still unknown costs of radioactive waste and spent nuclear fuel management, decommissioning and perpetual care are finally included in the rate base, nuclear power may prove to be much more expensive than conventional energy sources such as coal, and may well not be economically competitive with safe, renewable resource energy alternatives such as solar power. Nuclear power is the only energy technology which has a major capitalization cost at the outset of the fuel cycle and at the end of the fuel cycle. As the cost of nuclear energy continues to climb, and as a solution to the problems of radioactive waste management continues to elude government and industry, states such as California are rejecting the increased use of nuclear power and favoring the greater use of renewable energy technologies. These developments and others discussed in this report raise major questions for federal decision-makers about how best to cope with the nation's energy crisis in the years ahead. Practical recommendations aimed at greater economy, efficiency, and effectiveness in government actions are proposed.

ELECTRIC POWER; COSTS; GOVERNMENT POLICIES; WASTE PROCESSING; DECOMMISSIONING; NUCLEAR MATERIALS MANAGEMENT; COAL; ECONOMICS; SAFETY; SOLAR ENERGY; RECOMMENDATIONS

Chapter 2

URANIUM MILL TAILINGS CLEANUP

URANIUM MILL TAILINGS CLEANUP

504
Department of Energy Proposes Remedial Priorities for Tailings. Nuclear News 22(14):107. (1979, November)

The U.S. Department of Energy has proposed priorities for remedial actions to clean up or stabilize mill tailings at 22 inactive uranium processing sites. The sites are among those identified in response to the Uranium Mill Tailings Radiation Control Act of 1978. Sites proposed to have high priority for remedial action are located at or near Salt Lake City, UT; Canonsburg, PA; Shiprock, NM; Riverton, WY; and Durango, Grand Junction, Gunnison, Old Rifle, and New Rifle, CO. Medium-priority sites named are Mexican Hat, UT; Lakeview, OR; Falls City, TX; Tuba City, AZ; Naturita, CO; Ambrosia Lake, NM. Those sites proposed to have low priority are Green River, UT; Slick Rock (two sites) and Maybell, CO; Monument Valley, AZ; Lowman, ID; and Converse County, WY (Spook Site). Specific remedies will be determined on a site-by-site basis, and could range from moving tailings to permanent burial sites to stabilizing them with asphalt-like emulsions. (Complete Text)(RAF)

URANIUM; MILLING; TAILINGS; PRIORITIES; STABILIZATION; DECONTAMINATION

505
Aerial Radiation Survey of Salt Lake City Area Mill Tailings Sites. DOE Information, Weekly Announcements 3(43); 5 pp. (1979, October 23)

A blue-and-white helicopter owned by DOE will fly repeated passes at low levels over Salt Lake City during the period from Oct. 22-31, 1979, to perform an aerial radiation survey of the area. The survey is part of a national program which DOE is conducting to gather information on mill tailings at or near inactive uranium processing sites. Mill tailings, which produce low-level radiation, are the solid wastes left after uranium is removed from ore. The helicopter will fly as low as 150 feet above ground for the environmental monitoring mission, which is being carried out with cooperation of the state of Utah. The survey will cover an area of approximately 25 square miles. The flight will be conducted during daylight hours as weather permits. (Complete Text)

RADIOLOGICAL SURVEYS; URANIUM; MILLS; TAILINGS

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Management, Stabilization and Environment Impact of Uranium Mill Tailings. CONF-780740; Management, Stabilization and Environmental Impact of Uranium Mill Tailings, Proceedings of the NEA Seminar, Albuquerque, NM, July 24-28, 1978, 498 pp. (CONF-780740). (1978, July)

The meeting was intended to provide a forum for an exchange of information about current practices and technologies for stabilizing uranium mill tailings and to examine different aspects of their environmental impact. The discussions covered present and possible future RD programs and the contribution that international agencies could make in co-ordinating such programs and developing guidelines and standards. (RAF)

URANIUM; MILLING; TAILINGS; WASTE MANAGEMENT; ENVIRONMENTAL IMPACTS; STABILIZATION, PHYSICAL; RADIATION HAZARDS; RADIUM; RADON; GOVERNMENT POLICIES; REGULATIONS, INTERNATIONAL

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Borrowman, S.R., and P.T. Brooks Salt Lake City Metallurgy Research Center, Salt Lake City, UT

Radium Removal from Uranium Ores and Mill Tailings. Bureau of Mines Report of Investigations 8099; 12 pp. (1975)

Mill tailings from conventional uranium extraction processes contain nearly all of the radium originally in the ore. Such taiings require controlled storage in perpetuity to safeguard the surrounding environment from radioactive contamination. Alternatives to controlled storage of the tailings are (1) removal of the radium from the tailings for separate storage or use or (2) removal of the radium when processing the uranium ore. In laboratory tests conducted by the Federal Bureau of Mines, radium was leached from tailings using either hydrochloric acid or ethylenediamine tetraacetic acid. A hydrochloric acid leaching method was used to extract both radium and uranium from the ore to yield tailings containing less radium than those produced by either conventional sulfuric acid or alkaline leaching processes. From 77 to 94 percent of the radium in mill tailings was concentrated by sedimentation in slime fractions representing nearly 25 weight-percent of the original sample. Although a maximum permissible concentration of Ra in mill tailings allowing unrestricted usage has not been set, a value of 20 pCi Ra/g appears acceptable by several authorities. None of the Ra removal methods tested were able to produce tailings meeting this value. (Auth)(RAF)

URANIUM; ORES; MILLING; TAILINGS; SEPARATION PROCESSES; LABORATORY STUDIES; LEACHING; RADIUM 226; EDTA; ACIDS; SEDIMENTATION

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Dean, K.C., R. Havens, and K.T. Harper Salt Lake City Metallurgy Research Center, Salt Lake City, UT

Chemical and Vegetative Stabilization of a Nevada Copper Porphyry Mill Tailing. Bureau of Mines Report of Investigations 7261; 14 pp. (1969)

Mill tailings at McGill, Nevada are the waste products from flotation of porphyry copper ore. Vegetative stabilization of these tailings has been attempted intermittently since 1946. None of the vegetative tests has been fully successful, even when spray irrigation was used to offset the aridity of the area. Most of the failures occurred because of the abrasive action of airborne sand particles which buried the plants or cut them off at ground level. Stabilization of the tailings by some method, until the vegetation was sufficiently developed to control sand movement, was considered a necessity. Laboratory studies at the Bureau of Mines demonstrated that a commercially available resinous chemical (COHEREX) would stabilize fine tailing particles without harming accompanying vegetation. A 10-acre area was seeded with legumes, winter wheat, wheatgrasses, and wild rye, and the area was then sprayed with COHEREX to stabilize the sands until the vegetation could grow. During the year since treatment, the area has been well stabilized against wind erosion. The established vegetation appeared to be capable of self-perpetuation and renewal without irrigation. The cost of stabilizing was $135.50 per acre. (RAF)

COPPER; MILLING; TAILINGS; STABILIZATION, CHEMICAL; STABILIZATION, VEGETATIVE; LABORATORY STUDIES; VEGETATION; LEGUMES; GRASSES; RESINS; CHEMICALS; WINDS; EROSION; REVEGETATION; COSTS

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Douglas, R.L. U.S. Environmental Protection Agency, Office of Radiation Programs, Las Vegas, NV

Radiological Survey at the Inactive Uranium Mill Site near Riverton, Wyoming. ORP/LV-77-2; 23 pp. (1977, June)

The primary purpose of the radiological survey near Riverton, Wyoming was to delineate areas which are contaminated by windblown material from the tailings pile. Secondary purposes were to collect water samples from local wells, and to collect indoor radon progeny (working level) samples in structures near the site, in order to identify any major radiation exposures which may be occurring through these exposure pathways. The contaminated areas were delineated by making a series of differential gamma exposure rate measurements at the ground surface. A total of about 460 acres, exclusive of the tailings pile, was found to be contaminated above background levels. An area of 30 acres would have to be decontaminated to reduce the maximum residual exposure rate to 40 uR/hr, and 99 acres would have to be decontaminated to reduce the maximum residual exposure rate to 10 uR/hr. None of the samples tested exceeded the guidance established by the EPA for drinking water or the Surgeon General's guidelines for indoor radon progeny levels. (Auth)(RAF)

RADIOLOGICAL SURVEYS; URANIUM; MILLING; SAMPLING; WATER; RADON DAUGHTERS; SOILS; RADIATION, GAMMA; RADIUM; WELLS; AIR; RADIATION DETECTORS; ENVIRONMENTAL EXPOSURE PATHWAY; DOSE RATE

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Eadie, G.G., and R.F. Kaufman U.S. Environmental Protection Agency, Office of Radiation Programs, Las Vegas Facility, Las Vegas, NV

Radiological Evaluation of the *Effects* of Uranium Mining and Milling Operations on Selected Ground Water Supplies in the Grants Mineral Belt, New Mexico. Health Physics 32(4):231-241. (1977, April)

A study was conducted by the U.S. Environmental Protection Agency and the New Mexico Environmental Improvement Agency to evaluate the possible radiological contamination of ground water supplies in the Grants Mineral Belt areas of New Mexico (Grants, Gallup, Milan, Smith L. ke, Ambrosia Lake, Bluewater, Laguna/Paguate). Ground water contamination from uranium mining and milling results from the infiltration of mine and mill discharge waters and ion exchange plant effluents enriched in uranium series decay products. To date, municipal water supplies in the area have not been adversely affected by radionuclides in discharged wastes. However, ground water sampling locations show slightly elevated radionuclide concentrations attributable to mining and milling activities. Only seven of the 72 sampling locations had Ra 226 centrations in excess of 3 pCi/l. Uranium isotopes are the main contributors to the gross alpha activity; however, in most determinations, gross alpha underestimated the activity present from natural uranium. No correlation was found between gross alpha activity and Ra 226 content. Thorium isotopes and Po 210 contents fluctuate about background levels, whereas uranium contents are difficult to distinguish from the naturally elevated concentrations due to proximity to uranium-bearing formations. (RAF)

RADIOLOGICAL SURVEYS; URANIUM; MINING; MILLING; EFFLUENTS; GROUND WATER; CONTAMINATION; SAMPLING; RADIUM 226; DRINKING WATER; ALPHA PARTICLES; POLONIUM 210; THORIUM 230; THORIUM 232; BACKGROUND RADIATION; CONTAMINATION

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Ford Bacon and Davis Utah Inc., Salt Lake City, UT

A Summary of the Phase 2 - Title 1 Engineering Assessment of Radioactive Sands and Residues Lowman Site, Lowman, Idaho. GJT-17S. (1977, December)

Ford, Bacon Davis Utah Inc. has performed an engineering assessment of the problems resulting from the existence of radioactive uranium sand residues at the Lowman, Idaho site. The Phase 2 - Title 1 services normally include the preparation of topographic maps, the performance of core drillings and radiometric measurements sufficient to determine areas and volumes of tailings and other radium-contaminated materials, the evaluation of resulting investigation of site hydrology and meteorology, and the evaluation and costing of alternative corrective actions. Radon gas release from the 90,000 tons of sand residues at the Lowman site constitutes the most significant environmental impact, although external gamma radiation is also a factor. The two alternative actions presented are dike construction, fencing, and maintenance (Option 1); and consolidation of the piles, addition of a 2-ft-thick stabilization cover, and on-site cleanup (Option 2). Both options include remedial action at off-site structures. Cost estimates for the two options are \$393,000 and \$590,000. Reprocessing the sand residues for uranium recovery is not economically attractive at present. (Auth)

URANIUM; SANDS; TOPOGRAPHY; MAPS; CORES; DRILLING; RADIOLOGICAL SURVEYS; WASTE VOLUME; RADIUM; CONTAMINATION; HYDROLOGY; METEOROLOGY; COST ESTIMATES; RADON; RADIATION, GAMMA; DIKES; FENCING; STABILIZATION, PHYSICAL

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Ford, Bacon and Davis Utah Inc., Salt Lake City, UT

A Summary of the Phase 2-Title 1 Engineering Assessment of Inactive Mill Tailings Riverton Site, Riverton, Wyoming. GJT-19S; 22 pp. (1977, December)

Ford, Bacon, Davis Utah Inc. has performed an engineering assessment of the problems resulting from the existence of radioactive uranium mill tailings at the Riverton, Wyoming site. The Phase 2 - Title 1 services include: the performance of core drillings; soil, water and other sample analyses; radiometric measurements to determine areas with radium-contaminated materials; the evaluation of resulting radiation exposures of individuals and nearby populations; the investigation of site geology, hydrology, and meteorology; and the evaluation and costing of alternative corrective actions. Radon gas release from the 900,000 tons of tailings at the Riverton site constitutes the main environmental impact. The two alternative actions presented are fencing and maintenance of the site and off-site remedial action (Option 1); and, in addition to the items in Option 1, decontamination of the millsite and ore storage areas and additional stabilization cover to a minimum of 2 ft (Option 2). The cost estimates for the options are \$460,000 and \$1,140,000, respectively. Estimated costs for moving the tailings and all contaminated materials to unspecified sites 5 and 10 mi from the present location are \$6,000,000 and \$6,400,000, respectively. Reprocessing the tailings for uranium is not economically attractive at present. (Auth)

URANIUM; MILLS; TAILINGS; CORES; DRILLING; SOILS; WATER; RADIOLOGICAL SURVEYS; RADIUM; CONTAMINATION; EXPOSURE, POPULATION; GEOLOGY; HYDROLOGY; METEOROLOGY; COST ESTIMATES; RADON; WASTE VOLUME; FENCING; MAINTENANCE; STABILIZATION, PHYSICAL; DISPLACEMENT

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Ford, Bacon and Davis Utah Inc., Salt Lake City, UT

A Summary of the Phase 2 - Title 1 Engineering Assessment of Inactive Uranium Mill Tailings Shiprock Site, Shiprock, New Mexico. GJT-2S. (1977, March 31)

Ford, Bacon and Davis Utah Inc has performed an engineering assessment of the problems resulting from the existence of radioactive uranium mill tailings at Shiprock, New Mexico. The Phase 2, Title I services include the preparation of topographic maps, the performance of core drillings and radiometric measurements sufficient to determine areas and volumes of tailings and other radium-contaminated materials, the evaluation of resulting radiation exposures of individuals and nearby populations, the investigation of site hydrology and meteorology and the evaluation and costing of alternative corrective actions. Radon gas release from the 1.7 million tons of tailings at the Shiprock site constitutes the most significant environmental impact, although windblown tailings and external gamma radiation are also factors. The 11 alternative actions presented range from completion of the present ongoing EPA site decontamination plan (Option 1), to stabilizing in-place with varying depths of cover material (Options 2-4), to removal to an isolated long-term disposal site (Options 5-11). All options include remedial action costs for off-site locations where tailings have been placed. Costs estimates for the 11 options range from $540,000 to $12,500,000. Reprocessing the tailings for uranium is not economically feasible. (Auth)

URANIUM; MILLS; TAILINGS; TOPOGRAPHY; MAPS; CORES; DRILLING; RADIUM; CONTAMINATION; EXPOSURE, POPULATION; RADON; SOILS; WASTE VOLUME; WINDS; RADIATION, GAMMA; STABILIZATION, PHYSICAL; DISPLACEMENT; DIFFUSION; WATER; HEALTH EFFECTS; LAND USE; COST BENEFIT ANALYSIS; SOCIAL ASPECTS; RADIOLOGICAL SURVEYS; HYDROLOGY; METEOROLOGY

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Ford, Bacon and Davis Utah Inc., Salt Lake City, UT

A Summary of the Phase 2 - Title 1 Engineering Assessment of Inactive Uranium Mill Tailings Tuba City Site, Tuba City, Arizona. GJT-5S. (1977, March 31)

Ford, Bacon Davis Utah Inc. has performed an engineering assessment of the problems resulting from the existence of radioactive uranium mill tailings at the Tuba City millsite in Arizona. The Phase 2, Title I services include the preparation of topographic maps, the performance of core drillings and radiometric measurements sufficient to determine areas and volumes of tailings and other radium-contaminated materials, the evaluation of resulting radiation exposures of individuals residing nearby, the investigation of site hydrology and meteorology and the evaluation and costing of alternative corrective actions. Radon gas release from the tailings on the site constitutes the most significant environmental impact to the inhabited area near the site. In the downwind direction, to the northeast of the site, airborne radioactivity is greater than Federal guidelines but there are no dwellings in that direction in the area of concern. Gamma radiation is significant over the tailings but is near background levels in the housing area. The sparse population and relatively low radiation levels yield minimal immediate environmental impact; hence, the four alternative actions presented are directed towards restricting access to the site (Option 1), and returning the windblown tailings to the pile and stabilizing the pile with cover material (Options 2, 3, and 4). Fencing around the site or the tailings pile and the removal or decontamination of mill buildings is included in all options. Option 2 provides 2 ft of cover material on the tailings, Option 3 provides 4 ft of cover, and Option 4 provides 13 ft of cover. Costs of the options range from $671,000 to $2,904,000. Reprocessing the tailings for uranium is only marginally feasible and would require a more detailed economic evaluation before any action was taken. (Auth)

URANIUM; MILLS; TAILINGS; TOPOGRAPHY; MAPS; CORES; DRILLING; RADIOLOGICAL

SURVEYS; WASTE VOLUME; RADIUM; CONTAMINATION; EXPOSURE, POPULATION; HYDROLOGY; METEOROLOGY; COST BENEFIT ANALYSIS; RADON; WINDS; RADIATION, GAMMA; STABILIZATION, PHYSICAL; FENCING; BUILDINGS; DECONTAMINATION

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Ford, Bacon and Davis Utah Inc., Salt Lake City, UT

A Summary of the Phase 2 - Title 1 Engineering Assessment of Inactive Uranium Mill Tailings Monument Valley Site, Monument Valley, Arizona. GJT-4S. (1977, March 31)

URANIUM; MILLS; TAILINGS; TOPOGRAPHY; MAPS; SOILS; GEOLOGY; HYDROLOGY; METEOROLOGY; EXPOSURE, POPULATION; RADON; RADIATION, GAMMA; WATER; CONTAMINATION; WINDS; LAND USE; SOCIAL ASPECTS; COST BENEFIT ANALYSIS; RADIOLOGICAL SURVEYS; STABILIZATION, PHYSICAL

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Ford, Bacon and Davis Utah Inc., Salt Lake City, UT

A Summary of the Phase 2 - Title 1 Engineering Assessment of Inactive Uranium Mill Tailings Durango Site, Durango, Colorado. GJT-6S. (1977, November)

Ford, Bacon Davis Utah Inc. has performed an engineering assessment of the problems resulting from the existence of radioactive uranium mill tailings at Durango, Colorado. The Phase 2 - Title 1 services include the preparation of topographic maps, the performance of core drillings and radiometric measurements sufficient to determine areas and volumes of tailings and other radium-contaminated materials, the evaluation of resulting radiation exposures of individuals and nearby populations, the investigation of site hydrology and meteorology and the evaluation and costing of alternative corrective actions. Radon gas release from the 1.555 million tons of tailings at the Durango site constitutes the most significant environmental impact, although windblown tailings and external gamma radiation are also factors. The eight alternative actions presented range from vegetative stabilization (Option 1), to contouring and stabilizing in-place with varying depths of cover material (Options 2 and 3), to removal to an isolated long-term disposal site (Options 5-8). All options include remedial action costs for off-site locations where tailings have been placed. Costs estimated for the eight options range from $4,340,000 to $13,590,000. Reprocessing the tailings for uranium is sufficiently economically attractive to justify reprocessing in conjunction with each of the options. (Auth)

URANIUM; MILLS; TAILINGS; TOPOGRAPHY; MAPS; CORES; DRILLING; RADIOLOGICAL SURVEYS; WASTE VOLUME; RADIUM; CONTAMINATION; EXPOSURE, POPULATION; HYDROLOGY; METEOROLOGY; RADON; WINDS; STABILIZATION, VEGETATIVE; STABILIZATION, PHYSICAL; DISPLACEMENT; COST ESTIMATES; REPROCESSING

517
Ford, Bacon and Davis Utah Inc., Salt Lake City, UT

A Summary of the Phase 2 - Title 1 Engineering Assessment of Inactive Uranium Mill Tailings Phillips/United Nuclear Site Ambrosia Lake, New Mexico. GJT-13S. (1977, December)

Ford, Bacon Davis Utah Inc. has performed an engineering assessment of the problems resulting from the existence of radioactive uranium mill tailings at the Phillips/United Nuclear site at Ambrosia Lake, New Mexico. The Phase 2 - Title 1 services include the preparation of topographic maps, the performance of core drillings sufficient to determine areas and volumes of tailings, and radiometric measurements to determine radium-contaminated materials, the evaluation of resulting radiation exposures of individuals and nearby populations, the investigation of site hydrology and meteorology, and the evaluation and costing of alternative corrective actions. Radon gas release from the 2.6 million tons of tailings at the Phillips/United Nuclear site constitutes the most significant environmental impact, although windblown tailings and external gamma radiation are also factors. The estimated radiological health effects to the general population are considered to be minimal. The two alternative actions presented are: dike stabilization, fencing, and maintenance (Option 1), and adding 2 ft of stabilization cover material (Option 2). Both options include remedial action at off-site structures and on-site decontamination around the tailings pile. Cost estimates for the two options are $920,000 and $2,230,000, respectively. Reprocessing the tailings for uranium does not appear to be economically attractive at present. (Auth)

URANIUM; MILLS; TAILINGS; TOPOGRAPHY; MAPS; CORES; DRILLING; WASTE VOLUME; RADIOLOGICAL SURVEYS; RADIUM; CONTAMINATION; EXPOSURE, POPULATION; HYDROLOGY; METEOROLOGY; COST ESTIMATES; RADON; WINDS; RADIATION, GAMMA; HEALTH EFFECTS; STABILIZATION, PHYSICAL; DIKES; FENCING; MAINTENANCE

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Ford, Bacon and Davis Utah Inc., Salt Lake City, UT

A Summary of the Phase 2 - Title 1 Engineering Assessment of Inactive Uranium Mill Tailings Lakeview Site, Lakeview, Oregon. GJT-18S. (1977, December)

Ford, Bacon Davis Utah Inc. has performed an engineering assessment of the problems resulting from the existence of radioactive uranium mill tailings at the Lakeview, Oregon site. The Phase 2 - Title 1 services include: performance of core drillings; analyses of soil, water, and other samples; radiometric measurements to determine areas with radium-contaminated materials; evaluation of resulting radiation exposures of individuals and nearby populations; investigation of site geology, hydrology, and meteorology; and evaluation and costing of alternative corrective actions. Radon gas release from the 130,000 tons of tailings at the Lakeview site constitutes the main environmental impact, which is minimal. The two alternative actions presented are maintenance of the site now that the ARCO reclamation program has been completed (Option 1); and additon of stabilization cover to a minimum depth of 2 ft, improved fencing, and removal of a few isolated spots of contamination (Option 2). The cost estimates for these options are $40,000 and $290,000, respectively. (Auth)

URANIUM; MILLS; TAILINGS; CORES; DRILLING; SOILS; WATER; RADIUM; CONTAMINATION; RADIOLOGICAL SURVEYS; EXPOSURE, POPULATION; GEOLOGY; HYDROLOGY; METEOROLOGY; COST ESTIMATES; RADON; STABILIZATION, PHYSICAL; FENCING

519

Franc III, G.A. Colorado Department of Health, Grand Junction, CO

Instrumentation Use in the Uranium Mill Tailings Program in Colorado. 3 pp.

