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Remedial Action Program Information Center

Nuclear Facility Decommissioning and Site Remedial Actions: A Selected Bibliography, Vol. 13

Part 1. Main Text

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for the
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MASTER

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ABSTRACT

This publication contains 1035 abstracted references on environmental restoration, nuclear facility decommissioning, uranium mill tailings management, and site remedial actions. These citations constitute the thirteenth in a series of reports prepared annually for the U.S. Department of Energy (DOE) Environmental Restoration programs. Citations to foreign and domestic literature of all types—technical reports, progress reports, journal articles, symposia proceedings, theses, books, patents, legislation, and research project descriptions—have been included. The bibliography contains scientific, technical, economic, regulatory, and legal information pertinent to the DOE Environmental Restoration programs. There are 13 major sections of the publication, including: (1) DOE Decontamination and Decommissioning Program; (2) Nuclear Facilities Decommissioning; (3) DOE Formerly Utilized Sites Remedial Action Program; (4) DOE Uranium Mill Tailings Remedial Action Project; (5) Uranium Mill Tailings Management; (6) DOE Environmental Restoration Program; (7) DOE Site-Specific Remedial Actions; (8) Contaminated Site Restoration; (9) Remediation of Contaminated Soil and Groundwater; (10) Environmental Data Measurements, Management, and Evaluation; (11) Remedial Action Assessment and Decision-Making; (12) Technology Development and Evaluation; and (13) Environmental and Waste Management Issues. Within these 13 sections, the bibliographic references are arranged in nine subject categories by geographic location and then alphabetically by first author, corporate affiliation, or publication title. Indexes are provided for author, corporate affiliation, title word, publication description, geographic location, subject category, and key word.

This report is a product of the Remedial Action Program Information Center (RAPIC), which selects, analyzes, and disseminates information on environmental restoration, decontamination and decommissioning and remedial actions. RAPIC staff and resources are available to meet a variety of information needs. Contact the center at (615) 574-7580.

INTRODUCTION

This bibliography is published by the Remedial Action Program Information Center (RAPIC). RAPIC is part of the Information Systems department, Program Integration and Administration Division of the Environmental Restoration Program of Martin Marietta Energy Systems, Inc., with offices located at the Oak Ridge K-25 Site. RAPIC is funded by the U.S. Department of Energy (DOE) Office of Environmental Restoration and Waste Management (EM) to provide technical information support to the activities sponsored by these DOE programs:

- **Decontamination and Decommissioning Program**

  Lead Office — DOE Headquarters
  Lead Technical Contractor — Office of Technical Services,
  Roy F. Weston, Inc., and
  H&R Technical Associates, Inc.

- **Formerly Utilized Sites Remedial Action