Through the history of the uranium mill tailings program in Colorado, many instruments have been used to measure gross gamma and alpha radiation from radon and radon daughters. Gamma measurements are used to locate the contaminating deposits and to determine when they have been removed. Distance in measuring was overcome by doing gamma survey work with hand-held rate meters over the surface of each property, using a maximum 10' grid search pattern outside and 5' or less inside structures. Masking of a deposit by an adjacent deposit has been overcome to some degree by using differential and lead sheet shielded measurements. Shielding, on the other hand, continues to be a problem, and only by auger or coring and then gamma logging each hole, some buried deposits can be located. Quite a variety of instruments have been used to measure the alpha radiation from radon and its daughter products. Radon samples are probably the most accurate of the air measurements in indicating potential airborne radiation levels. The radon bag sampler was the sampler used to measure radon tailings piles in 1966. Limited use of 48-hour integrated radon bag samples was made during 1974, when the track etch film calibration effort was in progress. Film packets to measure radon were first used in 1966 but were found to be relatively insensitive to the low levels of radon found in structures. In 1971 a polaroid film packet device was tested (PHS-Sensintaffer), but this too was not sensitive enough. Next, a passive diffusion integrating radon monitor with recorder, developed by NYU, was tried and found to provide useful information on the changes in radon from hour to hour and day to day. Several designs of scintillation flasks are currently being used to take grab samples, which are used to define differences in radon levels through time and between areas within structures. The plastic HASL design shows great promise. The first radon flask grab samples used in the program were used to measure radon flux into collection chambers positioned on surfaces within structures. Track etch films, manufactured by General Electric and Kodak Pathe, were tested in a year-long calibration run and found to be sufficient in indicating elevated levels greater than .03 WL but are somewhat vague at near background levels of less than .02 WL. A passive diffusion radon track etch dosimeter, submitted by San Francisco University, was also tested and found lacking in sensitivity. Radon daughter grab samples were first used in 1968 as a screening device, but the gamma survey replaced them as the initial indicator of tailings presence under or around the structure. They are now used as early indicators of progress made in remedial actions. AEC - HASL developed an integrated radon daughter samples which utilizes a positive displacement piston air pump, that eliminates most of the clogging problems, and also developed a sampling capability using this type of sampler. (Auth)(JMF)

INSTRUMENTS; MILLING; MEASUREMENTS; ALPHA PARTICLES; RADON; SAMPLES; RADIATION DETECTORS; RADIATION, GAMMA; RADIATION SOURCES; SAMPLING; DOSIMETERS

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Franklin, J.C., T.O. Meyer, and R.C. Bates U.S. Department of the Interior, Bureau of Mines. Spokane Mining Research Center, Spokane, WA

Barriers of Radon in Uranium Mines. Bureau of Mines Report of Investigations 8259; 24 pp. (1977)

Water based epoxy sealants were tested over a period of 2 years for their effectiveness as barriers to radon release in uranium mines. Uranium ore samples were dipped in dilute HydrEpoxy 156, cured overnight, dipped in HydrEpoxy 300, and cured again. After monitoring for 30 days, radon emanation reduction averaged 79% for 10 samples. Six wet samples averaged 77% after sealing. The sealants were field tested in the Twilight Uranium Mine near Uravan, CO. Two test chambers were monitored for natural radon emanation and absolute pressure over a period of 13 days. An average of one inch of shotcrete was then applied to the walls of one chamber (At) to fill some of the fractures. Both this chamber and the control (Ac) were monitored for 26 days. During this period, Rn in At averaged 1861 pCi/l and ranged from 1311-1996 pCi/l; in Ac, Rn concentration increased from 2203 pCi/l to 11,303 pCi/l over a 28 day period, before beginning to decline again at the end of the testing phase. The reason for this phenomenon is uncertain, but may be due to added moisture. At the end of this test phase, dilute HydrEpoxy 156 was applied to the walls of At, followed the next day by HydrEpoxy 300. Rn flux reductions of more than 50% were obtained relatively soon after sealing, and reached almost 75% 19 months later. A second sealant test was conducted using two other chambers in the Twilight Mine; these chambers were closer together than in the previous test, and the shotcrete used in the test chamber was styrene butadiene latex filled, with chopped fiberglass fibers added. This method cost more than three times that of the first ($1.19/sq ft vs $0.30/sq ft) and had an efficiency 35% less, due mainly to difficulties associated with the fiberglass fibers. (LKH)

RADON; URANIUM; GASES; MINES; MINING; EMANATION; SAFETY; SEAL MATERIALS; ORES; SANDSTONES; COST BENEFIT ANALYSIS; FIELD STUDIES

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Hammon, H.G., K. Ernst, J.R. Gaskill, J.C. Newton, and C.J. Morris Lawrence Livermore Laboratory, Livermore, CA

Development and Evaluation of Radon Sealants for Uranium Mines. UCRL-51818; 67 pp. (1975, May 21)

The study of radon sealants for uranium mines was organized in three tasks: 1) film selection and preparation; 2) measurement of permeabiilty; and 3) evaluation of toxicity. Films for the penetration study were selected from commercially available polymer systems of known chemical composition. Most of the coatings were prepared by drawdown from solution or later using a doctor blade on a substrate of known permeability. This substrate was usually a polyethylene ionomer (Surlyn A). Permeation coefficients of the films and coatings to noble gases were determined and radon permeation coefficients were estimated from these da' . The volatile components of the coatings materials were identified qualitatively and semiqualitatively using gas chromatography and mass spectrography. The combustion and pyrolysis products were evaluated in two separate studies: 1) on cement-asbestos board specimens in a smoke chamber, and 2) small scale pyrolysis studies of unsupported films of the coatings. Toxicological evaluations were made of the data from published information. The coatings, in decreasing order of overall effectiveness are: HydrEpoxy 300, pigmented water-dispersed epoxy; Resitron II, furan (catalyzed furfuryl alcohol polymer); Essex Polyester, pigmented one-component styrenated polyester; Aerospray 70, plasticized polyvinyl acetate latex; Saran XD-7151, vinylidene chloride copolymer; EpiRez WD-510/EpiCure 872, unpigmented water-dispersed epoxy; WSU-118, modified epoxy; Promulsion 200, unidentified composition, and HydroSeal, acrylic emulsion. (RAF)

RADON; SEAL MATERIALS; URANIUM; MINES; PERMEABILITY; TOXICITY; POLYMERS; CHEMICAL COMPOSITION; FIRES; GASES

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Havens, R., and K.C. Dean Salt Lake City Metallurgy Research Center, Salt Lake City, UT

Chemical Stabilization of the Uranium Tailings at Tuba City, Arizona. Bureau of Mines Report of Investigations 7288; 12 pp. (1969, August)

Physical, vegetative, and chemical procedures for stabilizing Tuba City, Arizona acidic and basic uranium mill tailings were evaluated. Physical and vegetative procedures were eliminated from consideration because of adverse cost and climatic conditions. Successful stabilization was achieved using a relatively low-cost chemical method. Over 20 chemicals were tested for producing surfaces resistant to wind erosion. DCA-70, an elastomeric polymer, and Norlig A, a calcium lignosulfonate chemical were selected for the dikes and beaches, respectively. DCA-70 had the properties of good penetration (2 in.) through sandy materials and of becoming water insoluble after emplacement. Norlig A produced an extremely hard surface crust on both the acid and the carbonate ponds. It was the only chemical tested that produced durable wind-resistant crusts on the carbonate tailings. DCA-70 and Norlig A, both water soluble, were applied using an automated self-propelling sprinkler. The direct cost for stabilizing the 34.5-acre tailing pond was about $335 per acre. (RAF)

URANIUM; MILLING; TAILINGS; STABILIZATION, CHEMICAL; COSTS; WINDS; EROSION; POLYMERS; SULFONATES

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Haywood, F.F., W.A. Goldsmith, H.M. Hubbard, Jr., W.F. Fox, and W.H. Shinpaugh Oak Ridge National Laboratory, Health and Safety Research Division, Oak Ridge, TN

Assessment of the Radiological Impact of the Inactive Uranium-Mill Tailings at Monument Valley, Arizona. ORNL-5449; 68 pp. (1979, December)

Results of a radiological survey that was conducted at the inactive uranium-mill site at Monument Valley, Arizona, in March 1976, in cooperation with a team from Ford, Bacon and Davis Utah Inc., are presented. Consideration of these data and of previously published information on radiological conditions at the site lead to the conclusion that potential health effects from exposure to radionuclides in the mill tailings are relatively small. The occupants of three residences within 0.8 km (0.5 mile) of the tailings constitute the principal population at risk, but direct gamma-exposure rate measurements near the two residences closest to the tailings and calculations of radon dispersion indicate that the tailings do not raise either pathway of radiation exposure significantly above the background level. Data are not available to evaluate fully other possible exposure pathways, but the available information indicates that it is unlikely that doses through these pathways will add significantly to the total population dose. The low estimates of potential health effects from exposure to direct radiation and to exposure to radionuclides in the Monument Valley tailings piles are ascribed to the low Ra 226 inventory, to almost complete absence of small particles that are readily moved by wind and water, and to a small population in the vicinity of the tailings. (Auth)

RADIOLOGICAL SURVEYS; URANIUM; MILLING; TAILINGS; HEALTH EFFECTS; EXPOSURE, POPULATION; HAZARD ANALYSIS; RADIATION, GAMMA; RADON DAUGHTERS; DIFFUSION; ENVIRONMENTAL EXPOSURE PATHWAY; BACKGROUND RADIATION; RADIATION DOSE; RADIUM 226; SAMPLING; INSTRUMENTATION; SOILS; PARTICLE SIZE

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Haywood, F.F., W.A. Goldsmith, P.M. Lantz, W.F. Fox, W.H. Shinpaugh, and H.M. Hubbard, Jr. Oak Ridge National Laboratory, Health and Safety Research Division, Oak Ridge, TN

Assessment of the Radiological Impact of the Inactive Uranium-Mill Tailings at Shiprock, New Mexico. ORNL-5447; 86 pp. (1979, December)

Uranium-mill tailings at an inactive site near Shiprock, New Mexico, contain an estimated 950 curies (Ci) of Ra 226 together with its radioactive daughters. A radiological survey was conducted at this site in February 1976. Extensive decontamination work and tailings stabilization performed at the site since that time have greatly changed conditions there and, consequently, little effort was applied to quantification of potential health effects in comparison to the earlier consideration on the site at Salt Lake City. The present report delineates the radiological conditions that existed at the time of the survey including information on the surface and below-surface distribution of Ra 226. The data presented support the conclusion of earlier studies that diffusion of radon and inhalation of radon daughters is the principal mode of exposure of offsite population groups. However, from radon dispersion calculations and population statistics, it was found that few people live in the directions from the tailings where the maximum calculated annual average radon concentrations occur (southwest, west-southwest and west sectors). In these sectors, the contribution of the tailings to the average ambient radon concentration is less than the assumed annual average background radon concentration (0.5 pCi/liter, based on long-term measurements at Durango, Colorado, by other investigators) at distances greater than 2.3 km (1.4 mi) and is less than 10% of the background value at 7 km (4.4 mi) and beyond. Computer modeling of radon transport from the site indicates a maximum increase in lung cancer of 2 to 3% per year. Direct gamma exposure of the same population group is estimated to increase their risk of death from all cancers by 0.18%/year. Offsite doses from external gamma-rays resulting from displaced tailings are believed to be not significantly higher than those received from exposure to the average regional background radiation level (10 uR/hr). A limited examination of potential population exposure through aquatic and terrestrial pathways led to the conclusion that it is likely that doses received through such exposure modes will be small as compared to those received through the radon diffusion pathway. (Auth)

URANIUM; MILLING; TAILINGS; RADIUM 226; RADIOLOGICAL SURVEYS; DECONTAMINATION; STABILIZATION, PHYSICAL; HEALTH EFFECTS; DIFFUSION; RADON DAUGHTERS; EXPOSURE, POPULATION; MODELS; COMPUTER PROGRAMS; ENVIRONMENTAL EXPOSURE PATHWAY; LUNGS; NEOPLASMS; RADIATION DOSE; BACKGROUND RADIATION; SAMPLING; SURFACE CONTAMINATION; SEDIMENTS; WATER; RADIATION, GAMMA; PARTICLES, AIRBORNE

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Radiological Survey of the Inactive Uranium-Mill Tailings at Tuba City, Arizona. ORNL/5450; 74 pp. (1980, January)

Results of a radiological survey of the inactive uranium-mill site at Tuba City, Arizona, conducted in March 1976, are presented. Spread of tailings was detected in all directions by means of direct gamma measurements at 1 m above the ground and by determinations of the Ra 226 concentration in surface soil and sediment samples. In the direction toward which prevailing winds blow, the northeast, evidence of transporation of tailings was found at least 3.2 km from the tailings pile. Toward the north, south, and west, the spread was 300 to 400 m. Evidence of movement of tailings by water to offsite locations was also found. The concentration of Ra 226 in all water samples was well below the concentration guide for drinking water. The calculated subsoil distribution of Ra 226 in 14 holes, based on gamma monitoring data obtained by Ford, Bacon and Davis Utah Inc., is presented graphically and compared with available analytical data. (Auth)

RADIOLOGICAL SURVEYS; URANIUM; MILLING; TAILINGS; RADIATION, GAMMA; RADIUM 226; SURFACE CONTAMINATION; SOILS; SEDIMENTS; WINDS; ENVIRONMENTAL TRANSPORT, WATER; SAMPLING; SOIL PROFILE; RADIATION MONITORING; RADON DAUGHTERS; INSTRUMENTATION

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Holtzman, R.B., P.W. Urneris, A. Padova, and C.M. Bobula, 3rd Argonne National Laboratory, Radiological and Environmental Research Division, Argonne, IL

Contamination of the Human Food Chain by Uranium Mill Tailings Piles. NUREG/CR-0758; ANL/ES-69; 46 pp. (1979, April)

A study is in progress to estimate the contamination of the human food chain by U, Th 230, Ra 226, Pb 210, and Po 210 originating from tailing piles associated with uranium ore processing mills. Rabbits, cattle, vegetables, and grass were collected on or near two uranium mill sites. For controls, similar samples were obtained from areas 20 km or more from the mining and mill operations. For the onsite rabbits the mean Ra 226 concentrations in muscle, lung, and kidney of 5.5, 14, and 15 pCi/kg wet, respectively, were substantially higher than those in the respective tissues of control animals (0.4, 1.5, and 0.2 pCi/kg). The levels in liver did not differ significantly between the groups. The concentrations in bone (femur and vertebra) were about 9000 and 350 pCi/kg ash for the onsite and offsite animals, respectively. The levels of Pb 210 and Po 210 did not differ significantly for a given tissue between the two groups, except that the Pb 210 level in the kidney was greater in the onsite group. For cattle the results are less complete, but the data indicate that the concentrations in muscle, liver and kidney do not differ greatly between those grazed near the pile and the controls. The levels of Ra 226, and possibly of Pb 210, appear to be greater in the femur of the animals near the piles. Vegetables from a residential area on a mill site contained substantially greater concentrations of Ra 226 and Pb 210 than those reported for standard New York City diets. Grass and cattle dung from land irrigated by water containing 60 pCi/l Ra 226 from uranium mines had concentrations of Ra 226 and Pb 210 50 and 8 times, respectively, those in control samples. It is estimated that doubling the normal concentrations in meat and vegetables of uranium and daughter products could increase the dose equivalent rates to the skeletons of persons consuming these foods by 30 or more mrem/yr. The results show that some contamination of the human food chain is likely. The degree is probably not large since the sampling was designed to exaggerate the contamination level. Analytical procedures which include ashing of samples and determinations of Ra 226, Pb 210, Po 210, and Ca are detailed in the appendix. (Auth) (RAF)

FOOD CHAINS; CONTAMINATION; THORIUM 230; RADIUM 226; LEAD 210; POLONIUM 210; URANIUM; TAILINGS; MINES; MILLS; RABBITS; CATTLE; VEGETABLES; GRASSES; VEGETATION; ANIMALS; MUSCLES; INHALATION; LUNGS; MUSCLES; KIDNEYS; LIVER; BONES; INGESTION; DOSE RATE; MAN

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International Atomic Energy Agency, Vienna, Austria

Management of Wastes from the Mining and Milling of Uranium and Thorium Ores. STI/PUB/457; Safety Series No. 44; 50 pp. (1976)

The environmental protection aspects of radioactive and chemical wastes arising from all stages of mining and milling operations conducted with the primary or secondary objective of recovering uranium and/or thorium, up to and including the production and packaging of the first uranium and/or thorium concentrates, are considered. Descriptions are given of the wastes produced by these operations, along with waste management practices found satisfactory by experience and proposed solutions warranting evaluation. Problems in decommissioning and responsibility for long term maintenance, inspection, and monitoring programs are discussed. (GR)

Discusses environmental considerations affecting siting and discharge limits, including responsibility for long term maintainance, inspection, and monitoring programs. (DM/GR)

URANIUM; THORIUM; MINES; MILLS; WASTE MANAGEMENT; DECOMMISSIONING; ENVIRONMENT; MONITORING; LEACHING; MINING; WASTES, LIQUID; WASTES, SOLID; TAILINGS; DECONTAMINATION; DUSTS; PRECIPITATION, METEOROLOGICAL; GEOLOGY; HYDROLOGY; SOILS; BIOTA; RECOMMENDATIONS; SITE EVALUATION

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Jackson, P.O., R.W. Perkins, L.C. Schwendiman, M.A. Wogman, J.A. Glissmeyer, and W.I. Enderlin Battelle-Pacific Northwest Laboratories, Richland, WA

Radon 222 Emissions in Ventilation Air Exhausted from Underground Uranium Mines. NUREG/CR-0627; PNL-2888 Rev.; 54 pp. (1979, September)

The Rn 222 concentration in exhaust air is being measured at underground uranium mines in the Grants, New Mexico area. The objective of the work is to determine relationships between U3O8 production and the mine characteristics and practices relative to Rn 222 emission. Concentrations in the vent air from two mines ranged from 90 nCi/cu m to 3800 nCi/cu m during a month of observations. Diurnal radon emission patterns were seen from each mine which were inversely related to barometric pressure. The average diurnal emission patterns on weekends when no

mining occurred were very similar to those on weekdays during active mining, indicating that the mining activities had little short-term effect on those radon emissions. The radon emission rate from each mine vent showed a correlation with the associated ventilated surface area and the cumlative tons of U3O8 extracted there and a higher correlation with cumulative tons of ore extracted. Grab samples of vent air collected at 14 additional mines in the Grants area showed radon concentrations from 7 nCi/cu m to 21,000 nci/cu m. The radon emission rates ranged from 0.01 Ci to 10 Ci per vent per day. Ore production rate estimates were available for seven of the mines and based on a composite of emissions and production of these mines, a tentative average radon emission via ventilation air of 15.9 Ci/ton U3O8 was obtained. Aboveground sources of radon at one mine were estimated to release approximately 4% of the radon emitted in ventilation air from that mine. Using this estimate, a total release of 16.6 Ci/ton U3O8 is predicted. This is equivalent to 3340 Ci radon per Reference Reactor Year (RRY)(182 metric tons). After mine closure the waste piles at that mine are estimated to continue releasing radon at a rate of 13 Ci/yr per RRY. (Auth)

RADON 222; AIR; URANIUM; MINES; VENTILATION; ORES; PRODUCTIVITY; SAMPLING; CALCULATIONS; PREDICTIONS; WASTES, RADIOACTIVE; EMANATION

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Solubility Classification of Airborne Products from Uranium Ores and Tailings Piles. NUREG/CR-0530; PNL-2870; 61 pp. (1979, January)

Airborne products generated at uranium mills were assigned solubility classifications for use in the ICRP Task Group Lung Model. Assignments were based on measurements of the dissolution half-times exhibited by their component radionuclides in simulated lung fluid at 37 C. No significant difference was seen between the dissolution behavior of airborne samples and sieved ground samples of the same product, and both types were utilized in making the assignments. If the product contained radionuclides that dissolved at different rates, composite classifications were assigned to show the solubility class of each component. If the dissolution data indicated that a radionuclide was present in two chemical forms that dissolved at different rates, a mixed classification was assigned to show the percentage of radionuclide in each solubility class. Both composite and mixed classifications were shown to be compatible with the ICRP Lung Model. Based on results from seven samples, uranium-ore dust was assigned the composite classification: (U 235, U 238) W; (Ra 226) 10% D, 90% Y; (Th 230, Pb 210, Po 210) Y. Based on the results from nine samples, tailings-pile dust was classified: (Ra 226) 10% D, 90% Y; (Th 230, Pb 210, Po 210) Y. No significant difference was seen between the dissolution behavior of tailings-pile dust from either the alkaline-leach or acid-leach process for uranium recovery. Based on the results from five samples, uranium octoxide was classified Y. Based on the results from two samples, uranium tetrafluoride was also classified Y. Based on the results from one sample, ammonium diuranate was classified D. Based on the results from five samples, yellow-cake dust was classified (U 235, U 238) 60% D, 40% W. The term "yellow cake," however, covers a variety of materials which differ significantly in color, chemical composition, and dissolution rate; and this classification represents the average behavior of samples whose individual classifications ranged from 100% D to 36% D, 64% Y. Solubility classifications based on the dissolution half-times of particular yellow-cake products should, thus, be used when available. (Auth)

SOLUBILITY; CLASSIFICATION; PARTICLES, AIRBORNE; ORES; TAILINGS; DUSTS; URANIUM 235; URANIUM 238; RADIUM 226; THORIUM 230; LEAD 210; POLONIUM 210; URANIUM COMPOUNDS; YELLOW CAKE

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Kallus, M.I. U.S. Environmental Protection Agency, Houston, TX

Environmental Aspects of Uranium Mining and Milling in South Texas. EPA 906/9-75-004; 47 pp. (1975, October)

Recent investigations of uranium mining and milling operations in the Grants Mineral Belt of New Mexico found serious environmental problems to be associated with these activities. The purpose of this investigation was to determine whether or not similar problems existed in the South Texas uranium belt. The investigation showed that these problems did not exist. Activities included in the investigation were (1) a literature search to gather background information; (2) a search of the files of state environmental regulatory agencies to assemble pertinent data; (3) an aerial and surface reconnaissance of the area involved and (4) discussions with involved persons in both the governmental and private sectors. (Auth)

URANIUM; MINING; MILLING; ENVIRONMENTAL IMPACTS; HYDROLOGY; GEOLOGY; REGULATIONS, STATE; WATER QUALITY; SURFACE WATERS; GROUND WATER; AIR

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Kirner, N.P., A. Alan, and P.A. Blackburn U.S. Environmental Protection Agency, Washington, D.C.; Western Nuclear, Inc., Wellpinit, WA

Waste Management of Uranium Mining and Milling Operations. EPA 520/3-79-002; Low-Level Radioactive Waste Management, J.E. Watson, Jr., (Ed.), Proceedings of Health Physics Society Twelfth Midyear Topical Symposium, Williamsburg, VA, February 11-15, 1979. U.S. Environmental Protection Agency, Washington, DC, (pp. 17-181), 540 pp. (1979, May)

This presentation will attempt to describe the various sources of waste from uranium mining and milling. Western Nuclear, Inc., Sherwood Project will be an example of how a typical open pit mine and acid leach mill manages its waste. Uranium mining and milling operations remove, pulverize, and disperse radioactivity which is naturally deposited in the Earth's crust. No new radioactivity is created through these operations. The uranium and its daughters, including radon, are merely converted to a more dispersible form. Most currently extracted ores contain uranium concentrations of from 0.05% to 1%, with the more recently constructed U.S. mills utilizing the lower concentrations. Each site has particular characteristics which affect how it manages its waste. The Sherwood Project is located on the Spokane Indian Reservation, approximately 33 miles north, northwest from Spokane, Washington. Its location is high atop a bluff overlooking Lake Roosevelt with topography being generally hilly. Annual rainfall at the site is estimated to be 20 inches per year. The average temperature is 44.7 deg F. The only groundwater on the site consists of low volume springs used previously for livestock waterings. Lake Roosevelt is the major source of water in the near vicinity of the mill. The milling process generates the following wastes: Unreacted, acidic, barren ore; flocculated and barren precipitates; waste organic solution; neutralized, barren ammonium sulfate solution, aqueous wastes from the thickeners and centrifuge; contaminated runoff; dusts from the crushing circuit; sulfuric acid vapors; dusts from dryers and packaging areas; and radon emissions from radium bearing wastes. As with most acid leach mills, salts are a major threat to the ground water. Fortunately, there is minimal ground water at the Sherwood Project and the sorptive capacities of the soil are natural barriers to control migration of the salts. The most prominent feature of the Sherwood Project and the feature which will handle the major share of all wastes generated is the tailings retention system. The entire tailings area is, or will be, lined with a 30 mil polyester reinforced hypalon liner. Hypalon is a synthetic rubber which is reasonably resistant to weathering, ozone, and sunlight. It has high resistability to acids and alkalis. It is also moderately resistant to various organic solvents and biological degradation. It is usually supplied in the unvulcanized form and can be seamed by heat sealing or solvent welding. Each uranium extraction method, acid leach, basic leach, heap leach, in situ leach, has its own characteristic waste problems. These problems may be alleviated or enlarged by the characteristics of a particular location. The operators of the Sherwood Project have secured a surety bond from the Bureau of Indian Affairs in the amount of $6 million (April, 1978) to cover mill decommissioning and tailings stabilization costs. A separate bond was also secured from the Bureau of Indian Affairs in the amount of $176,000 to cover maintenance and monitoring of the reclaimed and stabilized area for a period of 50 years. (Auth)(JMF)

WASTE MANAGEMENT; WASTES, RADIOACTIVE; URANIUM; MILLING; MINING; GROUND WATER; RADON; RADIUM; COSTS; TAILINGS; WEATHERING; MONITORING

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Moffett, D. Canada Centre for Mineral and Energy Technology, Mining Research Laboratories, Elliot Lake, Ontario, Canada

Uranium Waste Researchers Consider Alternate Means of Tailing Disposal. Canadian Mining Journal, January 1977: 48-50. (1977, January)

See also "The Disposal of Solid Wastes and Liquid Effluents from the Milling of Uranium Ores" in CANMET Report 76-19 (76 pp.)

TAILINGS; URANIUM 238; URANIUM 234; THORIUM 230; RADIUM 226; LEAD 210; EFFLUENTS; BARIUM; PRECIPITATION, CHEMICAL; MINING; EXTRACTION; ORES; LEACHING; WASTES, SOLID; WASTES, RADIOACTIVE; REVEGETATION; FERTILIZERS; WATER TREATMENT; MILLING; DRAINAGE; METALS; CHEMICALS; SLUDGES

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Moffett, D. Canada Centre for Mineral and Energy Technology, Mining Research Laboratories, Elliot Lake, Ontario, Canada

The Disposal of Solid Wastes and Liquid Effluents from the Milling of Uranium Ores. CANMET Report 76-19; 76 pp. (1976, July)

Current Canadian practice in the milling of uranium-bearing ores commonly involves fine grinding followed by acid leach/ion exchange. The acid leach may be followed instead by solvent extraction. Alkaline leaching has been done, and in situ bacteriological leaching is of interest. Tailings disposal operations are necessary and create environmental problems. Uranium-mill wastes are unique because of their radioactivity. Some of the radioisotopes present may require an individual control procedure. Radium 226 is particularly important because it is the most hazardous of all isotopes found in the tailings. Acid and heavy-metal removal is conventionally done by the addition of lime, but other means are available, such as with limestone, sodium hydroxide, ammonia, silicon alloys or by sulphide precipitation. Modifications to unit operations in the mill process may be required to produce more acceptable effluents. Increased water recycling may be necessary to meet regulatory standards. (Auth)

See also "Uranium Waste Researchers Consider Alternate Means of Tailing Disposal" in Canadian Mining Journal, January 1977, pp. 48-50.

WASTES, SOLID; EFFLUENTS; MILLING; URANIUM; ORES; TAILINGS; WASTE DISPOSAL; LEACHING; ION EXCHANGE; EXTRACTION; SOLVENTS; ION EXCHANGE; WASTES, RADIOACTIVE; RADIUM 226; THORIUM; LEAD; POLONIUM; ACIDS; METALS; SEPARATION PROCESSES; HAZARD ANALYSIS; WATER TREATMENT; GRINDING; WASHING; YELLOW CAKE; HYDROLOGY; EVAPORATION; LAKES; BACKFILLING; CHEMICALS; LIMESTONES; AMMONIA; SILICON; ALLOYS; SULFIDES; SODIUM COMPOUNDS; HYDROXIDES

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Moffett, D., and M. Tellier Canada Centre for Mineral and Energy Technology, Mining Research Laboratories, Elliot Lake Laboratory, Elliot Lake, Ontario, Canada

Uptake of Radioisotopes by Vegetation Growing on Uranium Tailings. Canadian Journal of Soil Science 57:417-424. (1977, November)

An investigation was carried out on the uptake of several long-lived radioisotopes by grasses growing on uranium tailings. Field plots of creeping red fescue (FESTUCA RUBRA L.), reed canary grass (PHALARIS ARUNDINACEA L.), redtop (AGROSTIS ALBA L.) and climax timothy (PHLEUM PRATENSIS L.) which have been growing for 4 yr were sampled in this study. The tailings and the plant tissue were analyzed for uranium, thorium, radium 226, lead 210 and polonium 210. Sedimentation within the tailings area gave two zones: one of sands and one of slimes. The slimes contained significantly more radium 226, lead 210 and polonium 210 than the sands. There was no difference in uptake behavior by grasses growing in the sands and those growing in the slimes. Creeping red fescue (FESTUCA RUBRA L.) showed an anomalous uptake of lead 210, but other than this, all four grass species showed similar uptake behavior. Only uranium and radium 226 were significantly higher in the grasses from the tailings than the control. (Auth)

UPTAKE; VEGETATION; URANIUM; TAILINGS; GRASSES; THORIUM; RADIUM 226; LEAD 210; POLONIUM 210

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Momeni, M.H., W.E. Kesieleske, S. Tyler, A. Zielen, Y. Yuan, and J. Roberts Argonne National Laboratory, Division of Environmental Impact Studies, Argonne, IL

Radiological Impact of Uranium Tailings and Alternatives for Their Management. EPA 520/3-79-002; Low-Level Radioactive Waste Management, J.E. Watson, Jr., (Ed.), Proceedings of Health Physics Society Twelfth Midyear Topical Symposium, Williamsburg, VA, February 11-15, 1979. U.S. Environmental Protection Agency, Washington, DC, (pp. 307-328), 540 pp. (1979, May)

The radiological hazards associated with uranium tailings arises from inhalation of airborne particulates and radon daughters, ingestion of food grown in contaminated ground, and from external exposures to pollutants in the vicinity. Uncontrolled tailings piles are mobile sources of fugitive dust that may produce a practically uncleanable adjacent environment. A practical procedure for managing solid tailings is addition of surface moisture, mechanical and gravitational separation of slimes, and storage of slimes below solution tailings. Presently practical alternatives for tailings management are variations of two basic methods-surface and below-ground disposal. Protocol for tailings management should be based on both reduction of exposure pathways and containment throughout the predictable future. Isolation of tailings by natural materials such as clay lenses and combinations of overburden, top soil, vegetation and rip-rap may provide both minimization of exposure and stability. Experimental measurement of radon flux over two inactive tailings, acid and carbonate leached tailings resulted in average specific flux values of pCi Rn-222/sq m.sec / pCi Ra-226/g, respectively. The average diffusion coefficient for these tailings were, respectively, 2.4 x 10(E-3) and 5.7 x 10(E-4) sq cm/sec. Tailings covered with native soil of clay-silt-sand mixture to a depth of 225 cm resulted in attenuation of flux with diffusion coefficients of 3.69 x 10(E-3) and 3.60 x 10(E-3)/sec for ACID and ALKO sites, respectively. By means of the UDAD code dose commitments were estimated for inhalation of particulates and radon and for external exposure under three degrees of surface moisture on the tailings. Based on these analyses and assumption that the dose contribution from ingestion pathway is comparable in magnitude to that of inhalation, both compliance with the 25 mrem/year limit and reduction of flux to background level is feasible. Stability of alternative decommissioned tailings over the predictable future is discussed. (COMPLETE TEXT)

This paper contains charts and graphs expressing different characteristics of the tailings left behind after the milling process. Contains maps of the sampling areas.

RADIATION HAZARDS; INHALATION; INGESTION; ENVIRONMENT; SOILS; RADON; CHEMICAL ANALYSIS; PARTICLES, AIRBORNE; STANDARDS, FEDERAL; MEASUREMENTS; DECOMMISSIONING; DOSE RATE

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Momeni, M.H., J.B. Lindstrom, C.E. Dungey, and W.E. Kisieleski Argonne National Laboratory, Argonne, IL

Appendix to Radon and Radon-Daughter Concentrations in Air in the Vicinity of the Anaconda Uranium Mill. NUREG/CR-1133 Appendix; ANL/ES-81 Appendix; 82 pp. (1979, November)

The appendix contains tables and figures on meteorological measurements and Rn 222 and radon daughter measurements. Windspeed and direction were measured at three locations continuously for a period of about one year. The annual frequency distribution is listed for all stability classes. Radon concentrations are listed by the day and hour for the selected measuring stations. Working levels are presented for given days. Also listed are stratigraphic and hydrologic site characteristics. (RAF)

RADON 222; RADON DAUGHTERS; AIR; MEASUREMENTS; URANIUM; MILLS; TAILINGS; STRATIGRAPHY; HYDROLOGY; WORKING LEVELS; WINDS

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Momeni, M.H., J.B. Lindstrom, C.E. Dungey, and W.E. Kisieleski Argonne National Laboratory, Division of Environmental Impact Studies, Argonne, IL

Radon and Radon-Daughter Concentrations in Air in the Vicinity of the Anaconda Uranium Mill. NUREG/CR-1133; ANL/ES-81; 90 pp. (1979, November)

Radon concentration, working level, and meteorological variables were measured continuously from June 1977 through June 1973 at three stations in the vicinity of the Anaconda Uranium Mill with measurements integrated to hourly intervals. Both radon and daughters show strong variations associated with low wind velocities and stable atmospheric conditions, and diurnal variations associated with thermal inversions. Average radon concentration shows seasonal dependence with highest concentrations observed during fall and winter. Comparison of radon concentrations and working levels between three stations shows strong dependence on wind direction and velocity. Radon concentrations and working-level distributions for each month and each station were analyzed. The average maximum, minimum, and modal concentration and working levels were estimated with observed frequencies. The highest concentration is 11,000 pCi/cu m on the tailings. Working-level variations parallel radon variations but lag by less than one hour. The highest working levels were

observed at night when conditions of higher secular radioactive equilibrium for radon daughters exist. Background radon concentration was measured at two stations, each located about 25 km from the mill, and the average is 408 pCi cu m. Average working-level background is 3.6 X 10(E+3). (Auth)

RADON 222; RADON DAUGHTERS; AIR; MEASUREMENTS; URANIUM; MILLS; TAILINGS; STRATIGRAPHY; HYDROLOGY; METEOROLOGY; WORKING LEVELS; WINDS; SEASONS; BACKGROUND RADIATION; ORES

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Vegetating the Uranium Mine Tailings at Elliot Lake, Ontario. Journal of Soil and Water Conservation 32(4):171-174. (1977, July-August)

Pyritic uranium tailings near Elliot Lake, Ontario, were revegetated with a surface application of limestone (2.24 kg/sq m) to neutralize acidity and fertilizers to compensate for the lack of nutrients and a very low cation exchange capacity. No supplemental organic matter or top soil was applied. Twenty-four grasses, legumes, and annuals were seeded in field plots, 6 m by 3 m. Six grasses and three legumes persisted over four growing seasons. Species selection was based on herbage yield, percent groundcover, and field observations. Reed canary grass proved to be the most successful species, but a mixture of creeping red fescue with redtop or Kentucky bluegrass seemed preferable because of its superior sod-forming abilities. Legumes performed so poorly that their incorporation in seed mixtures is not recommended. The estimated cost of a seeding program is $6250/hectare. This cost estimate involves site preparation, establishment of vegetation, and maintenance of vegetation for four years. (Auth)(RAF)

REVEGETATION; URANIUM; MINING; TAILINGS; LIMESTONES; FERTILIZERS; GRASSES; LEGUMES; COST ESTIMATES

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Nielson, K.K., R.W. Perkins, L.C. Schwendiman, and W.I. Enderlin Battelle-Pacific Northwest Laboratories, Richland, WA

Prediction of the Net Radon Emission From a Model Open Pit Uranium Mine. NUREG/CR-0628; PNL-2889 Rev; 21 pp. (1979, September)

Radon emission from a model open pit uranium mining operation has been estimated by applying radon exhalation fluxes measured in an open pit uranium mine to the various areas of the model mine. The model mine was defined by averaging uranium concentrations, mine dimensions, production and procedural statistics for eight major open pit uranium mines in the Casper, Wyoming area. Active mining in the mode open pit uranium mine caused net radon releases of approximately 200 Ci/yr, compared to 220 Ci/yr naturally exhaled radon from the 6 sq km mine area. In terms of annual reactor fuel requirements, this is equivalent to 630 Ci/Reference Reactor Year (RRY) (182 tons U3O8/RRY). Radon releases would continue at the reduced rate of approximately 1400 Ci/yr after the 17-yr lifetime of the mine, assuming no changes in the physical environment with time. This may be compared with 260 Ci/yr naturally exhaled radon from an equivalent undisturbed 7 sq km area. The continuing radon releases due to the model mine were equivalent to 26 Ci/yr per RRY produced by the mine (182 tons U3O8/RRY). (Auth)(RAF)

THEORETICAL STUDIES; PREDICTIONS; RADON 222; URANIUM; MINES; MODELS; PITS; CALCULATIONS; OVERBURDEN; EMANATION

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Radium-226 Concentrations in the Hydrographic Basins Near Uranium Mining and Milling in Brazil. EPA 520/3-79-002; Low-Level Radioactive Waste Management, J.E. Watson, Jr., (Ed.), Proceedings of Health Physics Society Twelfth Midyear Topical Symposium, Williamsburg, VA, February 11-15, 1979. U.S. Environmental Protection Agency, Washington, DC, (pp. 337-350), 540 pp. (1979, May)

A monitoring survey of the Ra 226 concentrations in river waters in the vicinity of the mining area and future milling facilities in the Pocos de Caldas region began in January 1977. The objective of the monitoring survey is to establish a baseline to allow future comparisons between the

Ra 226 concentrations in waters of the hydrographic basins of the Pocos de Caldas plateau before and after the beginning of full scale commercial operations. Open pit mining started in July 1977 in the uranium deposits of Campo do Cercado, but the main uranium body has not been reached yet. Seasonal variations in riverflow are apparently accompanied by little variations in the Ra 226 concentrations in river waters. A crude calculational dosimetric model is in the process of being developed to estimate annual dose equivalent to an individual from Ra 226 via drinking water and irrigation patterns as a first step to calculate the collective dose equivalent commitment to the population of the Pocos de Caldas plateau and surroundings. (COMPLETE TEXT)

This paper contains maps, tables, charts, and graphs of Ra 226 in the water and the sampling techniques used.

MONITORING; SAMPLING; RADIONUCLIDES; MILLING; MINING; DOSE RATE; MODELS

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Public Health Service, Denver, CO

Stream Surveys in Vicinity of Uranium Mills. 4. Area of Shiprock, New Mexico, November 1960. PB-260 290; 23 pp. (1962, December)

An eight-day field survey was undertaken in the Shiprock, New Mexico area during November 1960 to determine the extent of pollution of the many seeps and drainages to the San Juan River from the general area of the Shiprock uranium mill. The quality of river water above and below Shiprock and of the water supplies for the town of Shiprock and the Navajo Helium Plant were also determined. This survey was a follow-up to determine residual effects of an accidental spill of toxic wastes released from the Shiprock uranium mill in August, 1960. Water quality conditions were evaluated on the basis of radiological, chemical and biological data collected in the study area. The proximity of a number of seeps to the Kerr-McGee uranium mill and the relatively high chemical and radioactivity content of seepage indicated that the source of this seepage was the tailings and/or barren liquor ponds at the mill. The radioactivity range of the various seepages and mill drain effluent were 17 to 860 uuc/l alpha activity, 150 to 1600 uuc/l beta activity, 340 to 4800 ug/l U and 0.2 to 5.0 uuc/l Ra 226. Seep and drain liquors were relatively high in levels of various chemical constituents (sulfates, nitrates, total dissolved solids). Radioactive and chemical pollution of the river by direct surface discharge of the seeps and mill discharge were negligible under conditions prevailing at the time of survey. Radioactivity levels in all water and sediment samples collected from the San Juan River above and below Shiprock were in the range of background. The bottom fauna population in the San Juan River immediately below Shiprock was in a state of recovery from the 1960 uranium mill spill. (RAF)

RADIOLOGICAL SURVEYS; URANIUM; MILLING; EFFLUENTS; STREAMS; RIVERS; SEDIMENTS; WATER QUALITY; BIOTA; CHEMICALS; ALPHA PARTICLES; BETA PARTICLES; RADIUM 226; BIOTA; SULFATES; NITRATES

542
Raicevic, D. Canada Centre for Minerals and Energy Technology, Ore Processing Laboratory, Ottawa, Canada

Decontamination of Elliot Lake Uranium Tailings. The Canadian Mining and Metallurgical Bulletin, August 1, 1979; 7 pp. (1979, August)

After more than 93% of the uranium is extracted from Elliot Lake uranium ores by a sulfuric acid leaching process, the leach residue (tailings) contains small amounts of uranium and radioactive isotopes, particularly radium 226, which is the most serious health hazard. Heavy metal components and pyrite are also present, along with the gangue minerals. Currently, over 1000 acres of the Elliot Lake area are covered with these tailings which contain over five million tons of pyrite. Because of constant oxidation of the pyrite by bacteria (thiobacillus) and the presence of moisture, pyrite slowly generates sulphuric acid, which steadily leaches the metal-bearing constituents from the tailings. The seepage-flows of the dissolved contaminants, although often quite low in volume, have an environmental impact on the Elliot Lake area. Although these seepages are treated and most of the contaminants removed and impounded, a small amount of the radioactive contaminants reaches Lake Huron via the Serpent River. This paper describes a flotation approach for treatment of the Elliot Lake uranium tailings to produce new, decontaminated tailings practically free of pyrite with radium, thorium and uranium contents considerably reduced. The decontaminated tailing produced, which comprises about 75% by weight of the current uranium tailings, appears to be suitable for mine backfill. Because mine backfilling normally uses about 50% of the plant tailings, the surface storage of about half of the uranium tailings, therefore, would be eliminated by this process. Mine backfilling would also increase the mine production and thus enlarge the over-all uranium resources due to recovery of the ore from pillars. The pyrite concentrate produced from the current uranium tailings would be suitable for sulfuric acid production. The possibility of uranium recovery, and disposal of radium and thorium from the concentrates produced, is now being studied. (Auth)(RAF)

DECONTAMINATION; URANIUM; ORES; TAILINGS; BACKFILLING; RADIUM 226; THORIUM; PYRITE; METALS; MINERALS; SULFURIC ACID; LEACHING; ENVIRONMENTAL IMPACTS

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Rogers, V.C., R.F. Overmyer, and C.R. Varley Ford, Bacon and Davis Utah Inc., Salt Lake City, UT

Engineering Evaluation of the Decommissioning of Former Uranium Ore Processing Facilities. IAEA-SM-234/24; Decommissioning of Nuclear Facilities, Proceedings of an International Symposium, Vienna, Austria, November 13-17, 1978. International Atomic Energy Agency, Vienna, (pp. 411-431), 694 pp. (IAEA-SM-234/24). (1979)

The United States Department of Energy has sponsored engineering services relating to the decommissioning and reclamation of former uranium ore milling and processing facilities. The engineering services are divided into two stages: Title 1 and Title 2. The Title 1 services include: an engineering assessment of existing conditions, estimations of types, areas and volumes of radioactive materials, assessment of building decontamination or demolition efforts, the estimation of potential environmental impacts and the determination of various decommissioning and reclamation alternatives, including cost. The Title 2 services include the preparation of detailed plans and specifications for implementing the selected reclamation alternatives. Reports have been issued for the Title 1 effort on 22 inactive uranium milling sites in eight western states. The amount of tailings and contaminated material estimated at the sites ranges from 40,000 to 2,470,000 t. In some cases, the environmental and health impacts dictate that the tailings and contaminated materials be removed from their current location to alternative long-term storage sites. Alternate sites were located based upon remoteness from populated areas, satisfactory hydrological conditions, availability of cover material, and present and future use of the land. Where on-site storage is considered practical and at alternate storage locations, the tailings and contaminated materials will be covered with physical stabilization materials such as clay, soil, and gravel or riprap to reduce gamma radiation to background rates, to reduce radon exhalation, and to eliminate the further spread of contaminated materials. (Auth)

URANIUM; ORES; MILLING; DECOMMISSIONING; RECLAMATION; WASTE VOLUME; BUILDINGS; DEMOLITION; ENVIRONMENTAL IMPACTS; COSTS; TAILINGS; HEALTH EFFECTS; DISPLACEMENT; HYDROLOGY; STABILIZATION, PHYSICAL; WASTE STORAGE; SOILS; RADIATION, GAMMA; RADON

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Rogers, V.C., G.M. Sandquist, and J. Byrne IRT Corporation, University of Utah, Salt Lake City, UT

Leaching of Radioactive Materials at the Salt Lake City Uranium Mill Tailings Site. Transactions of the American Nuclear Society 21:94. (1975)

The extent of contamination to the ground was determined at the old Vitro Mill site. Between the years 1951 and 1964 the mill processed 1.7 million tons of uranium ore and the tailings were distributed over 96 acres. The major hazard is the presence of Ra 226 and its daughters. Since the pile is near industrial and residential areas a recommendation has been made to move the pile. Also the dirt beneath the pile must be moved as a result of leaching. Core samples were taken to the depth of 9 feet in soil that is a moderately wet sand for the first 3 feet, a very wet sand-clay mixture for the next two feet, and a drier sand-clay below 5 feet. Core samples were taken in 1973 and 1975, and both showed significant activity to the depth of 5 ft. The activity was higher in the 1975 cores, and particularly in the 2 to 4 and 5 to 6 ft intervals. The increased activity is probably a reflection of additional surface and near-surface water in the region. Soil samples from the 1975 cores contained significantly more moisture than the corresponding cores from 1973. From the curves Rn 222 also had the same distribution as Ra 226. (NDV)

RADON; CONTAMINATION; DECONTAMINATION; DISPOSAL SITE; LEACHING; REACTOR CORES; SOILS, SANDY CLAY; TAILINGS; FIELD STUDIES; WASTES, RADIOACTIVE; WASTES, GASEOUS; SAMPLING; MOISTURE; DECOMMISSIONING

545

Travis, C.C., S.J. Cotter, A.P. Watson, M.L. Randolph, L.M. McDowell-Boyer, and D.E. Fields Oak Ridge National Laboratory, Health and Safety Research Division, Oak Ridge, TN

A Radiological Assessment of Radon-222 Released from Uranium Mills and Other Natural and Technologically Enhanced Sources. NUREG/CR-0573; ORNL/NUREG-55; 216 pp. (1979, February)

This report presents estimates of radiation exposure and dose commitment resulting from unit (1 kCi/year) and estimated total annual releases of Rn 222 at each of 4 generic uranium mill sites in the western United States. The study population included residents of the United States, Canadian, and Mexican land area between 20 and 60 degrees N latitude. The study was done in support of the U.S. Nuclear Regulatory Commission's Generic Environmental Impact Statement on Uranium Milling. Inhalation of Rn 222, its short-lived daughters, and Pb 210 (including primary and resuspended Pb 210 and resuspended Po 210 for 100 years following release) and ingestion of deposited Pb 210 were evaluated. Methodologies were developed to account for ingestion of both Pb 210 deposited on soil or vegetation during the release year and the Pb 210 persisting in soil during the post-release period. Annual ingestion exposures to the study population were calculated for the period 1978-2078. For comparative purposes, the report also contains estimates of inhalation population exposure and dose to the United States population in 1978 due to other natural and technologically enhanced sources of Rn 222. The sources considered were natural soil, evapotranspiration, agricultural soils, potable water supplies, building materials, natural gas, liquified petroleum gas, uranium and nonuranium mining, geothermal sites, coal-fired power plants, phosphate fertilizer use, and wells. Inhalation and ingestion of Pb 210 was not considered in these comparative estimates. (Auth)

RADON 222; URANIUM; MILLING; MINING; EMANATION; INHALATION; RADON DAUGHTERS; LEAD 210; POLONIUM 210; FOODS; INGESTION; SOILS; VEGETATION; EXPOSURE, POPULATION; RADIATION DOSE; GEOTHERMAL RESOURCES; AIR; DOSE COMMITMENT; EVAPORATION;TRANSPIRATION; AGRICULTURE; DRINKING WATER; BUILDING MATERIALS; NATURAL GAS; GASES; LAND USE; TILLING; FOSSIL-FUEL POWER PLANTS; FERTILIZERS; PHOSPHATES; WELLS; RESUSPENSION; DIFFUSION; MODELS; PETROLEUM

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U.S. Atomic Energy Commission, Fuels and Materials, Directorate of Licensing, Washington, D.C.

Uranium Milling. Part of Environmental Survey of the Nuclear Fuel Cycle, (pp. B-1 - B-27), 333 pp. (1972, November)

In the milling operation, uranium is extracted from the ore and is concentrated as a semi-refined U3O8 product called "yellow cake", which is the fuel material for the production of uranium hexafluoride. A description is given of the mechanical and chemical processes involved in the milling operation and the acid leach process has been selected as the model for describing the milling operation in the fuel cycle. The principal environmental considerations are natural resource use, effluents and accidents. The low level radiological airborne emissions consist of uranium and uranium daughter products. Conservative estimates of dispersion in the atmosphere predict site boundary concentrations in the range of less than 1 percent to 14 percent of the limits of 10 CFR 20. Liquid and solid chemical and radiological wastes are discharged to the tailings retention pond, and no significant adverse effect on the off-site environment is involved. After the model plant is decommissioned, the pond area is graded, covered with earth and restored for limited use. (FMM)

URANIUM; ORES; EFFLUENTS, RADIOACTIVE; ACCIDENTS; WASTES, RADIOACTIVE; MODELS; ENVIRONMENT; TAILINGS; LAND USE; HAZARD ANALYSIS

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U.S. Department of Energy, Assistant Secretary of the Environment, Environmental Control Technology Division, Office of Environmental Compliance and Overview

Annual Status Report on the Inactive Uranium Mill Tailings Sites Remedial Action Program. DOE/EV-0060; 185 pp. (1979, December)

This first annual status report includes a brief summary of conditions and activities preceding enactment of legislation for the remedial action program of inactive uranium mill tailings sites, a description of program progress to date, and a forecast of activities to be accomplished during the next year. Assessments of inactive uranium mill tailings sites in the United States led to the designation of 25 processing sites for remedial action under the provisions of Section 102(a) Public Law 95-604. Under the provisions of Section 102(b), the Department of Energy assessed the potential health effects to the public from the residual radioactive materials on or near the 25 sites; and, with the advice of the Environmental Protection Agency, the Secretary established priorities for performing remedial action. The 25 sites, their locations, and remedial action priorities are listed in a table. In designating the 25 sites and establishing the priorities for performing remedial action, the Department of Energy consulted with the Environmental Protection Agency, Nuclear Regulatory Commission, Department of the Interior, governors of the affected states, Navajo Nation, and appropriate property owners. Public participation in this process was encouraged through the publication of two Federal Register notices, two press releases, and public meetings held by three affected states and local governments. During Fiscal Year 1980, the Department of Energy will be conducting surveys to verify the radiological characterization at the designated processing sites; developing cooperative agreements with the affected states; and initiating the appropriate National Environmental Policy Act documentation prior to conducting specific remedial actions. (RAF)

URANIUM; MILLING; TAILINGS; RESIDUAL ACTIVITY; DOCUMENTATION; PROGRAMS, GOVERNMENT; RADIOLOGICAL SURVEYS; COSTS; REPROCESSING; LEGAL ASPECTS; SITE SELECTION

548
U.S. Department of Energy, Grand Junction Office

Progress Report on the Grand Junction Uranium Mill Tailings Remedial Action Program. DOE/EV-0033; 115 pp. (1979, February)

This report on the remedial action program at Grand Junction, Colorado is for the purpose of fulfilling the requirements of Public Law 95-236, effective February 21, 1978, and also to address specific items requested in a June 21, 1978, report by the Comptroller General of the United States. The report provides a history of the program, an analysis of the current status of the program, problems encountered and measures being taken to solve them, and a forecast of future effort required. From the start of remedial efforts in 1973 through September 30, 1978, remedial action has been done on 325 individual structures, including 289 private residences, 14 schools, and 22 commercial business/church locations. As recently as one year ago, the total number of structures requiring remedial action was estimated to be about 600. However, continuing measurements of radon daughter concentrations in structures which previously showed only slightly elevated gamma radiation have resulted in identification of additional structures exceeding the Surgeon General's guidelines for radon daughters. Because radon daughter concentrations in structures are highly variable depending on the season of the year and the level of activity, annual averages are used for determining eligibility under the guidelines. Based on this recent experience the estimate of the total number of structures which will eventually qualify for remedial action has been increased from 600 to 800, and the estimated total program cost has been increased from $12,670,000 to $15,960,000. It must be emphasized that these estimates are based only on experience ratios of past measurements and are highly uncertain. It is not expected that further funding, if necessary, will be required before fiscal year 1982. (Auth)

URANIUM; MILLING; TAILINGS; RADON DAUGHTERS; RADIATION, GAMMA; COST ESTIMATES; SEALING; DISPLACEMENT; VENTILATION; FILTRATION; COSTS; LEGAL ASPECTS; BUILDINGS; INSTRUMENTATION; CONSTRUCTION

549
U.S. Nuclear Regulatory Commission; U.S. Department of the Interior, Geological Survey; U.S. Department of Agriculture, Forest Service

Draft Environmental Statement related to the Rocky Mountain Energy Company's Bear Creek Project (Converse County, Wyoming). (19 7, January)

ENVIRONMENTAL IMPACT STATEMENTS; URANIUM; MINING; MILLING

550
U.S. Nuclear Regulatory Commission, Office of Standards Development, Washington, DC

Design, Construction, and Inspection of Embankment Retention Systems for Uranium Mills. NRC Guide 3.11 (Rev. 2); 9 pp. (1977, December)

This guide describes some engineering practices and methods generally considered satisfactory for the design, construction, and inspection of earth and rockfill embankments used for retaining uranium mill tailings. They result from review and action on a number of specific cases and reflect the latest general approaches to the problem that are acceptable to the NRC staff. It is important that design analysis consider stability, settlement, seepage, and hydrologic analyses. Specifically, the design needs to ensure that retention dam failure should not occur. Construction methods for mill tailings dams are closely related to the planning and operation of the mill. Where a tailing embankment is constructed in a single stage of natural borrow materials or overburden and waste rock, conventional procedures for earth and rock-fill dams can be used. Where a tailing dam is constructed in stages, one of the following three methods is used: a) upstream method, b) downstream method, or c) centerline method. A continuous program of inspection is needed, beginning with the start of construction, through the tailing disposal, and continuing after abandonment of the completed system. (RAF)

REGULATIONS, FEDERAL; URANIUM; MILLS; TAILINGS; DESIGN; CONSTRUCTION; INSPECTIONS; DAMS; STABILIZATION, PHYSICAL; HYDROLOGY; SEEPAGE; OVERBURDEN; SOILS; ROCKS; RUNOFF; SEISMOLOGY; MAINTENANCE; INSTRUMENTATION

551
U.S. Nuclear Regulatory Commission, Washington, DC

Draft Generic Environmental Impact Statement on Uranium Milling. NUREG-0511 (Vols. 1-2); 450 pp. (1979, April)

The principal objectives of the statement have been as follows: to assess the nature and extent of the environmental impacts of uranium milling in the United States from local, regional, and national perspectives on both short- and long-term bases, to determine what regulatory actions are needed; more specifically, to provide information on which to determine what regulatory requirements for management and disposal of mill tailings and mill decommissioning should be; and to support any rule makings that may be determined to be necessary. Volume 1 contains the summary and text, and volume 2 contains the supporting appendices.

ENVIRONMENTAL IMPACT STATEMENTS; URANIUM; MILLING; ENVIRONMENTAL EFFECTS; WASTE DISPOSAL; DECOMMISSIONING; RADIOACTIVITY

CONTAMINATED SITE RESTORATION

552
Decontamination and Decommissioning. Division of Environmental Control Technology Program, 1977, (pp. 101-132). (1978, June)

Brief summaries are given of individual projects under the following four programs: management of Surplus Radioactively Contaminated DOE Facilities; Remedial Action at Formerly Utilized Manhattan Engineer District and Atomic Energy Commission contractor sites; remedial action for inactive uranium mill tailings sites; and Grand Junction remedial action.

DECOMMISSIONING; DECONTAMINATION; FEED MATERIALS PLANTS; TAILINGS; NUCLEAR FACILITIES; RADIATION MONITORING; WASTE DISPOSAL; WASTES, RADIOACTIVE; BURIAL

553
McMurdo Sound Cleanup. Nuclear Engineering International 22(263):39. (1977, October)

Final cleanup of the nuclear power station site at McMurdo Sound in Antarctica will take place this coming southern summer. It will be followed by an extensive site survey by an independent agency to verify that the dismantling of this US-built PM-3A plant has been accomplished in accordance with the provisions of the antarctic treaty.

PM-3A REACTOR; REACTORS, PWR; DECOMMISSIONING; DECONTAMINATION

554
Ahlquist, A.J., A.K. Stoker, and L.K. Trocki Los Alamos Scientific Laboratory, Los Alamos, NM

Radiological Survey and Decontamination of the Former Main Technical Area (TA-1) at Los Alamos, New Mexico. 201 pp. (1977, December)

A radiological survey was conducted on the undeveloped portions of the site of the former Main Technical Area (TA-1) of the Los Alamos Scientific Laboratory in north-central New Mexico. Between 1943 and 1965, research work on nuclear weapons was carried out in TA-1. The area was decontaminated and demolished in stages, and beginning in 1966 the land was given to Los Alamos county or sold to private interests. The survey disclosed traces of radioactive contamination undetected or considered insignificant during original demolition in the 1950s and 1960s. The remaining contamination was removed in 1975 and 1976 to levels considered to pose no health or safety hazards and, further, to the lowest levels considered practicable. Methods used in the survey included measurement techniques for detecting alpha emitters such as uranium and plutonium, extensive surface and subsurface soil sampling, and use of conventional health physics instrumentation to provide detailed information on approximately 16 hectares (40 acres) of land. As a result of the decontamination efforts, approximately 15,000 cu m of contaminated or potentially contaminated material was removed to an approved radioactive waste disposal site on ERDA property. Full details of the methods, findings, decision criteria, and as-left conditions are documented. (Era citation 03:025122)

NUCLEAR FACILITIES; ALPHA PARTICLES; RADIATION DETECTORS; CONTAMINATION; DECOMMISSIONING; DECONTAMINATION; LAND USE; PLUTONIUM; RADIATION MONITORING; WASTE DISPOSAL; URANIUM

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Boyns, P.K. EG and G, Inc., Las Vegas Area Operations, Las Vegas, NV

An Aerial Radiological Survey of the Area Surrounding the Monticello and Elk River Nuclear Power Plants (Monticello and Elk River, Minnesota). EGG-1183-1659; 21 pp. (1977, January)

An aerial radiological measuring system was used to survey an extensive area surrounding the Elk River and Monticello Nuclear Power Stations in May 1972. The two reactors are approximately ten miles apart. The detection system onboard an aircraft collected gamma-ray cross-count and energy spectral data on each flight line of the survey. The information was processed by a computer to construct a 625-square mile area map which shows the distribution of gamma-ray exposure 1 meter above the ground. The 1 meter level exposure rates mapped were mostly in the 8 to 10 ur/hr range. The exposure rates and radionuclides present were consistent with normal terrestrial background. The Elk River area was previously surveyed in 1968 (before shutdown), the Monticello area in 1970. Comparison of the 1970 and 1972 Monticello data showed no measurable changes in gamma exposure rates. (RAF)

RADIATION MONITORING; ELK RIVER REACTOR; MONTICELLO REACTOR; RADIATION, GAMMA; MEASUREMENTS; AIR; MAPS; RADIONUCLIDES; BACKGROUND RADIATION; REACTORS, BWR; NUCLEAR POWER PLANTS; RADIOLOGICAL SURVEYS

556
Consumers Public Power District

Final Site Radiation Survey for Decommissioned Hallam Nuclear Power Facility. IWL-9885-201; DOCKET 115-3; Letter to AEC Div. of Reactor Licensing from Consumer Public Power District; 39 pp. (1970, February 9)

Contains results of final site radiation survey and its immediate environs completed in accordance with procedures issued 10/06/69. The survey utilized techniques and equipment, consistent with good health physics practice. Survey included site buildings and the grounds within one-quarter mile distance from center line of reactor vessel and the liquid-effluent drainage system.

REACTORS, GRAPHITE MODERATED; HALLAM REACTOR; LICENSE STATUS; REACTORS, LMCR; REACTORS, POWER; DECOMMISSIONING; RADIOLOGICAL SURVEYS

557
Dickson, H.W., and W.D. Cottrell Oak Ridge National Laboratory, Oak Ridge, TN

Radiological Assessment of Decommissioned Nuclear Facilities. 10th Midyear Health Physics Society Symposium, New York, New York, October 11, 1976 (6 pp.). (1976)

A radiological survey of the former Middlesex Sampling Plant, Middlesex, New Jersey, has been completed. The surveyed property served as a uranium ore sampling plant during the 1940's and early 1950's. It was released for unrestricted use in 1967 following a radiological survey by the Atomic Energy Commission and is now a reserve training center for the U.S. Marine Sixth Motor Transport Battalion. The present survey was undertaken to determine whether the existing radiological status of the property is consistent with current health standards and radiation protection practices. The radiological survey included measurement of residual alpha, beta, and gamma contamination levels, radon and radon daughter concentrations in buildings, external gamma radiation levels on the site and on adjacent property, and radium concentrations in soil on the site and on adjacent property. (ERA citation 02:023292)

BUILDINGS; NUCLEAR FACILITIES; SOILS; AIR; URANIUM; ALPHA PARTICLES; BETA PARTICLES; CONTAMINATION; DAUGHTER PRODUCTS; DECOMMISSIONING; ENVIRONMENT; RADIATION, GAMMA; RADIATION MONITORING; RADIATION PROTECTION; RADIOACTIVITY; RADON; SAMPLING; TIME FACTOR; URANIUM ORES; REACTORS, TEST

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Dickson, H.W., G.S. Hill, and P.T. Perdue Oak Ridge National Laboratory, Oak Ridge, TN

Weldon Spring Dose Calculations. Report; 30 pp. (1978, September)

In response to a request by the Oak Ridge Operations (ORO) Office of the Department of Energy (DOE) for assistance to the Department of the Army (DA) on the decommissioning of the Weldon Spring Chemical Plant, the Health and Safety Research Division of the Oak Ridge National Laboratory (ORNL) performed limited dose assessment calculations for that site. Based upon radiological measurements from a number of soil samples analyzed by ORNL and from previously acquired radiological data for the Weldon Spring site, source terms were derived to calculate radiation doses for three specific site scenarios. These three hypothetical scenarios are: a wildlife refuge for hunting, fishing, and general outdoor reaction; a school with 40 hr per week occupancy by students and a custodian; and a truck farm producing fruits, vegetables, meat, and dairy products which may be consumed on site. Radiation doses are reported for each of these scenarios both for measured uranium daughter equilibrium ratios and for assumed secular equilibrium. Doses are lower for the nonequilibrium case. (ERA citation 04:004433)

DECOMMISSIONING; FEED MATERIALS PLANTS; HUMAN POPULATIONS; SOILS; SURFACE WATERS; RADIATION HAZARDS; LAND USE; RADIATION DOSE; RADIATION MONITORING; RADIOACTIVITY; RADIONUCLIDE MIGRATION; RADIUM 226; SAMPLING; THORIUM 230; THORIUM 232; TIME FACTOR; URANIUM 235; URANIUM 238

559
Dorian, J.J., and V.R. Richards United Nuclear Industries, Inc., Richland, WA

Radiological Characterization of the Retired 100 Areas. Report; 458 pp. (1978, May 26)

A study was conducted to establish radionuclide inventories and concentrations in the retired 100 Area radioactive solid and liquid waste disposal facilities, leakage areas, reactors, and associated facilities. The data are intended to aid in establishing the long-term disposition and control procedures for these facilities. The purpose of the long-term controls would be to place all facilities in a stable condition such that the possibility of polluting the environs with radioactive material or of affecting the local ecology through radiation exposure is minimized. Adequate short-term control of the contaminated deactivated 100 Area facilities and disposal sites has been established. Maintaining this radiological control requires an ongoing maintenance/surveillance program. Costs associated with this maintenance/surveillance program are expected to increase due to facility deterioration. Future stabilization and/or removal attempts to establish long-term contamination controls will be dependent upon the definition of radiological release criteria for future decommissioning activities at Hanford. Guidance on acceptable levels of surface contamination is provided in AEC Regulatory Guide 1.86 "Termination of Operating Licenses for Nuclear Reactor." Only limited guidance has been provided on acceptable activity levels when radionuclides are uniformly distributed in some matrix. Battelle-Northwest is establishing radiological release criteria for future decommissioning activities at Hanford as part of the "Disposition of Retired Contaminated Facilities at Hanford" study. Based on dose calculations, radiological release criteria are being derived that will provide long-term public protection from any residual contamination remaining in decontaminated facilities. (ERA citation 03:056655)

WASTE MANAGEMENT; DECOMMISSIONING; INVENTORIES; MAINTENANCE; RADIATION MONITORING; RADIATION PROTECTION; WASTE STORAGE; ISOTOPES

560
Ebasco Services, Incorporated, New York, NY

Postdecommissioning Monitoring Feasibility Study for Radioactive Waste Repositories in Rock Salt Formations. Report; 45 pp. (1977, September)

A preliminary evaluation of the postdecommissioning monitoring of a radioactive waste repository facility established in bedded or domal salts has been performed. The results of the study indicate that while some general conclusions as to monitoring feasibility can be made, any detailed evaluation of monitoring program effectiveness must be based upon evaluations performed for a specific site. A wide range of presently available instrument packages could be deployed in surface, borehole, or buried locations to monitor key radiological, geological, and hydrological properties of the repository and its surroundings after decommissioning. If sufficient sensitivity can be obtained, these measurements, when correlated with analytical modeling results, could provide a description of repository integrity, allowing further extrapolations of expected behavior. Definitive projections of sensitivity and thus the applicability of presently available instrumentation cannot be made, however, without reference to specific site characteristics or without the benefit of regulatory criteria. Owing to reliability considerations and technological limitations, it appears that any monitoring program should be based upon sensors located either at the surface or in accessible boreholes or subsurface galleries which do not penetrate the repository containment strata. Because of this feature of retrievability of the sensing devices such a system could be maintained for an indefinite period of time. It is recommended that plans for postdecommissioning monitoring be given further consideration during the specification of site investigation and preoperation programs. Particular effort should be expended in (1) developing regulatory criteria appropriate to the decommissioned repository, (2) defining what constitutes a significant variation in monitorable parameters, and (3) comparing these variations and regulatory criteria with instrument sensitivities under actual site conditions.

BOREHOLES; DECOMMISSIONING; EVALUATION; RADIATION MONITORING; WASTES, RADIOACTIVE; WASTE STORAGE; LOGGING, RADIOACTIVITY; RESEARCH PROGRAMS; SALT DEPOSITS; NUCLEAR FACILITIES

561

Eberline Instrument Corporation, Santa Fe, NM

Rulison Radiation Contamination Clearance Report. PNE-R-68; 49 pp. (1977, June)

Cleanup work for Project Rulison, which was designed to determine the potential increase in production by using a nuclear explosive to stimulate and enhance natural gas recovery in the Mesaverde formation of the Rulison Field, Garfield County, Colorado, commenced on July 10, 1972, and was completed on July 25, 1972. The purpose was to decontaminate, if necessary, and remove from the site all equipment and materials not needed for possible future gas production. The task was accomplished and the radiological condition of the site was documented by extensive instrumentation and soil sampling techniques. Since then neither the Austral Oil Company nor ERDA, which were co-sponsors of the project, have any plans to commercially produce the available chimney gas. Accordingly, during the period September 1, 1976 through October 12, 1976, both the emplacement well, where the explosive was detonated, and the re-entry well, for production testing, were plugged and abandoned, and the equipment that remained after the 1972 general cleanup was decontaminated if necessary, and removed from the site. No burial of radioactive solids was attempted at the Rulison site. Radioactive nuclide particulates resulting from the detonation are contained in the detonation-formed cavity. On October 4, 1976, 0.166 Ci of tritium in waste water and drilling mud were pumped into the Mesaverde formation at a depth of approximately 5300 to 5800 feet for disposal. It should be noted that the potable aquifers above this depth were previously cemented off during emplacement drilling. Tritium contaminated material and soil resulting from the general and the final cleanups were shipped to Beatty, Nevada for burial at the Nuclear Engineering Company facility. The total amount of tritium shipped to burial as a result of both the general and final cleanup operations was estimated to be 0.781 Ci. No other radioactive nuclide was involved in either cleanup. All personnel participating in the general cleanup in July 1972 wore thermoluminescent dosimeters. During the final cleanup, only technicians who might be required to work with radiation calibration sources were required to wear these dosimeters. Concentrations of the contaminant, where detected, were in most cases negligible and in no case greater than a fraction of the guideline. There is nothing to prevent the Rulison site from being returned to unrestricted use, subject to applicable subsurface drilling restrictions. (Auth)(JMF)

The document contains a large table of tritium sampling at different soil depths. Also, several maps of areas where soil samples were taken.

DECONTAMINATION; DECOMMISSIONING; EQUIPMENT; TRITIUM; SAMPLING; PERSONNEL; WASTE DISPOSAL; WASTES, RADIOACTIVE; WASTES, SOLID; WASTES, LIQUID; EXPLOSIONS, NUCLEAR; SOILS

562

General Electric Company, Pleasanton, CA

Technical Specification Changes to Provide for Non-Reactor Activities. Amendment 16 to EVESR License; DOCKET 50-183; 6 pp. (1969, October 16)

Modified tech specs to redefine EVESR plant area in order to provide for conduct of non-reactor oriented activities. The facilities and activities requiring continued regulation will be consolidated into one building. (Reactor was shutdown in 1967.)

REACTORS, INTERNAL SUPERHEAT; SPECIFICATIONS; DECOMMISSIONING

563

General Electric Company, San Jose, CA

Esada Vallecitos Experimental Superheat Reactor Proposed Amendment 15-Utilization of Dismantled EVESR Components. DOCKET 50-183; 7 pp. (1967, December 20)

Proposed Amendment 14 requested license termination. Proposed Amendment 15 proposes a second course of action since license termination does not appear possible at this time. The reactor has been deactivated and defueled. GE wishes to make nonreactor use of the facility, including making various tests and experiments on the components and systems. The only significant source of radioactivity is the pressure vessel, and no experiments are planned for it. Administrative control will be similar to that for an operating reactor.

REACTORS, BWR; REACTORS, INTERNAL SUPERHEAT; VALLECITOS EXPERIMENTAL SUPERHEAT REACTOR; DECOMMISSIONING

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Giardina, P.A., and J. Feldman U.S. Environmental Protection Agency Region II Jeanette Eng, Radiation Branch, New Jersey Department of Environmental Protection; U.S. Environmental Protection Agency Region II Radiation Branch

Recommendations for Remedial Action and Decommissioning of a Radioactive Waste Burial Site. EPA 520/3-79-002; Low-Level Radioactive Waste Management, J.E. Watson, Jr., (Ed.), Proceedings of Health Physics Society Twelfth Midyear Topical Symposium, Williamsburg, VA, February 11-15, 1979. U.S. Environmental Protection Agency, Washington, DC. (pp. 366-372). 540 pp. (1979, May)

For the past year, the Nuclear Fuel Services, Inc. (NSF) site located in West Valley, NY has been the subject of state and federal efforts to determine decontamination land decommissioning options. In 1978, the U.S. Environmental Protection Agency (EPA) issued Criteria for Radioactive Wastes for storage and disposal of all forms of radioactive wastes. Under an Atomic Energy Commission (AEC) license, NFS operated the only commercial fuel reprocessing facility in the U.S. As a result of the reprocessing activities, the site contains liquid high-level radioactive waste, buried cladding hulls and defective fuel elements, a spent fuel storage pool, and a low-level burial ground. Low-level radioactive material contained therein also comes from sources other than NFS's operations. The site received a license from the State of New York to perform low-level burial operations and radioactive material was buried until 1975. Studies of the low-level burial area show radioactive gases have leaked through the trench caps and the caps are more permeable than the surrounding soil allowing infiltration into the trenches. Active site maintenance is used to prevent trench water overflow through the trench caps. Work must now be done to assess the hazard potential of the radioactive material over time, to assure that the risk attributable to the site is adequately assessed, to assure the acceptability of the risk, and to assure that the controls at the site are adequate. This work may show that more remedial attention is needed at the site in the form of engineered barriers and safeguards to meet the proposed EPA criteria for radioactive waste. Upgrading monitoring and passive communications safeguards also seems desirable. (Auth)

DECONTAMINATION; DECOMMISSIONING; NUCLEAR FACILITIES; STANDARDS, FEDERAL; WASTES, RADIOACTIVE; WASTE MANAGEMENT; WASTE DISPOSAL; FUEL REPROCESSING; WASTES, HIGH-LEVEL; WASTES, LIQUID; WASTES, LOW-LEVEL; BURIAL TRENCHES; MAINTENANCE; HAZARD ANALYSIS; MONITORING

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Gilbert, K.V., E.M. Wright, and R.D. Madding Mound Laboratory, Miamisburg, OH

A Report on the Decontamination and Decommissioning of the Technical (T) Building at Mound Laboratory. MLM-2239; 24 pp. (1976, May 21)

The technical (T) building was used for separation and purification of polonium-210 isotope. A total of 32,400 sq ft was affected by the termination effort. This area housed 439 lin ft of gloveboxes, 236 of which were radioactively contaminated. Throughout the project span, six to eight skilled tradesmen were assigned to the termination effort. Total cost of the project, including standby maintenance of both restored and awaiting-restoration space was $2.157 million. Permanent walls, ceilings, and service areas were decontaminated to 2000 cpm before painting over was permitted.

DECONTAMINATION; POLONIUM; BUILDINGS; RADIOCHEMICAL PROCESSING; DECOMMISSIONING; COSTS; PERSONNEL; PROTECTIVE COVERING; JACOBS

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Goldsmith, W.A., F.F. Haywood, R.W. Leggett, W.D. Cottrell, M.T. Ryan, D.L. Anderson, D.J. Christian, R.W. Doane, B.S. Ellis, W.M. Johnson, and W.H. Shinpaugh Oak Ridge National Laboratory, Health and Safety Research Division, Oak Ridge, TN

Formerly Utilized MED/AEC Sites Remedial Action Program. Radiological Survey of the

St. Louis Airport Storage Site, St. Louis, Missouri. DOE/EV-0005/16; 119 pp. (1979, September)

The results of two radiological surveys of the St. Louis-Lambert Airport property, formerly known as the Atomic Energy Commission (AEC) Airport Storage Site, St. Louis, Missouri, are presented in this report. These surveys were conducted over the 21.7-acre area on which uranium- and radium-bearing waste materials were stored from the 1940's to the late 1960's. The surveys included direct measurements of beta-gamma radiation at the ground surface and external gamma radiation at 1 m above the ground throughout the site and adjacent drainage systems; determination of uranium, actinium, and radium concentrations in samples of soil from the surface and from holes bored at locations on and near the site; determination of radionuclide concentrations in groundwater and surface water samples; measurement of radon flux from the ground surface; and measurements of Rn 222 in air at accessible locations nearest the site. The second (or followup) survey was designed to support an environmental characterization survey and to provide a basis for comparison of changes in site conditions associated with known changes in topography. Results of these surveys indicate that some offsite drainage pathways are becoming contaminated, probably by runoff from the site; no migration of Rn 222 from the site was observed. This contamination is leading to exposures resulting from beta and gamma radiation and from the inhalation of radon and its short-lived daughters. Measurements made at the site indicate that, in several cases, such exposures exceed pertinent guidelines. In addition, construction of buildings on the site could produce exposures to radon and its daughters which greatly exceed guidelines. Consequently, some remedial measures are in order. (Auth)(RAF)

RADIOLOGICAL SURVEYS; DOSE RATE; BETA PARTICLES; RADIATION, GAMMA; SOILS; SAMPLING; RADON 222; GROUND WATER; BACKGROUND RADIATION; AIR; SURFACE CONTAMINATION; URANIUM 238; RADIUM 226; RESUSPENSION; SEDIMENTS; BOREHOLES; SURFACE WATERS; ACTINIUM 227; RUNOFF; THORIUM 230; LEAD 210

567

Gwiazdowski, B., J. Penskw, J. Jagielak, M. Biernacka, and K. Mamont-Ciesla Central Laboratory of Radiation Protection, Warsaw, Poland

Environmental Gamma Radiation Measurements in Nuclear Power Station Siting Studies in Poland. IAEA-SM-180/22; Environmental Surveillance Around Nuclear Installations, Proceedings of a Symposium, Warsaw, Poland, November 5-9, 1973. International Atomic Energy Agency, Vienna, Vol. 1 (pp. 89-104). (1974)

Good knowledge of the true conditions pertaining in the natural environment in a region considered for a nuclear power station site is an important requirement in siting procedures. The natural gamma background radiation of a particular region of a country is one of the distinctive factors defining the status of the environment. Monitoring of the gamma background dose-rate level permits control and evaluation of population exposure over wide areas, using comparatively simple measurement techniques. Over a three-year period, a program of field measurements using a portable high-pressure ionization chamber and an airborne monitor and with spectrometric evaluation of soil samples has been completed. The program of surface measurements comprised the survey of gamma background exposure dose rate at one meter above the ground a 100 measurement points distributed over a region of 40 km radius. The airborne monitor survey was made by recording the dose rate during flights on paralled paths 2 km apart. The dose rate was determined for ground level over a square net of points spaced at 2 km sides, which was the base used for drawing up the map of dose-rate distribution. The experience gained in this survey shows that the airborne radiometer survey is a quick method that enables a rapid assessment of the radiation field distribution over large areas of the country to be made, while ensuring continuity of the measurement to a great extent. Portable high-pressure ionization chambers give great accuracy when making radiation exposure dose measurement under field conditions. Spectrometric analysis of soil samples identifies the important isotopes and enables one to apportion the total radiation dose rate between them. The results obtained from the survey in the Zarnowiechie Lake area give a good picture of the level and distribution of the gamma background radiation field. The value of the dose rate is in general quite low - lying in the range from about 2 microrems/hour to about 10 microrems/hour. The comparison of results of measurements at the same points of three years shows good consistency. In our opinion the data that have been gathered provide a sufficient basis for future control of the environment both in the vicinity of the nuclear power station and in the surrounding region. This will make it possible to estimate any changes in the dose to the population living in the area. (Auth)(JMF)

This document contains a map of the area where the radioactive measurements were taken, and a scheme of how they were taken.

ENVIRONMENT; NUCLEAR FACILITIES; RADIATION DETECTORS; RADIATION, GAMMA; BACKGROUND RADIATION; SAMPLING; MONITORING; SPECTROMETRY; ISOTOPES; NUCLEAR POWER

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Harness, J.L., and J.D. McKinney EG and G Idaho, Inc., Idaho Falls, ID

Containment of Transuranic Contamination at the Early Waste Retrieval Project. TREE-1061; 29 pp. (1977, January)

This report documents the occurrence of transuranic contamination at Idaho National Engineering Laboratory's Early Waste Retrieval project and the consequent recovery from the contamination. On July 26, 1976, while retrieving buried transuranium waste under the Early Waste Retrieval Program, a corroded 55-gallon 17H drum was retrieved. When uprighted, several liters of liquid escaped from the drum. This liquid was contaminated with transuranics-principally Pu-239, Am-241, and some Pu-238. As a result of the spread of this contamination in the Operating Area Confinement, six working days were required to decontaminate the area. At no time did the contamination escape the interior of the Operating Area Confinement building. No contamination to personnel resulted from this occurrence, nor was a hazard presented to the general public. The facility was designed and constructed to contain the transuranic contamination resulting from such an occurrence. Proper prior planning and personnel training prevented the contamination occurrence from becoming a major event. This report details the occurrence, the recovery, and the information obtained from this event. (Auth)(RAF)

WASTES, TRANSURANIC; RETRIEVABILITY; DRUMS; LEAKAGE; FILTERS; PLUTONIUM 239; AMERICIUM 241; PLUTONIUM 238; EXCAVATION; DECONTAMINATION; SOILS; AIR; PERSONNEL; ASPHALT; RADIATION MONITORING

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Harper, J., and R. Garde Los Alamos Scientific Laboratory, Los Alamos, NM

Decommissioning of a Plutonium 239 Contaminated Incinerator Facility. IAEA-SM-234/26; Decommissioning of Nuclear Facilities. Proceedings of an International Symposium. Vienna, Austria, November 13-17, 1978. International Atomic Energy Agency, Vienna, (pp. 601-608), 694 pp. (IAEA-SM-234/26). (1979)

In early 1978, a plutonium contaminated incinerator facility at the Los Alamos Scientific Laboratory (LASL), Los Alamos, New Mexico, was decommissioned. The project involved dismantling the facility and disposal by burial or by retrievable storage of the debris at an on-site waste disposal area. Contaminated soil from the 0.5 hectare area was buried. The facility was constructed in 1951 to incinerate plutonium contaminated wastes. It was later used as a decontamination facility. The major features included a 185 sq m control building, incinerator, cyclone dust collector, spray cooler, venturi scrubber, air filter bank, ash separator, and two 140,000 liter ash storage tanks. Preliminary soil contamination surveys were performed by a LASL developed portable phoswich detector system. Final soil contamination levels were measured with a zinc sulphide gross alpha scintillation system. Six hundred cubic meters of debris and 1200 cu m of soil contaminated with less than 10 nCi Pu 239/g were buried at the LASL disposal area. Five cubic meters of Pu 239 contaminated ash residues were packed and stored to meet the Department of Energy's 20 year retrievable storage criteria. (Auth)

INCINERATION; PLUTONIUM 239; NUCLEAR FACILITIES; DECOMMISSIONING; DISMANTLING; WASTE DISPOSAL; BURIAL; WASTE STORAGE; RETRIEVABILITY; SOILS; BUILDINGS; EQUIPMENT; RADIATION DETECTORS

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Harris, W.R., B.R. Kokenge, and G.C. Marsh Mound Laboratory, Miamisburg, OH

Termination of the Special Metallurgical (SM) Building at Mound Laboratory: A Final Report. MLM-2381; 42 pp. (1976, December 22)

The report describes and highlights the more important factors associated with the termination of the special metallurgical (SM) building at Mound Laboratory. As a result, a written record of the more important techniques and procedures is now available for reference by others involved in similar termination efforts. Included in this report is a description of the organizational units that were used in this effort along with a description of their responsibilities. A general description of the SM building and a discussion of the more relevant procedures and equipment that were used are also presented. In addition, pertinent health physics information, such as personnel exposure, final wipe levels in the terminated facility, and assays of the structure, are provided. Based on the experience gained from this project, recommendations were made regarding the design of future radioactive material handling facilities so that when they are ultimately terminated the effort can be accomplished more efficiently.

DECOMMISSIONING; DECONTAMINATION; GLOVE BOXES; RADIATION HAZARDS; NUCLEAR FACILITIES; PLUTONIUM 238; WASTE DISPOSAL; WASTES, RADIOACTIVE

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Kirby, J.A., P.L. Phelps, L.R. Anspaugh, G.W. Huckabay, F. Markwell, and M. Barnes Lawrence Livermore Laboratory, Electronics Engineering Department, Environmental Sciences Division, Livermore, CA; U.S. Energy and Research Administration, Las Vegas, NV; Desert Research Institute, Water Resources Research, Las Vegas, NV

A Comparison of IN SITU Gamma Soil Analysis and Soil Sampling Data for Mapping Americium 241 and Plutonium 239 Soil Concentrations at the Nevada Test Site. UCRL-78273; 5 pp. (1976, November 30)

Soil sampling and IN SITU Am 241-gamma counting with an array of four high purity, planar, Ge detectors are compared as means of determining soil concentration contours of plutonium and their associated uncertainties. This paper presents such a comparison from data taken over an area of about 300,000 sq m at the Nevada Test Site on Frenchman's Flat (dry lake bed) and a description of the methods employed. This area is essentially flat and a grid pattern was previously plotted with 100- or 200-ft spacings from ground zero in the north, south, east, or west direction. Both of the techniques in this study are subject to numerous errors. Soil sampling in principle is an ideal technique, but in areas with steep concentration gradients, a given soil sample may not be representative of that area. In addition, since the samples are analyzed by radiochemical separation, only 10 g of each sample were actually analyzed. This greatly compounds the problem of analyzing a representative sample, particularly in this area since plutonium may be present in high concentration in discrete particles. Further, it has been observed that radioactivity frequently accumulates under bushes or in mounds in the Nevada desert. A two-fold or more difference in concentration has been frequently reported. Some soil sample sites were resampled during this study. Comparison of Pu 239 measurements for these samples indicated that a two-fold difference in results frequently occurred. In general, the most serious potential error in the IN SITU method is the assumption of a depth distribution. The magnitude of this effect is shown where the response of the detector is plotted as a function of alpha. From this plot, it is seen that a two-fold error is produced if alpha = 0.22/cm on the low side or if alpha = 5/cm on the high side compared to the normal value of 0.6/cm. With the range of alphas observed from the depth profile data of 0.25/cm to 0.85/cm, a possible error of about + or -50% from the alpha = 0.6/cm value could occur. The IN SITU data are preferable to soil sampling data for several reasons. Because the IN SITU detector looks at very large amounts of soil, it is far more representative. The overall errors associated with the IN SITU method are lower than that associated with soil sampling. Finally, the IN SITU data are less costly. (Auth)(JMF)

The paper contains contour maps of the sampling area, graphs representing the performance of the sampling techniques, and photograph of the IN SITU detector.

SAMPLING; SAMPLES; PLUTONIUM; ALPHA PARTICLES; COSTS; SOILS; RADIOCHEMISTRY; RADIATION, GAMMA; RADIATION DETECTORS

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Lantz, M.W., and H.A. Berry Reynold Electrical Engineering Company, Inc., Las Vegas, NV

Gnome Site Decontamination and Decommissioning - Phase 1 Radiological Survey and Operations Report Carlsbad, New Mexico. NVO/0410-48; 106 pp. (1978, December)

The radiological survey conducted during Phase I of the Gnome Site Decontamination and Decommissioning Project in Carlsbad, New Mexico, by Reynolds Electrical and Engineering Co., Inc. (REECO) and EG and G Inc., during the periods August 1 through September 30, 1977 and March 1, 1978 to the end of FY 1978 is described. An aerial radiological survey and a gamma spectrometric ground survey were performed by EG and G, and an intense radiological ground survey was conducted by REECO. The monitoring program included soil sampling and analyses, downhole gamma probe measurements, portable instrument surveys, and thermoluminescent dosimeter (TLD) gamma detection. Presently, the proposed guidelines recommend the removal of contaminated soil with beta-gamma activity above 2 x 10(E-5) uci/g and tritium soil moisture concentration above 3 x 10(E-2) uci/ml. Environmental pathway analyses showed that the proposed guidance is acceptable in terms of dose to man. The doses calculated using existing site data would not pose a radiological hazard from Cs 137, Sr 90, and tritium. Analyses of the data gathered in Phase I have provided information necessary to plan operations for the decontamination and decommissioning of the gamma site in Phase 2 and 3. The Phase 2 objective is to clean out existing wells and make other decontamination and decommissioning preparations. During Phase 3 the operational plan for disposal of contaminated materials will be executed. (RAF)

DECONTAMINATION; DECOMMISSIONING; RADIOLOGICAL SURVEYS; PROJECT GNOME; SPECTROSCOPY, GAMMA; SOILS; SAMPLING; VEGETATION; ANIMALS; RADIATION, GAMMA; INSTRUMENTS; THERMOLUMINESCENT DOSIMETERS; CESIUM 137; STRONTIUM 90; TRITIUM; WELLS; ENVIRONMENTAL EXPOSURE PATHWAY; RADIATION DOSE; CALCULATIONS

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Luthy, D.F., and E.L. Lewis Mound Laboratory, Miamisburg, OH

Decontamination of HEPA Filters: July-September 1977. MLM-2491; 18 pp. (1978, February 20)

Dissolution parameters (in various reagents) of Am 241 and Pu 239 oxide mixtures, U 233 oxide, Np 237 oxide, Cm 244 oxide, Th 232 oxide, and plutonium dioxide were determined. The reagents used were various concentrations of HNO3-HF-H2SO4, HNO3-(NH4)2Ce(NO3)6, HNO3-HF, and HNO3. Both simulated contaminated HEPA filter media and actual glovebox filter media from spent filters were used. The maximum decontamination factor achieved was 833 using a six-stage dissolution process. Also, plutonium dioxide was fused with sodium carbonate at various elevated temperatures, and a dissolution percentage was determined. (COMPLETE TEXT)

The document contains charts, graphs, and tables of dissolution tests for the various radionuclides studied.

DECONTAMINATION; WASHING; PLUTONIUM 239; URANIUM COMPOUNDS; NEPTUNIUM 237; CURIUM 244; THORIUM COMPOUNDS; GLOVE BOXES; FILTERS; TEMPERATURE; DISSOLUTION; AMERICIUM 241; URANIUM 233; THORIUM 232; OXIDES

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Nemec, J.F. United Nuclear Industries, Inc., Richland, WA

Production Reactor Decommissioning Study: 100-F Site and Facilities Description. Report; 136 pp. (1978, March 13)

A brief description is presented of the 100-F Area site as well as the contaminated and potentially contaminated facilities which remain in the area. The facilities described contain varying amounts of radioactive materials ranging from the extreme case of the 105-F Reactor itself to the rather minor contamination found in the 1904-F outfall structure. The descriptions are intended to provide personnel who are both directly and indirectly interested in the project, with sufficient background information regarding the past usage, construction and current status of the facilities to permit them to properly evaluate the scope and complexity of the problems which may be encountered.

REACTORS, HANFORD PRODUCTION; REACTOR DECOMMISSIONING; SPECIFICATIONS

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Nevada Operations Office, Las Vegas, NV

Special Study: Tatum Dome Test Site, Lamar County, Mississippi Final Report. Report, 71 pp. (1978, October)

The Tatum Dome Test Site near Hattiesburg, Mississippi, was host to two nuclear detonations and two detonable gas detonations; all of which were totally contained within the salt dome. Upon completion of the testing programs, the site was deactivated and decommissioned on June 30, 1972. A long-term hydrologic program was initiated in 1972 to assure public safety in and around the site area. During the conduct of the monitoring program, anomalous tritium readings were observed in water samples from a pond near the salmon/sterling ground zero. An expanded sampling program was developed to: (1) determine the source of the contamination, (2) define the locations of the various tritium concentrations, and (3) provide permanent shallow water monitoring. Results and conclusions from the sampling program are presented.

RADIATION MONITORING; RADIOACTIVITY; SALMON EVENT; STERLING EVENT; SURFACE WATERS; TRITIUM; EXPLOSIONS, NUCLEAR

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Paine, D., K.R. Price, and R.W. Mitchell Rockwell Hanford Operations, Richland, WA

Evaluation of a Decommissioned Radwaste Pond. RHO-SA-99; 15 pp. (1979, February)

An eight hectare radwaste pond (216-S-17) which received cooling water effluent from a nuclear fuel reprocessing plant at Hanford from 1951 to 1954 was contaminated due to unplanned releases. Subsequently, it was decommissioned by covering the area with 45-60 cm of backfill. Soil erosion and nuisance contamination, in the form of tumbleweeds (SALSOLA KALI), occurred between 1954 and 1972 due to the lack of a specific revegetation program. Siberian wheatgrass (AGROPYRON SIBERICUM) and cereal rye (SECALE CEREALE) were planted in 1972 and allowed to grow under natural conditions. A routine evaluation of the site disclosed the presence of contaminated Siberian wheatgrass plants. This report describes the results of a radioecological study of the site in 1978. Nondestructive methods developed for in situ evaluation to determine radionuclide inventories and transport parameters for biotic and abiotic compartments are presented concomitant with standard procedures. Results indicate that Siberian wheatgrass is a suitable perennial for revegetation of low-level waste disposal sites in an arid environment. Only .002% of the total calculated site inventory was incorporated into wheatgrass even though optimum conditions for uptake of radionuclides existed due to a combination of wind erosion and shallow soil backfill. In general, greater than 99% of the total radiation inventory was associated with the soil or sediment column. Analysis of 27 Great Basin pocket mice (PEROGNATHUS PARVUS) for total Cs 137 body burden showed very little incorporation of Cs 137 into their system. (Auth)(RAF)

DECOMMISSIONING; PONDS; WASTES, RADIOACTIVE; WASTES, LIQUID; BACKFILLING; SOILS; EROSION; VEGETATION; GRASSES; REVEGETATION; ENVIRONMENTAL TRANSPORT; ANIMALS; MICE; CESIUM 137; UPTAKE; RADIATION DETECTORS

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Ramsey, R.W.

Environmental Control Technology (ECT) Remedial Action Program. CONF-790923; Decontamination and Decommissioning of Nuclear Facilities, Proceedings of a Conference, Sun Valley, ID, September 16-20, 1979. Session IV-B, (pp. 1-2) 90 pp. (CONF-790923). (1979)

The overall objective of the decontamination and decommissioning (D and D) program, conducted in the Division of Environmental Control Technology (ECT), is to reduce to acceptable levels any potential health and environmental hazards associated with facilities and sites no longer required or used in the nation's nuclear programs. Government-owned property that is now surplus to programmatic needs and private property contaminated by Government-contracted activities are included in subprograms of the D and D program. In some cases the degree of decontamination from previous efforts has been found insufficient to allow unrestricted use, and remedial action is necessary to eliminate potential health concerns. The D and D goal is to determine any conditions of health and environmental risks and to restore facilities and sites to a condition allowing unrestricted use. Whether residual radioactive material is contained and stabilized on the site or removed and disposed of elsewhere, the potential impacts must be assessed and methods found to reduce them to the lowest practicable level. Responsibilities for decontamination and decommissioning under ECT include three subprogram activities based upon remedial action: (1) Remedial action at formerly utilized Manhattan Engineer District and Atomic Energy

Commission (MED/AEC) contractor sites. (2) Remedial action at inactive uranium mill tailings sites. (3) Remedial action at Grand Junction. The objective of the remedial actions at formerly utilized MED/AEC sites program is to identify the need for and to plan and conduct cleanup operations at radioactively contaminated sites that were used by the Manhattan Engineer District of Atomic Energy Commission (MED/AEC). Review of the files for 150 such sites showed that 82 sites required visits and preliminary radiological surveys to determine their radiological condition. Further detailed radiological surveys at over 40 such sites showed that 30 sites have residual radioactive contamination above currently acceptable levels for unrestricted use. It is estimated that 12 of these sites require environmental analysis to aid in selection of a proposed action. The other 18 sites can be cleaned up with less effort. The purpose of the remedial action at inactive uranium mill tailings sites program is to reduce the public exposure to radiation from accumulated tailings at inactive uranium mill sites. The bulk of these tailngs resulted from production of uranium to meet urgent National Defense needs. The 95th Congress passed legislation, Public Law 95-604, authorizing the Department of Energy to pay 90% of the cost of a remedial action program to clean up 22 named processing sites and any others found to require remedial action. The remedial action at Grand Junction, by authority of Public Law 92-314, provided for a cooperative program with the State of Colorado for reducing public exposure to radiation in Grand Junction resulting from past use of uranium mill tailings for construction purposes. The Federal Government pays 75% of the cost. The remedial work got underway in 1973 and is continuing. As of the end of fiscal year 1978, remedial action has been undertaken on 325 structures, including 289 private residences, 14 schools, and 22 commercial and church locations. Through September 30, 1978, the total program costs were $6,952,000, of which the Federal Government's share (75%) was $4,214,000. Efforts are being made to accelerate the pace of the program by developing methods of assessing radiation levels which will require less time, and contracting for larger blocks of remedial work at a time. (Auth)(JMF)

This paper is only an abstract of the actual paper which is to be published later.

DECOMMISSIONING; DECONTAMINATION; WASHING; NUCLEAR FACILITIES; ENVIRONMENT: HAZARD ANALYSIS; ENVIRONMENTAL IMPACT STATEMENTS; DISPOSAL SITE; URANIUM; TAILINGS; MILLING; MILLS; REGULATIONS, FEDERAL; STANDARDS, FEDERAL; COSTS; RADIATION HAZARDS; EXPOSURE, POPULATION

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Schroeder, O.C. Douglas United Nuclear, Inc., Richland, WA

Deactivation of Hanford Reactors. DUN-SA-114; 1 p.; Transactions of the American Nuclear Society 12(Suppl.):52. (1969, October)

Six reactors removed from service - four on standby for 5 years, two considered abandoned. Complete discharge of fuel from reactors. Cooling water shut off, and process tubes blown clear of water and capped. Control rods and safety rods stored in reactor. Building closed and vent . Control rooms heated in winter, and humidity controlled in summer where possible. All deactivated equipment returned to service in other area as needed. Retention basin washed down, covered with asphalt, floors covered with dirt. Biweekly, monthly, quarterly, or annual inspection as needed.

DECONTAMINATION; WASTE STORAGE; DECOMMISSIONING; FUEL REPROCESSING; REACTORS, PRODUCTION; RADIATION MONITORING

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Simpson, O.D., J.A. Chapin, R.E. Hine, M.P. Orme, and G.A. Soli

Analysis of Soil Samples from OMRE Decommissioning Project. CONF-790923; Decontamination and Decommissioning of Nuclear Facilities, Proceedings of a Conference, Sun Valley, ID, September 16-20, 1979. Session II-B, (pp. 4-5), 90 pp. (CONF-790923). (1979)

The decontamination and decommissioning (D and D) of retired nuclear reactor plants and the restoration of the landsite to its original state is of primary importance to the Nation. As of December 1977, there have been fifty-two reactors constructed at the Idaho National Engineering Laboratory (INEL). Seventeen of these are currently operable; the others are in various stages of retirement ranging from completely decontaminated and open to the public, to defueled and placed under protective confinement. Several reactors have undergone D and D in the past, but these projects were done individually without an integrated plan. An integrated, site-wide, long-range D and D plan has been developed at the INEL and the Organic Moderated Reactor Experiment (OMRE) facility is the first reactor to be addressed by this plan. The reactor vessel, buildings, and other structures were removed from the site during 1978. Portions of the remainder of the facility such as soil, concrete pads and various structural materials close to the reactor core had become radioactive by neutron activation. Samples from these materials as well as those from the leach pond area, where radioactive waste liquids were disposed, were analyzed by gamma-ray spectrometry to determine their radioactive content. Beta and alpha analyses were also done using gross counting techniques, chemical techniques to separate the Sr 90 and electrodeposition techniques to establish the alpha-emitting radioactive isotopes. These techniques were used to characterize the radioactive isotopes in the reactor excavation, leaching pond, back-fill dirt and general background areas outside the facility boundaries. The primary radioactive isotopes observed in the soil samples taken from the reactor area were Co 60, Eu 152, and Eu 154. Fission product activities were established to be less than 2 pCi/g of soil. Cobalt 60, Sr 90, Cs 137 and minor traces of Eu 152 were found in the soil of the leach pond area. In order to verify that the gamma-ray-emitting isotopes measured in the soil samples were the only ones present in the area (excluding natural radioactivity), a special survey of the OMRE decommissioned area was done utilizing a motorized laboratory containing a high-resolution Ge(Li) gamma-ray spectrometer. Results indicate that the activity at the OMRE decommissioned area is confined to localized areas (i.e., the leach pond area and reactor area). Comparisons of activities measured in soil taken from the lip of the leach pond with activities in soil obtained outside the INEL site boundaries indicate that the activity in the soil at the edge of the leach pond is at background levels. (Auth)(JMF)

This paper is only an abstract of the actual paper which is to be published later.

DECONTAMINATION; WASHING; DECOMMISSIONING; SPECTROMETRY; NUCLEAR FACILITIES; REACTORS; HOLDING PONDS; SAMPLING; SAMPLES; ALPHA PARTICLES; TRANSURANICS; WASTE DISPOSAL; WASTES, RADIOACTIVE; WASTE MANAGEMENT; WASTES, TRANSURANIC; RADIATION SOURCES

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U.S. Department of Energy

Formerly Utilizied MED/AEC Sites Remedial Action Program. Radiological Survey of Site A, Palos Park Forest Preserve, Chicago, Illinois. DOE/EV-0005/7; 91 pp. (1978, April)

The site was used by the Manhattan Project in the 1940s. The principal finding of this study on the radiological status of the Site A/Plot M area is the presence of tritium (as water) in the Plot M area and in the three wells to the north. No abnormal amounts of radioactivity were found in any other forest preserve district wells or in any private wells. The only radionuclide in the site a core samples attributable to operations at the site is tritium. The concentrations were substantially less than in the Plot M area. The only important pathway for exposure to the public from the radionuclides buried in Plot M is from the tritiated water moving from the plot to the dolomite aquifer and consumed by individuals using the picnic wells. The possible dose to people from this pathway is estimated at 0.7 mrem/yr as compared to the EPA drinking water standard of 4 mrem/yr.

TRITIUM; CONTAMINATION; SOILS; WATER; WELLS; CONTAMINATION; BURIAL; WASTE DISPOSAL; DECOMMISSIONING; JACOBS; RADIATION MONITORING

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U.S. Department of Energy, Oak Ridge Operations Office, Oak Ridge, TN

Formerly Utilized MED/AEC Sites Remedial Action Program Radiological Survey of the Former VITRO Rare Metals Plant, Canonsburg, Pennsylvania. DOE/EV-0003/3 (Revised); 282 pp. (1979, June)

The results of a radiological survey of the former VITRO Rare Metals Plant in Canonsburg, Pennsylvania, are presented in this report. This 18-acre site was used from 1911 to 1922 to extract radium from carnotite ore, from 1930 to 1942 to extract radium and uranium salts from onsite residues and carnotite ore, and from 1942 to 1957 to recover uranium from various ores and scrap materials. The radiological survey was conducted in two phases. Phase 1 included measurement of radon and radon daughter concentrations in onsite buildings; concentrations measured in this part of the survey were well above guideline levels. Phase 2 consisted of measurement of surface contamination levels on the site, external gamma radiation levels at 1 m above surfaces on and near the site, radionuclide concentrations in surface and subsurface soil and water on and near the site, and radon concentrations in air at offsite locations. The results of the second phase of the survey indicate that large quantities of the radioactive wastes generated during radium and uranium recovery operations still remain on the site. Radium-bearing wastes are present in soil beneath or adjacent to each of the buildings on the site and in the top few feet of soil over almost the entire site, with some areas being contaminated to a depth of 16 ft or more. Alpha contamination levels, beta-gamma dose rates, and external gamma radiation levels in some areas of the buildings and outdoors on the site are above current federal guidelines concerning the release of property for unrestricted use. Concentrations of Ra 226 in water in holes drilled on the site are above the maximum permissible concentration (MPCw). Also, measurements made offsite show that contamination from the site has spread to nearby offsite locations, and that there is significant atmospheric transport of Rn 222 from the site. (Auth)

RADIOLOGICAL SURVEYS; RADON 222; RADIUM 226; URANIUM 238; THORIUM 230; RADON DAUGHTERS; BUILDINGS; SURFACE CONTAMINATION; RADIATION, GAMMA; INSTRUMENTATION; SOILS; WATER; AIR; CONTAMINATION; ALPHA PARTICLES; BETA PARTICLES; DOSE RATE; SEDIMENTS

582

U.S. Department of Energy, Washington, DC

Environmental Development Plant (EDP): Decontamination and Decommissioning. Report; 76 pp. (1978, July)

Radioactively contaminated facilities, equipment, materials, and land that are no longer useful or needed for a nuclear purpose are candidates for decontamination and decommissioning (D/D). Following D/D, intrinsic values can be salvaged and land returned to other desired uses. There are several hundred individual facilities which are located on ERDA reservations or which have been assigned to ERDA for management and D/D action. Included are facilities used for the production of special nuclear materials, for nuclear energy R and D, and for the testing of nuclear devices. Many of the facilities were operated or utilized by ERDA's predecessor agencies. Also included are certain privately-owned sites and tailings of uranium mills previously operated by private enterprise. The scope of this EDP does not include D/D of commercial power reactors but the technology and issues described here may be directly applicable to such privately owned facilities. The numbers of nuclear facilities that are candidates for D/D continue to increase as they become obsolescent; consequently, a rapid expansion in the volume of D/D work is projected. R and D programs are needed to guide decisions on where and when D/D should be done, to facilitate the work, and to minimize the near and long term risks to both workers and the public.

CONTAMINATION; DECOMMISSIONING; DECONTAMINATION; GOVERNMENT POLICIES; RADIATION HAZARDS; LAND USE; NUCLEAR POWER; PERSONNEL; PLANNING; REACTORS; SAFETY; SOCIO-ECONOMIC FACTORS; URANIUM

583

U.S. Department of the Air Force

Status Report of PM-1 Dismantling. Letter to AEC Director of Regulation; 2 pp. (1969, March 11)

Unirradiated fuel shipped 27 Jan. 1969. Uncontaminated equipment shipped. Rad-waste skid package decontaminated and ready for shipment. Changes in concrete slab to cover primary area listed. In 4 months, all buildings should be razed and land recontoured.

REACTORS, PWR; PM-1 REACTOR; DECOMMISSIONING; REACTOR OPERATION; DOCUMENTATION; REACTORS, MILITARY

584

Ureda, B.F. Atomics International, Canoga Park, CA

Stir Facility Decontamination and Disposition Final Report. AI-ERDA-13168; 80 pp. (1976, August 26)

The decontamination and disposition (D and D) of Building 028, Shield Test Irradiation Reactor (STIR) facilities, are complete. The core tank, the activated concrete structures surrounding the core tanks, the thermal column, the reactor shield, the test vault carriage, the water cooling systems, and the water shield door were removed, and the facility exhaust system was partially dismantled. The facilities were decontaminated to levels which were as low as practicable, but in all cases to levels below the limits described as acceptable for future unrestricted use. The more significant D and D activities are summarized, and special techniques are noted. Results of the radiological monitoring in support of the D and D operations and of the final radiological survey are presented.

CONCRETES; DECONTAMINATION; HOT CELLS; WASTE MANAGEMENT; IRRADIATION TESTING; SHIELDING; DECOMMISSIONING; OPERATING EXPERIENCE

585

Willoughby, W., and H.T. Babb Carolinas Virginia Nuclear Power Associates, Inc.

Decommissioning the Carolinas Virginia Tube Reactor. Transactions of the American Nuclear Society 12(Suppl.):54. (1969, October)

Major steps included (1) shipment of all special nuclear material off site, (2) shipment of all heavy water to Savannah River Plant, (3) amendment of license to provide for ownership and possession but not operation, (4) dismantling the reactor, cleanup of various areas and systems, shipment of wastes off site, (5) report of decommissioned status, and (6) an AEC inspection. The reactor was deactivated and radioactive materials and equipment are stored within a double security area - security fence and secured reactor buildings.

REACTORS, BWR; REACTORS, PRESSURE TUBE; REACTORS, PWR; DECOMMISSIONING; OPERATING EXPERIENCE; CAROLINAS VIRGINIA TUBE REACTOR

CRITERIA AND STANDARDS

586
Advance Notice of Proposed Rulemaking. Federal Register 43(49):10370-10271. (1978, March 13)

The U.S. Nuclear Regulatory Commission has under way extensive studies intended to provide a data base for developing decommissioning criteria for nuclear facilities. The Commission is considering amending its regulations to provide more specific guidance on decommissioning criteria for production and utilization facility licensees and byproduct, source, and special nuclear material licensees. This notice is to invite advice and recommendations on several questions concerning decommissioning nuclear facilities.

DECOMMISSIONING; NUCLEAR FACILITIES; REGULATIONS, FEDERAL; DOCUMENTATION; STANDARDS, FEDERAL

587
After Carrying Out the Final Operating Plan, Mining Supervision is Ended. Glueckauf 113(2):101-102. (1977, January)

In several decisions, the OVG Muenster has in the past year concerned itself with the question of how long the mining authority's responsibility continues after the end of mining operations. The court has preferred a restrictive interpretation of the words 'and after dismantling' in Paragraph 196 Section 2 ABG, and has taken the view that mining supervision ends after the shutting down of a mining operation, with carrying out the measures provided in the final operating plan. The main content of the two most important judgments of the OVG Muenster in this context is reproduced.

COAL; MINES; DECOMMISSIONING; INSPECTIONS; LEGAL ASPECTS

588
Application for the Decommissioning of the Kernkraftwerk Brunsbuettel Rejected. Energiewirtschafthiche Tagesfragen 26(7):382. (1976, July)

The 10th Division of the Regional Admisistrative Court in Schleswig has rejected, on the 2nd of July the application by 21 citizens for the temporary decommissioning of the Kernkraftwerk Brunsbuettel on the Elbe Estuary. It does not follow that the action against the operation of the nuclear power plant, which operates already on a test basis since June 23rd, has been rejected altogether. The main procedure, which will possibly begin only next year, will rule on that.

BRUNSBUETTEL REACTOR; LEGAL ASPECTS; REACTOR DECOMMISSIONING; REACTOR OPERATION

589
American Institute of Chemical Engineers, NY; American National Standards Institute, NY

Design Criteria for Decommissioning of Nuclear Fuel Reprocessing Plants. ANSI-N-300-1975; 8 pp. (1975, December 10)

This standard provides criteria for designers of nuclear fuel reprocessing facilities to guide them in enabling these facilities to meet the requirements of federal regulations governing shutdown and decommissioning. Title 10 Code of Federal Regulations, Chapter 1, Part 50, Appendix F, states in part that "a design objective for fuel reprocessing plants shall be to facilitate decontamination and removal of all significant radioactive wastes at the time the facility is permanently decommissioned." Included in the scope of this standard are the following considerations: (1) Protection from radiation hazards to personnel and the environment during and after decommissioning. (2) Decontamination of plant structures and process equipment. (3) Dismantling or isolation of the facilities. (4) Disposal of contaminated materials. When the owner has deactivated or shut down one process facility but continues to operate on the same site or builds another operating plant on the same site, this deactivation of the facility, even if it involves abandonment in place, is not decommissioning in the context of this standard. Deactivation can be partial or can involve complete shutdown of process operation. Even when total plant shutdown is part of deactivation, the plant owner has complete control of the functions or activities remaining on site and retains the responsibility for surveillance of the deactivated facility to assure public health and safety. This standard provides guidance to designers by giving specific functional criteria for structures and systems (Section 3.0) and by establishing normal operational criteria to minimize problems during the decommissioning stage (Section 4.0).

DECOMMISSIONING; DECONTAMINATION; DESIGN; FUEL REPROCESSING PLANTS; WASTE STORAGE; STANDARDS, FEDERAL

590
Bernero, R.M., and E.F Conti U.S. Nuclear Regulatory Commission, Washington, DC

Development of United States Policy and Standards for Decommissioning Nuclear Facilities. IAEA-SM-234/13; Decommissioning of Nuclear Facilities, Proceedings of an International Symposium, Vienna, Austria, November 13-17, 1978. International Atomic Energy Agency, Vienna, (pp. 11-27), 694 pp. (IAEA-SM-234/13). (1979)

The United States Nuclear Regulatory Commission (NRC), responsible for commercial nuclear licensing, is reevaluating its policy on decommissioning of all types of nuclear facilities. Battelle Pacific Northwest Laboratories (PNL) is being used as a major contractor in this effort. Present NRC regulations and guidance for decommissioning are reviewed. Decommissioning experience in the UnitedStates of America is reviewed. Detailed studies are being made of the alternatives and costs for decommissioning of a number of different facilities, including a pressurized water reactor, a boiling water reactor, a fuel reprocessing plant, a mixed-oxide fuel fabrication plant, a uranium oxide fuel fabrication plant, a uranium mill a UF6 conversion plant and a low level waste burial ground. Studies are also being made of methods to facilitate decommissioning. The principal issues in decommissioning policy are discussed, including residual radioactivity limits, financial assurance, and generic applicability. The mechanics of policy development, including discussion with the States, are described. Regulation enactment procedures are explained. (Auth)

NUCLEAR FACILITIES; DECOMMISSIONING; REGULATIONS, FEDERAL; REVIEWS; COSTS; REACTORS, PWR; REACTORS, BWR; FUEL REPROCESSING PLANTS; FABRICATION PLANTS, MIXED OXIDE FUEL; URANIUM; MILLS; WASTES, LOW-LEVEL; BURIAL; RESIDUAL ACTIVITY; GOVERNMENT POLICIES

591
Busekist, O.V. Eurochemic, Mol, Belgium

Legal Aspects of the Decommissioning of Nuclear Facilities. IAEA-SM-234/45; Decommissioning of Nuclear Facilities, Proceedings of an International Symposium, Vienna, Austria, November 13-17, 1978. International Atomic Energy Agency, Vienna (pp. 29-40), 694 pp. (IAEA-SM-234/45). (1979)

In all countries having a nuclear industry, the front end of the nuclear fuel cycle is completely covered by detailed legislative and regulatory regimes, in particular with respect to the operation of nuclear facilities. Their decommissioning has so far not been given the same degree of attention, but there is a growing recognition of the need to establish a suitable administration and legal framework for these activities as well. The present paper describes the regulatory systems adopted by certain countries and discusses various aspects to be taken into consideration when establishing such a framework. (Auth)

NUCLEAR FACILITIES; DECOMMISSIONING; LEGAL ASPECTS; REGULATIONS, INTERNATIONAL

592
Castellon Fernandez, E. Hidroelectrica Espanola, S.A., Forum Atomico Espanol, Madrid, Spain

Consideration of the Legal System Required for Achievement of Current Nuclear Power Plant Construction Programmes. Nuclear Inter Jura 75 Congress, Aix-en-Provence, France, September 29, 1975 (pp. 28-48). (1976)

The extensive nuclear power plant construction programs currently in progress in western countries require updating of the legislation in force in this field, especially as regards the following: acquisition of the sites necessary by means of a national planning program of available sites; simplification of formalities concerning issuance of administrative licenses; revision of the principle of absolute and exclusive liability of the nuclear operator which forms the basis of the third party liability system for nuclear damage; radioactive waste management and decommissioning of nuclear plants. Furthermore, this new legislation should be harmonized between the different countries concerned.

INTERNATIONAL COOPERATION; LEGAL ASPECTS; LICENSING; NUCLEAR FACILITIES; NUCLEAR INDUSTRY; NUCLEAR POWER PLANTS; WASTE MANAGEMENT

593
Charbonnel, M. Ministere de l'Industrie et de la Recherche, Service Central de Surete des Installations Nucleaires, Paris, France

Inspection of Installations in France. Interregional Training Course on Nuclear Power Project Planning and Implementation, Saclay, France, March 30, 1976 (8 pp.). (1976)

The purpose of controlling nuclear installations is to check that the equipment, procedures and work conform to the instructions in the regulations made by the controlling bodies, at the construction stage as well as at the operational one. Control also covers documents whose preparation is entrusted to the constructor or the operator; safety reports, general operating rules, etc. At the construction stage, control covers site selection, fabrication of the installation components, their assembly, the preliminary, as well as the final tests. During operation control covers, in particular, the qualifications of the staff, the proper operation of the facilities and conduct of the main operations and the conformity of effluent release with the authorized standards. Finally, control may be exercised over decommissioning and dismantling of the installation.

INSPECTIONS; NATIONAL CONTROL; NUCLEAR FACILITIES; REACTOR DECOMMISSIONING; REACTOR OPERATION

594
Chu, S.L.

AEC Authorizing Legislation Fiscal Year 1973. Part 5- Volume 2. Environmental Statements 9 through 15. Hearings before the Joint Committee on Atomic Energy, Congress of the United States, Ninety-Second Congress, Second Session, January 26- February 3, 17, 22, 23, 29- March 1, 8, and 9, 1972.. WASH-1516; 1006 pp.

ACCELERATORS; CONTAMINATION; ENVIRONMENT; FABRICATION; LEGAL ASPECTS; WASTES, LIQUID; NATURAL GAS; EXPLOSIONS, NUCLEAR; PLOWSHARE PROJECT; PLUTONIUM 238; REACTORS, POWER; WASTE DISPOSAL; WASTES, RADIOACTIVE; REACTOR DISMANTLING; WASTE STORAGE

595
Coady, J.R., and L.C. Henry Atomic Energy Control Board, Ottawa, Canada

Regulatory Principles, Criteria and Guidelines for Site Selection, Design, Construction and Operation of Uranium Tailings Retention Systems. CONF-780740; Nuclear Energy Agency Seminar on Management, Stabilization Environmental Impact of Uranium Mill Tailings, Albuquerque, NM, July 24-28, 1978, (pp. 427-52). (1978, July)

Principles, criteria and guidelines developed by the Atomic Energy Control Board for the management of uranium mill tailings are discussed. The application of these concepts is considered in relation to site selection, design and construction, operation and decommissioning of tailings retention facilities.

LICENSING; MILLING; SITE SELECTION; DESIGN CRITERIA; REGULATIONS, FEDERAL; URANIUM; DECOMMISSIONING; STANDARDS, INTERNATIONAL

596
Conti, E.

Residual Activity Limits for Unrestricted Use From Decommissioning. CONF-790923; Decontamination and Decommissioning of Nuclear Facilities, Proceedings of a Conference, Sun Valley, ID, September 16-20, 1979. Session IV-A, (p. 2), 90 pp. (CONF-790923). (1979)

The Nuclear Regulatory Commission (NRC) program for developing a regulation for decommissioning of facilities licensed by the NRC has, as a key element, the need for specific residual activity limits for unrestricted use of facilities and surrounding soil. The method of developing these residual activity limits for decommissioning was twofold. First, a nuclide pathway dose assessment methodology was utilized to develop reference activity concentrations on surfaces and in soil. The values of the derived activity concentrations were established following detailed concentration values were then compared to existing dose and environmental contamination standards as benchmark comparisons. These comparisons included considering the Surgeon General's criteria for Grand Junction, nuclear weapons fallout, variability in natural background, EPA's proposed Pu in soil guidance for federal agencies, the safe drinking water standards for radionuclides, and the EPA standard for the uranium fuel cycle. Comparison to these benchmarks is particularly important, since the EPA proposed standard for residual activity is not scheduled to be issued until 1980. Values of the residual activity limit developed for reactor decommissioning will be presented with the corresponding potential individual dose commitments. (Auth)(JMF)

This paper is only an abstract of the actual paper which is to be published later.

DECOMMISSIONING; REGULATIONS, FEDERAL; NUCLEAR FACILITIES; SOILS; STANDARDS, FEDERAL; ENVIRONMENT; WATER; TRANSURANICS; RESIDUES; EXPOSURE, POPULATION; WASTES, RADIOACTIVE; WASTES, TRANSURANIC

597
Conti, E.F. U.S. Nuclear Regulatory Commission, Office of Standards Development, Washington, DC

Residual Radioactivity Limits for Decommissioning - Draft Report. NUREG-0613: 8 pp. (1979, October)

The Plan for the Reevaluation of NRC Policy on Decommissioning of Nuclear Facilities, NUREG-0436, identified the need for specifying acceptable criteria for residual radioactivity following decommissioning for both surface and volumetric facility component contamination and for residual radioactivity in soil. This paper presents the approach and consideration of an NRC staff technical task group with focus on the radionuclides and exposure conditions characteristic of light-water reactor facilities. The approach is based on the assumption that the following objectives would be met: residual activity limits should present a small risk from exposure, the limits should allow conducting an effective measurement program to demonstrate compliance, and they should be consistent with existing guidance. Numerical estimates of radiation dose to man were developed: Those estimates provide insight into (a) what residual radioactivity levels would be related to a particular dose level, (b) which of the various exposure pathways are significant, and (c) the nuclides within the spectra of nuclides associated with the facility which are significant dose contributors. Analysis of data to date indicates that residual activity levels which would be expected to result in exposures of 5 mrem per year to an individual from realistic exposure pathway conditions would both be consistent with existing guidance and result in activity levels which can be effectively monitored for enforcement. The radionuclides which are of particular importance to light water reactor decommissioning are Co 60, Cs 137, and Cs 134. The exposure pathways which are most significant for reactor sites are external irradiation from deposited radionuclides, with ingestion of contaminated foods and inhalation of resuspended activity of much smaller magnitude. (RAF)(Auth)

RESIDUAL ACTIVITY; REACTOR DECOMMISSIONING; SOILS; REACTORS, LIGHT-WATER; STANDARDS, FEDERAL; RADIATION DOSE; MODELS, MATHEMATICAL; DOSIMETRY; ENVIRONMENTAL EXPOSURE PATHWAY; RADIOLOGICAL SURVEYS; INSTRUMENTATION; COBALT 60; CESIUM 134; CESIUM 137; EXPOSURE, EXTERNAL; INGESTION; INHALATION

598
Conti, E.F., and P.B. Erickson U.S. Nuclear Regulatory Commission, Washington, DC

Radiological Criteria for Release of Land and for Decommissioning Facilities. Transactions of the American Nuclear Society 26:120. (1977, June)

None

DECOMMISSIONING; DECONTAMINATION; RADIATION HAZARDS; LAND USE; NUCLEAR POWER PLANTS; RADIATION PROTECTION; WASTE MANAGEMENT; STANDARDS, FEDERAL

599
Crofford, W.

Environmental Protection Agency Decommissioning Standard. CONF-790923; Decontamination and Decommissioning of Nuclear Facilities, Proceedings of a Conference, Sun Valley, ID, September 16-20, 1979. Session I, (p. 5), 90 pp. (CONF-790923). (1979)

The Environmental Protection Agency will be publishing a decommissioning standard in 1981, which is designed to insure public health protection by establishing radiation exposure levels. Issues currently perceived to influence the decommissioning standard are: (1) Change of mode with time as a function of costs and benefits; i.e., change from custodial, storage to complete dismantlement. (2) Limitation on institutional control such as time limits. (3) Criteria for engineered and natural barriers. (4) Positive assurance of adequate finances when time to decommission. (5) Time period for which impact must be considered. (6) Differences between existing facilities and future facilities. (7) Occupational exposures in terms of cost/benefits for decommissioning where there is a trade of cost and personnel radiation exposure between immediate dismantlement and delayed dismantlement to allow a period of radioactive decay. The decommissioning operations and the resulting decommissioning modes are viewed as radiation protection problems rather than waste disposal problems. Waste disposal will be covered under separate waste management standards. (Auth)(JMF)

This paper is only an abstract of the actual paper which is to be published later. The paper contains a summary of the Environmental Protection Agency's decommissioning standard.

DECONTAMINATION; DECOMMISSIONING; NUCLEAR FACILITIES; STANDARDS, FEDERAL; REGULATIONS, FEDERAL; WASHING; EXPOSURE, OCCUPATIONAL; COSTS; COST ESTIMATES

600

Cunningham, R.E., K.S. Dragonette, J.A. Cedarn, R.G. Ryan, P.H. Lohaus, and J.S. Burns U.S. Nuclear Regulatory Commission, Office of Nuclear Material Safety and Safeguards; U.S. Nuclear Regulatory Commission, Office of State Programs

NRC Task Force Report on Review of the Federal/State Program for Regulation of Commercial Low-Level Radioactive Waste Burial Grounds. NUREG-0217; 60 pp. (1977, March)

The issue of federal vs. state regulation of commercial radioactive waste burial grounds is explored in the report. The need for research and development, a comprehensive set of standards and criteria, a national plan for low-level waste management, and perpetual care funding are also discussed. Five of the six commercial burial grounds are regulated by agreement states; the sixth is regulated solely by the NRC. The sites are operated commercially and the operators contribute to the perpetual care funds for the sites at varying rates. The states have commitments for the perpetual care of the decommissioned sites except for one site, located on federally owned land. The states, through their regulatory programs have adequately protected the public health and safety. However, waste disposal is a national low-level waste disposal program. The citizens of individual states should not bear the cost of major contingency actions or inadequacies in perpetual care funding for burial sites which serve national rather than state needs. The NRC task force recommends that federal control over the disposal sites should be increased by requiring joint federal/state site approval, NRC licensing, federal ownership of the land, and a federally administered perpetual care program. In addition, the task force recommends that the NRC accelerate the development of its regulatory program for the disposal of low-level waste, to insure the avoidence of an undisciplined proliferation of low-level burial sites, and to evaluate alternative disposal methods. (JMT)

ACCIDENTS; HAZARD ANALYSIS; INSPECTIONS; LEGISLATION; SAFETY; STANDARDS, FEDERAL; STANDARDS, STATE; WASTE MANAGEMENT; WASTES, LOW-LEVEL; WASTE DISPOSAL; DISPOSAL SITE

601

Detilleux, E., and W.L. Lennemann International Atomic Energy Agency, Vienna, Austria

Criteria, Standards and Policies Regarding Decommissioning of Nuclear Facilities. International Conference on Nuclear Power and Its Fuel Cycles, Salzburg, Austria, May 2-13, 1977 (13 pp.). (1977)

The paper discusses the decontamination and decommissioning experiences encountered at the Eurochemic Fuel Reprocessing Plant, their implications and the knowledge gained from these experiences. It includes the results of technical reviews made by the Nuclear Energy Agency of OECD and the International Atomic Energy Agency regarding decommissioning nuclear facilities. The conclusions which are presented should weigh heavily in the considerations of the national authorities involved in regulating nuclear power programs. The paper notes the special planning that should be arranged between those responsible for the nuclear facility and competent public authorities who jointly should make a realistic determination of the eventual disposition of the nuclear facility, even before it is built. Recommendations cover the responsibilities of nuclear plant entrepreneurs, designers, operators, and public and regulatory authorities. (Atomindex citation 08:303217)

NUCLEAR FACILITIES; DECOMMISSIONING; PLANNING; RADIATION PROTECTION; SAFETY

602

Dickson, H.W. Oak Ridge National Laboratory, Oak Ridge, TN

Standards and Guidelines Pertinent to the Development of Decommissioning Criteria for Sites Contaminated with Radioactive Material. Report, 57 pp. (1978, August)

A review of existing health and safety standards and guidelines has been undertaken to assist in the development of criteria for the decontamination and decommissioning of property contaminated with radioactive material. During the early years of development of the nuclear program in the United States, a number of sites were used which became contaminated with radioactive material. Many of these sites are no longer useful for nuclear activities, and the U.S. DOE desires to develop criteria for the management of these sites for future uses. Radiation protection standards promulgated by ICRP, NCRP, and ANSI have been considered. Government regulations, from the Code of Federal Regulations and the legal codes of various states, as well as regulatory guidelines with specific application to decommissioning of nuclear facilities also have been reviewed. In addition, recommendations of other scientific organizations such as the National Academy of Sciences/National Research Council Advisory Committee on the Biological Effects of Ionizing Radiations and the United Nations Scientific Committee on the Effects of Atomic Radiation were considered. Finally, a few specific recommendations and discussions from current literature were included. 28 references. (ERA citation 04:002654)

FEED MATERIALS PLANTS; NUCLEAR FACILITIES; DECONTAMINATION; DECOMMISSIONING; RADIATION PROTECTION; RADIOACTIVE MATERIALS; RECOMMENDATIONS; REGULATIONS; SAFETY; STANDARDS, FEDERAL

603

Fuel Process Systems Standards Branch, Nuclear Regulatory Commission, Washington, DC

Plan for Reevaluation of NRC Policy on Decommissioning of Nuclear Facilities. Report; 136 pp. (1978, December)

Present NRC criteria and requirements for decommissioning nuclear facilities, as embodied in NRC regulations and guides, are identified and explained. Also identified and discussed are plans and programs now underway for reevaluating these criteria and requirements and for developing more explicit decommissioning criteria for light water reactors and for facilities and plants involving byproduct, source, and special nuclear materials. The overall program includes technical studies at the Battelle Pacific Northwest Laboratory on engineering methodology, radiation risks, and estimated costs of decommissioning light water reactors and associated fuel cycle facilities. The scope and purpose of these studies are presented and discussed. Schedules for each component of the overall program have been developed and are presented and discussed.

GOVERNMENT POLICIES, NRC; REACTORS, WATER COOLED; STANDARDS, FEDERAL; REGULATIONS; RADIATION HAZARDS; COST ESTIMATES; FUEL CYCLES; REACTOR DECOMMISSIONING; NUCLEAR FACILITIES

604

Fuerste, W., and M. Schiffer (Comp.) Rheinisch-Westfaelischer Technischer Ueberwachungs-Verein e.V., Essen, German Federal Republic

Technischer Ueberwachtungsverein-Functions During Operation of Nuclear Power Plants. 4th Indo-German Seminar on Operation of Nuclear Power Plants, Julich, German Federal Republic, June 29, 1976 (pp.522-532). (1976, September)

The 'Technische Ueberwachtungsverein TUEV' is a technical surveillance agency, active in the field of safety of almost all kinds of industrial products. In the field of safety of nuclear power plants the TUEV, as authorized inspectorate, has the following tasks: a) safety assessment, b) design review, c) examination of specifications, d) examination of manufacturing documents, e) manufacturing surveillance, f) construction site surveillance, g) preoperational tests, h) records control, i) operation surveillance, j) decommissioning surveillance. Especially in the field of operation of nuclear power plants the TUEV fulfills the following functions: 1) recurring inspection tests on systems and components, 2) evaluation of changes and their control in nuclear power plants, 3) damage analysis. Details of the TUEV functions and tasks during operation of nuclear power plants are presented.

INSPECTIONS; NATIONAL CONTROL; NUCLEAR POWER PLANTS; MODELS, ORGANI-

ZATIONAL; PERFORMANCE TESTING; REACTOR COMMISSIONING; REACTOR DECOMMISSIONING; REACTOR OPERATION; REACTOR SAFETY

605
Gilinsky, V. International Atomic Energy Agency, Vienna, Austria

U.S. Nuclear Safety Review and Experience. International Conference on Nuclear Power and Its Fuel Cycles, Salzburg, Austria, May 2-13, 1977 (1 p.). (1977)

The nuclear safety review of commercial nuclear power reactors has changed over the years from the relatively simple review of Dresden 1 in 1955 to the highly complex and sophisticated regulatory process which characterizes today's reviews. Four factors have influenced this evolution: (1) maturing of the technology and industry; (2) development of the regulatory process and associated staff; (3) feedback of operating experience; and (4) public awareness and participation. The NRC's safety review responsibilities start before an application is tendered and end when the plant is decommissioned. The safety review for reactor licensing is a comprehensive, two-phase process designed to assure that all the established conservative acceptance criteria are satisfied. Operational safety is assured through a strong inspection and enforcement program which includes shutting down operating facilities when necessary to protect the health and safety of the public. The safety of operating reactors is further insured through close regulation of license changes and selective backfitting of new regulatory requirements. An effective NRC standards development program has been implemented and coordinates closely with the national standards program. A confirmatory safety research program has been developed. Both of these efforts are invaluable to the nuclear safety review because they provide the staff with key tools needed to carry out its regulatory responsibilities. Both have been given increased emphasis since the formation of the NRC in 1975. (Atomindex citation 08:303229)

REACTORS; LICENSING; NUCLEAR POWER PLANTS; SAFETY; STANDARDS, FEDERAL

606
Graham, H.B. Oak Ridge National Laboratory, Oak Ridge, TN

Status of ANSI Standards on Decommissioning of Nuclear Reprocessing Facilities. CONF-750822; Decontamination and Decommissioning of ERDA Facilities, Proceedings of a Conference Idaho Falls, ID, August 19-21, 1975, (7 pp.) (CONF-750822). (1975)

Preparation of the American nuclear standard design objectives for decommissioning of nuclear reprocessing facilities was industry's attempt at interpreting 10CFR, Part 50, Appendix F for the designer of nuclear reprocessing facilities. Appendix F states in part that 'A design objective for reprocessing plants shall be to facilitate decontamination and removal of all significant radioactive waste at the time the facility is permanently decommissioned.' This is what the subcommittee has attempted to do.

DECONTAMINATION; MAINTENANCE; DECOMMISSIONING; FUEL REPROCESSING; STANDARDS, FEDERAL

607
Graham, H.B. Oak Ridge National Laboratory, Oak Ridge, TN

Standard for Design Criteria for Decommissioning of Nuclear Fuel Reprocess Plants. CONF-760615; 17th Annual Meeting of the Institute of Nuclear Materials Management, Seattle, WA, June 23, 1976, (8 pp.); Nuclear Materials Management 5(3):495-500. (1976)

The material reported in this paper was developed by the American National Standards Institute Standards Committee N46, which is sponsored by the American Institute of Chemical Engineers. This standard has been approved in accordance with ANSI's acceptance procedures. The ANSI's board of standards review approved this standard for publication December 19, 1975. Decommissioning refers to those actions to be taken by the facility licensee to: (1) decontaminate the plant and equipment to the extent practical; (2) remove sources of radioactivity from the premises; (3) return the site to such a condition that it may be safely returned to unrestricted use; and (4) maintain the facility under the minimum surveillance required for the protection of the public health and safety for a specified time, where it is shown to be technically and/or economically possible to decontaminate to feasible levels acceptable for unrestricted use.

FUEL REPROCESSING PLANTS; DECOMMISSIONING; DECONTAMINATION; COSTS; WASTE DISPOSAL; STANDARDS, FEDERAL

608
Harmon, D.F. U.S. Nuclear Regulatory Commission, Washington, DC

NRC Regulations for Nuclear Power Plant Decommissioning. American Nuclear Society Annual Meeting, San Diego, California, June 18, 1978; Transactions of the American Nuclear Society 28:669. (1978, June)

LEGAL ASPECTS; NUCLEAR POWER PLANTS; REACTOR DECOMMISSIONING; REGULATIONS, FEDERAL

609
International Atomic Energy Agency, Vienna, Austria

Draft Code of Practice - Governmental Organization for the Regulation of Nuclear Power Plants. 35 pp. (1975, July 25)

This code of practice forms part of the IEAE's safety codes and guides. The main objective is to provide guidance based upon various national practices to be used by member states in establishing regulatory bodies for the siting, construction, commissioning, operation and decommissioning of nuclear power plants. Many of the provisions of the code may be applicable to the regulation of other nuclear facilities. Items covered in this code are: establishing and maintaining a regulatory body, assessment of the safety, inspections and enforcement actions during all stages of the licensing process, and establishing regulations in health, safety, and environmental protection.

REGULATIONS, INTERNATIONAL; SAFETY; STANDARDS, INTERNATIONAL; DECOMMISSIONING; CONSTRUCTION; NUCLEAR POWER PLANTS; LICENSING; SITE SELECTION

610
International Atomic Energy Agency, Vienna, Austria

Safety in Nuclear Power Plant Operation, Including Commissioning and Decommissioning - IAEA Safety Standard. STI/PUB/503; 35 pp. (1978, December)

This code of practice deals with the safety aspects of management, commissioning, operation and decommissioning of the plant. The code forms part of the agency's program, referred to as the NUSS program, for establishing codes of practice and safety guides relating to land-based stationary thermal neutron power plants. Topics discussed include: surveillance by the operating organization and regulatory body; operational limits and conditions; commissioning; plant management and site personnel; operating instructions and procedures; maintenance, testing examination, and management; emergency arrangements; quality assurance; security; records and reports; and decommissioning.

ADMINISTRATIVE CONTROL; LICENSING; REACTOR OPERATION; DOCUMENTATION; PROCEDURES; RADIATION PROTECTION; WASTE MANAGEMENT; QUALITY ASSURANCE; SECURITY; DECOMMISSIONING; NUCLEAR POWER PLANTS; EMERGENCY PROCEDURES; STANDARDS, INTERNATIONAL

611
Iwler, L.

Regulatory Bodies Ready for N-Plant Retirements. Electrical World 190(2):19-20. (1978, July 15)

Feature article: at least six state regulatory commissions and several European countries are starting to provide long-term funding to decommission existing and future nuclear power plants. On the federal level, the House Committee on government operations is evaluating the process of plant dismantling and the treatment of nuclear wastes. A study by the committee found that dismantling costs for a single plant could range from $31-100 million in 1977 dollars. These figures do not include perpetual care costs for radioactive materials. After the 30-40 yr lifespan of a nuclear plant being built now, decommissioning costs would quadruple, given 5% annual inflation. Funding requests for dismantling plants in Pennsylvania, Florida, California, and Oregon are described. (1 photo)

NUCLEAR POWER; NUCLEAR POWER PLANTS; DECOMMISSIONING; ECONOMICS; NUCLEAR POWER

612
Jennekens, J.H. Atomic Energy Control Board, Ottawa, Canada

Regulation of Nuclear Power Stations in Canada. CONF-770708; Thermal Reactor Safety Meeting, Sun Valley, ID, July 31, 1977, Vol. I (pp. 271-278). (1977)

In Canada, 500 and 750 MWe CANDU-PHW systems are in operation and a standard 600 MWe design has been developed. Plants of the latter type are under construction in Canada and abroad. This design has evolved from the experience gained since 1957 in the design and operation of a number of nuclear-electric generating stations, all fuelled with natural uranium and moderated by heavy water. The reactor safety philosophy in Canada has developed in association with the evolution of the CANDU system and has been almost exclusively influenced by the experience gained in the design and operation of such systems. It is evident that nuclear regulatory agencies throughout the world share a commonality of purpose, namely, the achievement of a high standard of safety in the siting, design, construction, commissioning, operation and decommissioning of nuclear power stations. The objective of this paper is to outline the Canadian approach.

REACTORS, CANDU TYPE; REACTORS; LICENSING; REACTOR SAFETY; REGULATIONS

613

Kennedy Jr., W.E., R.B. McPherson, and E.C. Watson Battelle-Pacific Northwest Laboratories, Richland, WA

Acceptable Residual Radioactive Contamination Levels for Sites of Decommissioned Nuclear Facilities. EPA 520/3-79-002; Low-Level Radioactive Waste Management, J.E. Watson, Jr., (Ed.), Proceedings of Health Physics Society Twelfth Midyear Topical Symposium, Williamsburg, VA, February 11-15, 1979. U.S. Environmental Protection Agency, Washington, DC, (pp. 373-384), 540 pp. (1979, May)

Examination of existing guidelines and regulations has led to the conclusion that there is need for a general method to derive residual contamination levels that should be acceptable to the public in return for use of any site of decommissioned nuclear facilities. The method used for this study is to determine these acceptable environmental levels based on a maximum annual dose to an individual from the residual contamination via all environmental pathways. A maximum annual dose criterion of one mrem is selected for purposes of illustrating the method. Acceptable residual radioactive contamination levels for the sites of three current-design nuclear facilities are presented. The reference facilities considered are: a Fuel Reprocessing Plant (FRP), a Pressurized Water Reactor (PWR), and a small Mixed Oxide Fuel Fabrication Plant (MOX). Using maximum annual dose as a basis permits an accurate accounting of the impact of radionuclide mixtures at each unique nuclear site. The results presented consider all probable radiation exposure pathways contributing significantly to the maximum annual dose to an individual from chronic exposure to the residual radioactive contamination on the site. For chronic radiation exposure, the year in which the maximum annual dose occurs depends upon the chemical and physical characteristics of the residual radionuclides, the body organ of reference, and the radiation exposure pathway. The acceptable residual radioactive contamination levels are based on the calculated maximum annual dose resulting from the radionuclide mixture accumulated from a calculated annual release during the facility operating lifetime. The results of this study show acceptable radioactive contamination levels at plant shutdown in units of microcuries per square meter 5.0 x 10(E-3) for the FRP, 1.2 x 10(E-2) for the PWR, and 1.3 x 10(E-2) for the MOX. (COMPLETE TEXT)

RADIOACTIVITY; NUCLEAR FACILITIES; DECOMMISSIONING; REGULATIONS, FEDERAL; CONTAMINATION; STANDARDS, FEDERAL; ENVIRONMENT; EXPOSURE, POPULATION; FUEL REPROCESSING; REACTORS, PWR; FABRICATION, FUEL

614

Lear, G., and P.B. Erickson Idaho Operations Office, Idaho Falls, ID; Aerojet Nuclear Company, Idaho Falls, ID

Decommissioning and Decontamination of Licensed Reactor Facilities and Demonstration Nuclear Power Plants. pp. 31-45. (1975, September)

DECONTAMINATION; LEGAL ASPECTS; NUCLEAR POWER PLANTS; REACTOR DECOMMISSIONING; REGULATIONS; REACTORS, RESEARCH

615

Martin, A., F.C.J. Tildsley, and L. Clark Associated Nuclear Services, Epsom, Surrey, United

Kingdom; Nuclear Installations Inspectorate, London, United Kingdom

Criteria for the Management of Redundant Nuclear Facilities. IAEA-SM-234/46; Decommissioning of Nuclear Facilities, Proceedings of an International Symposium, Vienna, Austria, November 13-17, 1978. International Atomic Energy Agency, Vienna. (pp. 319-335), 694 pp. (IAEA-SM-234/46). (1979)

In the paper, various aspects of the management of redundant nuclear facilities are examined, with particular reference to the establishment of criteria. Comparisons are made of the likely residual radioactive inventories in reactors, reprocessing plants and mixed oxide fuel fabrication plants and the implications for decommissioning and dismantling are discussed. Site selection may be influenced by considerations of decommissioning and in turn the approach and timescale of a decommissioning program will reflect aspects of a site. These are discussed briefly. The need to take account at the design stage of the eventual problems of decommissioning and dismantling are emphasized, and the means by which such a requirement would be met in practice are illustrated. In reactors, features incorporated for the purpose of in-service inspection will ease future dismantling, whilst in fuel plants, many features which are required for the safe and reliable operation and maintenance of the plants would also be advantageous in their decommissioning. Operational practices can have a significant influence on the radiological environment of a plant, and hence on the difficulties of access and on the generation of radioactive wastes. This is particularly true of fuel plants because of the nature of the processes and the process materials. Waste management is a key area of concern, and illustrative comparisons are made of the waste arising from normal operation and from dismantling of the different types of plants. Disposal routes are still under consideration in most countries and the approaches adopted will greatly affect the cost and the radiological impact of the removal of redundant facilities. (Auth)

STANDARDS, INTERNATIONAL; RESIDUAL ACTIVITY; REACTORS; FUEL REPROCESSING PLANTS; FABRICATION PLANTS, MIXED OXIDE FUEL; DECOMMISSIONING; DISMANTLING; SITE SELECTION; TIME FACTOR; DESIGN; WASTE MANAGEMENT; WASTE DISPOSAL; COSTS

616
Murphy, T.D.

Occupational Exposure and ALARA. CONF-790923; Decontamination and Decommissioning of Nuclear Facilities, Proceedings of a Conference, Sun Valley, ID, September 16-20, 1979. Session V-A, (pp. 3-5), 90 pp. (CONF-790923). (1979)

To maintain an acceptable occupational radiation exposure levels, it is necessary to reduce the time needed for maintenance operations, reduce system components, reduce the time needed for maintenance operations, reduce the frequency of such operations, and reduce the number of people involved in such operations. Many alternatives, and combinations thereof, for such additional regulatory action that would reduce radiation risk have been considered. (1) Amend 10 CFR Parts 20, 30, 40, 50 and 70 to require licensees to develop and implement individual occupational ALARA programs, with guidance on the program content to be given in regulatory guides tailored for the various types of licensed activities. (2) Require these licensees to perform cost-benefit analyses for major tasks and to provide all safety procedures, equipment, and facilities that are shown to be cost-effective, using a dollars-per-man-rem criterion. (3) Establish annual design and operational collective dose (man-rem) objectives (goals) for various types of licensees. (4) Continue to implement the occupational ALARA concept through the license review process and the issuance of regulatory guides that address ALARA in different types of facilities, training of workers, surveys, etc., but without amendment of the regulations requiring licensees to develop and submit ALARA program for NRC evaluation and incorporation into the license. (5) Impose additional specific design criteria in 10 CFR part 50, Appendix A, to reduce occupational radiation doses at power reactors. In addition to whatever alternative or combination of alternatives is selected, the NRC staff proposed certain amendments to 10 CFR part 20 which would eliminate the dose averaging formula, 5(N-18), and the associated Form NRC-4 exposure history and impose annual dose-limiting standards (5 rems per year) while retaining quarterly standards. (Auth)(JMF)

This paper is only an abstract of the actual paper which is to be published later.

DECONTAMINATION; WASHING; NUCLEAR FACILITIES; REGULATIONS, FEDERAL; EX-

POSURE, OCCUPATIONAL; COBALT; RADIATION HAZARDS; RADIATION SOURCES; DOSE RATE; REACTORS, PWR; COST BENEFIT ANALYSIS; RADIONUCLIDES

617

Paschall, R.K. Atomics International, Canoga Park, CA

Decontamination and Decommissioning Criteria for Use in Design of New Plutonium Facilities. AI-ERDA-13156; 127 pp. (1975, June 30)

Decontamination and decommissioning (D and D) criteria were assembled for use in designing new plutonium facilities. These criteria were gathered from literature searches and visits to many plutonium facilities around the country. The recommendations of reports and experienced personnel were used. Since total D and D costs can be millions of dollars, improved designs to facilitate D and D will result in considerable savings in cost and time and will help to leave the site for unrestricted future use after D and D. Finally, better design will reduce hazards and improve safety during the D and D effort.

DECONTAMINATION; DECOMMISSIONING; DESIGN; FUEL REPROCESSING; REACTORS, LMFBR; PLUTONIUM; WASTE DISPOSAL; STANDARDS, FEDERAL

618

Petterson, B.G. National Institute of Radiation Protection, Stockholm, Sweden

Establishment of Activity Limits for Items to be Released for Unrestricted Use. IAEA-SM-234/38; Decommissioning of Nuclear Facilities, Proceedings of an International Symposium, Vienna, Austria, November 13-17, 1978. International Atomic Energy Agency, Vienna, (pp. 251-262), 694 pp. (IAEA-SM-234/38). (1979)

Materials, equipment and premises considered for release for unrestricted use in the course of decommissioning operations of nuclear facilities must be cleared from the radiation protection point of view prior to actual release. Activity limits to be applied must be based on characteristics of the future possible uses of the various items and their activity content. The objective of activity limits is to maintain radiation doses resulting from such uses within acceptable limits, i.e. activity limits must be based on appropriately established dose limits. The ICRP recommended System of Dose Limitation provides a suitable framework on which to base decisions on such dose limits. This paper discusses the application of the ICRP System of Dose Limitation on the particular component of decommissioning operations where items are considered for release for unrestricted use. In particular, the principles involved in deriving activity limits based on the System are discussed. (Auth)

NUCLEAR FACILITIES; DECOMMISSIONING; STANDARDS, INTERNATIONAL; RADIATION DOSE; RESIDUAL ACTIVITY

619

Queniart, M. Ministere de l'Industrie et de la Recherche, Service Central de Surete des Installations Nucleaires, Paris, France

Technical Regulations in France. Interregional Training Course on Nuclear Power Project Planning and Implementation, Saclay, France, March 30, 1976 (11 pp.). (1976)

The technical regulations for the safety of nuclear installations cover all the measures to be taken at the successive stages of design, construction, entry into service, operation and decommissioning of these installations, to prevent accidents and wrongful acts, as well as to limit their effects. The public authorities ensure that these regulations are observed by setting up a prior licensing system. One of the difficulties in preparing technical regulations is to define a satisfactory safety level, given the relative lack of sufficient experience in this field, and subjective considerations. Another problem stems from the diversity of reactor types and the speed of technological development. Finally, it is not always easy to incorporate these special regulations in the general legislative framework. These matters are illustrated by examples of French and United States regulations, as well as by codes and guides published by IAEA.

NATIONAL CONTROL; NUCLEAR FACILITIES; REACTORS; LICENSING; REACTOR SAFETY; REGULATIONS

620

Rowe, W.D. U.S. Energy Research and Development Administration, Washington, DC; Oak Ridge

National Laboratory, Oak Ridge, TN; U.S. Environmental Protection Agency, Washington, DC

Radiation-Protection Standards and Waste Management. International Symposium on Management of Waste from the LWR Fuel Cycle, Denver, CO, July 11, 1976, (pp. 514-523). (1976)

This paper reviews some of the difficult questions to be addressed in the development of fundamental environmental criteria and standards for radioactive waste management. A short discussion is included of the need to develop more precise definitions of terminology, better conceptualization of long-term problems, and new concepts to express risks from waste management and to evaluate the ability of proposed technical alternatives to control such risks. EPA's plans to develop fundamental environmental criteria and generally applicable environmental radiation-protection standards for waste disposal are summarized. Finally, the principal projects in EPA's planned near-future programs are reviewed in the areas of high-level waste, transuranic solid waste, low-level waste, residual decommissioning waste, ocean disposal, and wastes containing natural radioactivity.

ENVIRONMENTAL EFFECTS; WASTE MANAGEMENT; REGULATIONS; GOVERNMENT POLICIES, EPA

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Rowe, W.D. U.S. Energy Research and Development Administration, Washington, DC; Oak Ridge National Laboratory, Oak Ridge, TN; U.S. Environmental Protection Agency, Washington, DC

Functions of the U.S. Environmental Protection Agency in Radioactive Waste Management. International Symposium on Management of Waste from the LWR Fuel Cycle, Denver, CO, July 11, 1976 (pp. 39-44). (1976)

In its development of critera for the management of radioactive wastes, EPA's underlying philosophy is that waste management means containment rather than planned release and dispersion. EPA's program in the development of criteria for the disposal of high-level wastes, low-level wastes, wastes contaminated with transuranic elements, decommissioning, ocean dumping, and naturally occurring radioactive wastes from ores processing and from non-nuclear energy industries is briefly outlined. (JSR)

CONTAMINATION; REGULATIONS; FUEL CYCLES; WASTE DISPOSAL; WASTE MANAGEMENT; GOVERNMENT POLICIES, EPA; REACTORS, WATER COOLED

622

Russell, J.L., and W.N. Crofford US Environmental Protection Agency, Office of Radiation Programs

Decommissioning Standards - the Radioactive Waste Impact. EPA 520/3-79-002; Low-Level Radioactive Waste Management, J.E. Watson, Jr., (Ed.), Proceedings of Health Physics Society Twelfth Midyear Topical Symposium, Williamsburg, VA, February 11-15, 1979. U.S. Environmental Protection Agency, Washington, DC, (pp. 252-260), 540 pp. (1979, May)

Considerations important in establishing standards for decommissioning nuclear facilities, sites and materials include the form of the standards, timing for decommissioning, occupational radiation protection, costs and financial provisions, and low-level radiation protection, costs and financial provisions, and low-level radioactive waste. The most difficult problem in establishing radiation protection standards for decommissioning is the choice of the rationale or basis of the standard as an initial step in identifying rationale which may be suitable for decommissioning. A thorough review is planned of existing standards, regulations and criteria which deal with areas such as exposure rate limits in uncontrolled areas, decontamination criteria and standards, and others. An important part of the decommissioning of a nuclear power plants is the time at which facilities and sites must meet dose level requirements. The challenge is to select the timing for decommissioning to optimize the benefits to be obtained through radioactive decay and to minimize the remoteness of the generation conducting the decommissioning from the generation receiving the benefits. As an initial estimate of what the timing for decommissioning should be, it is suggested that EPA's proposed Radiation Protection Criteria (EP) for the Disposal of Radioactive Waste be used. Criterion No. 2 of this proposal states, "Controls which are based on institutional functions should not be relied upon for longer than 100 years to assure continued isolation from the biosphere". The major health related issue determining timing requirements for decommissioning is occupational radiation exposure. Since Co 60 is a predominant radiation source and has longest half life, occupational exposure reduction to be gained by delaying decommissioning can be directly related to the half life of Co 60. Therefore, it appears that a maximum timing limit of 50 years for reactors will provide an optimum point for occupational exposures balanced with economic and institutional considerations. Because of the long-lived nature of the products on the front and tail ends of the fuel cycle, there is nothing to be gained through a delay here. A comparison of annual volumes of low-level radioactive wastes versus decommissioning volumes indicated that over its operation life, a reactor is expected to generate anywhere from about the same volume to as much as four times the volume that will be generated during decommissioning. In shallow land burial the spacing required between trenches, the decommissioning volume thus represents a land use commitment of about one acre per reactor. This would not appear to be an inordinate commitment of land, especially when compared to fossil fuel power demands. Thus, it is concluded that the low-level waste volume from decommissioning is not a serious problem nor a limiting consideration. Also, if the utility could demonstrate that the decommissioning cost was a small fraction of the power production cost, say less than 5% to 10%, this cost could be included in the operating costs and regulated by the controlling Public Utility Commission. (Auth)(JMF)

DECOMMISSIONING; NUCLEAR FACILITIES; EXPOSURE, OCCUPATIONAL; STANDARDS, FEDERAL; COSTS; WASTES, LOW-LEVEL; WASTES, RADIOACTIVE; REGULATIONS, FEDERAL; EXPOSURE, POPULATION; WASTE DISPOSAL; ENVIRONMENT; HAZARD ANALYSIS

623

Scharnhoop, H. Muenster University, Muenster, German Federal Republic

Judicial Problems in Connection with the Decommissioning of Nuclear Facilities. 5th Symposium on Nuclear Law, R. Lukes (Ed.), Muenster, German Federal Republic, December 8, 1976 (pp. 141-147). (1977)

The 4th Amendment of the Atomic Energy Act has regulated in Section 7, Sub-section 3 ATG decommissioning, safe containment, and dismantling of facility or components. The term 'removal' of such removed or dismantled radioactive components is not mentioned in this context. Removal is dealt with in the added Section 9A ATG.

LEGAL ASPECTS; NUCLEAR FACILITIES; NUCLEAR POWER PLANTS; REACTOR DECOMMISSIONING; REACTOR DISMANTLING; COSTS

624

Scharnhoop, H. Muenster University, Muenster, F.R. Germany

Shut-down and Ownership of Out-of-Operation Nuclear Facilities Subject to Approval. 3rd. German Symposium on Atomic Energy Law, Goettingen, German Federal Republic, October 22, 1974 (pp. 63-72). (1975)

The questions are discussed whether the shut-down of a plant or the ownership of an out-of-operation facility requires a license under Section 7 of the Atomic Energy Act. The answers to these questions are recorded positively as a result.

LEGAL ASPECTS; LICENSING; NUCLEAR FACILITIES; REACTOR DECOMMISSIONING

625

SCS Engineers, Reston, VA; U.S. Nuclear Regulatory Commission, Washington, DC

State Workshops for Review of the Nuclear Regulatory Commission's Decommissioning Policy Held at Philadelphia, Pennsylvania, Atlanta, Georgia, Albuquerque, New Mexico on September 18-30, 1978. Conference Proceedings. Report; 361 pp. (1978, November)

The Nuclear Regulatory Commission is developing a more explicit overall decommissioning policy and amending current regulations 10 CFR, Parts 20, 40, 50 70. To provide for state comment on the plan and the first two major decommissioning studies, that of a PWR (NUREG/CR-0130) and a fuel reprocessing plant (NUREG-0278), a series of workshops were held. This report contains the workshop proceedings.

REGULATIONS, FEDERAL; MEETINGS; REACTORS; REACTORS, PWR; RECOMMENDATIONS; REACTOR DECOMMISSIONING; NUCLEAR FACILITIES; FUEL REPROCESSING PLANTS; GOVERNMENT POLICIES, NRC

626

Servant, J. International Atomic Energy Agency, Vienna, Austria

Regulatory Requirements and Administrative Practice in Safety of Nuclear Installa-

tions. International Conference on Nuclear Power and Its Fuel Cycles. Salzburg. Austria. May 2-13. 1977 (13 pp.). (1977)

The regulatory rules and procedures dealing with the safety of nuclear facilities and, more broadly, nuclear security in France are reviewed. The policy of the French administration which requires that the licensee responsible for the installation has to demonstrate that all possible measures are taken to ensure a sufficient level of safety from the early stage of the project to the end of the operation of the plant is outlined. The licensing progress for the main categories of installations are outlined: nuclear power plants of the PWR type, fast breeders, uranium isotope separation plants, and irradiated fuel processing plants. Emphasis is placed on the most noteworthy points: standardization of projects, specific risks of each site, problems of advanced type reactors, etc. The development of the technical regulations is presented with emphasis on the importance of an internationally concerned action within the nuclear international community. The second part of this paper describes the French operating experience of nuclear installations from the safety point of view. Especially, the author examines the technical and administrative utilization of data from safety significant incidents in reactors and plants, and the results of the control performed by the nuclear installations inspectorate. The current situation, far from being frozen, is finely attuned to the general evolution of nuclear problems. The author concludes by reviewing the essential problems which have to be solved now and presents the corresponding solutions, for example: the fore examination of the safety options of the future projects, the limitation of the doses received by professionally exposed personnel, the measures to be taken after decommissioning of nuclear installations, etc.

NUCLEAR FACILITIES; NUCLEAR POWER PLANTS; REACTORS; LICENSING; REGULATIONS; SAFETY

627
Six, C.

From a State Perspective. CONF-790923; *Decontamination and Decommissioning of Nuclear Facilities, Proceedings of a Conference*, Sun Valley, ID, September 16-20, 1979. Session I, (pp. 5-6), 90 pp. (CONF-790923). (1979)

Many concerns of state officials dealing with federal regulations and standards for the use of nuclear power are apparent. The primary responsibilities of setting just and reasonable rates and assuring reliable utility service needs to be enlarged to allow states active roles in the "great nuclear debate". Hard data for making intelligent economic decisions on nuclear versus other options, and to include all costs on the setting of just and reasonable rates, have not been available. The decommissioning work done by the Nuclear Regulatory Commission (NRC) and Battelle is a big step toward providing commissions with the tools to assure that current ratepayers pay all costs of the nuclear energy they consume. Hopefully, included will be provisions for the payment of the cost of decommissioning the plants sometime in the future. Also the Spent Nuclear Fuel Act of 1979, supported by the National Association of Regulatory and Utility Commissioners, (NARUC) would eliminate the ratemaking problem. The Act will provide an interim step-with the attendant contractual commitments between utilities and the federal government - until questions of spent fuel reprocessing and the breeder reactor are settled. Another ratemaking problem which should be resolved in the future is changing the Internal Revenue code so that monies utilities would collect for future payment of decommissioning and waste disposal costs not be considered taxable income. (JMF)

This paper is only an abstract of the actual paper which is to be published later. The paper outlines concerns of state energy officials who deal with federal regulations effecting the use of nuclear power.

DECOMMISSIONING; NUCLEAR FACILITIES; RECOMMENDATIONS; REGULATIONS, STATE; REGULATIONS, FEDERAL; STANDARDS, FEDERAL; STANDARDS, STATE; REACTORS; WASTES, RADIOACTIVE; WASTE MANAGEMENT; NUCLEAR POWER; ECONOMICS; COSTS

628
Stello, V.

Nuclear Regulatory Commission's View of Decontamination and Decommissioning. CONF-790923; Decontamination and Decommissioning of Nuclear Facilities, Proceedings of a Conference, Sun Valley, ID, September 16-20, 1979. Session I, (pp. 3-4), 90 pp. (CONF-790923). (1979)

The Nuclear Regulatory Commission (NRC) is in the midst of a major re-evaluation of policies and regulations on decommissioning. The present regulations are not very specific on the matter; too much is left uncertain for the public. NRC hopes to remove that uncertainty with a vastly better public knowledge of the alternatives and costs to decommission nuclear facilities licensed by the NRC, and with a clearer NRC policy. Analysis of decommissioning has shown that, for the reactor and fuel cycle facilities studied so far, the technology already exists for complete decommissioning. Occupational exposures are not excessive even for immediate dismantling, although delay in reactor decommissioning can lead to substantial reduction in exposures. The estimated costs of decommissioning appear to be readily manageable. Discussion of these analyses and results with state representatives have been useful. They have asked NRC to provide clear policy and criteria for decommissioning, and as much independent cost analysis as possible. The states call on NRC to set basic requirements but to leave as much decision making as possible to local authorities. NRC is also interested in the decontamination process since it may provide the important resolution of the conflict between the continuing need for timely inservice inspection and maintenance, and the growing occupational exposures entailed. (Auth)(JMF)

This paper is only an abstract of the actual paper which is to be published later.

DECONTAMINATION; DECOMMISSIONING; NUCLEAR FACILITIES; RECOMMENDATIONS; EXPOSURE, OCCUPATIONAL; REGULATIONS, STATE; REGULATIONS, FEDERAL; STANDARDS, FEDERAL; STANDARDS, STATE; REACTORS; WASHING; GOVERNMENT POLICIES, NRC

629
U.S. Atomic Energy Commission, Washington, DC

Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material. USAEC (Division of Materials Licensing) Guidelines; 4 pp. (1970; 1971, April 22)

The instructions in this guide in conjunction with Tables 1 and 2 specify the radioactivity and radiation exposure rate limits which should be used in accomplishing the decontamination and survey of surfaces of premises and equipment prior to abandonment or release for unrestricted use. The limits in Tables 1 and 2 do not apply to premises, equipment or scrap containing induced radioactivity for which the radiological considerations pertinent to their use may be different. The release of such facilities or items from regulatory control will be considered on a case-by-case basis.

DECONTAMINATION; BYPRODUCT MATERIAL; CONTAMINATION, SURFACE; DECOMMISSIONING; NUCLEAR MATERIALS; RADIATION MONITORING; REGULATIONS, FEDERAL

630
U.S. Atomic Energy Commission, Washington, DC

Termination of Operating License for Nuclear Reactors. AEC Regulatory Guide 1.86; 5 pp. (1974, June)

To terminate an operating license requires that the dismantlement of the facility and disposal of the component parts not be inimical to the common defense and security or to the health and safety of the public. This guide describes methods and procedures considered acceptable by the regulatory staff for the termination of operating licenses for nuclear reactors.

LICENSE STATUS; PROCEDURES; DECOMMISSIONING; REGULATIONS, FEDERAL; DOCUMENTATION; REACTOR OPERATION; LICENSING

631
U.S. Nuclear Regulatory Commission, Office of Standards Development, Washington, DC

Plan for Reevaluation of NRC Policy on Decommissioning of Nuclear Facilities. Report; 65 pp. (1978, March)

Recognizing that the current generation of large commercial reactors and supporting nuclear facilities would substantially increase future decommissioning needs, the NRC staff began an in-depth review and re-evaluation of NRC's regulatory approach to decommissioning in 1975. Major technical studies on decommissioning have been initiated at Battelle Pacific Northwest Laboratory in order to provide a firm information base on the engineering methodology, radiation risks, and estimated costs of decommissioning light water reactors and associated fuel cycle facilities. The Nuclear Regulatory Commission is now considering development of a more explicit overall policy for nuclear facility decommissioning and amending its regulations in 10 CFR Parts 30, 40, 50, and 70 to include more specific guidance on decommissioning criteria for production and utilization facility licensees and byproduct, source, and special nuclear material licensees. The report sets forth in detail the NRC staff plan for the development of an overall NRC policy on decommissioning of nuclear facilities.

DECOMMISSIONING; NUCLEAR FACILITIES; NUCLEAR POWER PLANTS; PLANNING; REACTOR DECOMMISSIONING

632
U.S. Nuclear Regulatory Commission, Washington, DC

Conference Proceedings for State Workshops for Review of the Nuclear Regulatory Commission's Decommissioning Policy. NUREG CP-0003; 351 pp. (1978, December)

NRC is developing a more explicit overall policy for nuclear facility decommissioning and amending current Regulations 10 CFR, Parts 20, 40, 50, and 70. The proposed plan for developing the new policy was presented in NUREG-0436; "Plan for Reevaluation of NRC Policy on Decommissioning of Nuclear Facilities," March 1978. To provide for state comment, NRC conducted 3 workshops in Philadelphia, Pennsylvania; Atlanta, Georgia; and Albuquerque, New Mexico, between September 18 and September 30, 1978. This report contains the workshop proceedings as edited by the NRC and SCS engineers, Reston, Virginia.

REVIEWS; DECOMMISSIONING; NUCLEAR POWER PLANTS; GOVERNMENT POLICIES, NRC

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Waite, D.A., and C.E. Jenkins Battelle-Pacific Northwest Laboratories, Richland, WA

Development of Disposition Criteria Deviation Methodology for Commercial Fuel Cycle Facilities. Report; 21 pp. (1975)

Development and definition of acceptable criteria for release of nuclear sites and or facilities under specified use restriction categories or disposition criteria are discussed. Previous reports have defined site and facility characteristics before major decontamination or decommissioning. With this background information, disposition criteria were developed to facilitate decision-making regarding disposition alternatives. To develop these disposition criteria, existing guidance was reviewed, philosophy and objectives were identified, and mechanisms were developed and applied to a generic mixed oxide fuel fabrication plant. (GRA)

FABRICATION PLANTS, MIXED OXIDE FUEL; DECOMMISSIONING; DECONTAMINATION; EQUIPMENT; NUCLEAR INDUSTRY; RADIATION DOSE

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- Uranium Mill Tailings Restoration
- Contaminated Site Restoration
- Criteria and Standards

This appendix contains references to recently acquired literature relevant to decommissioning of nuclear facilities.

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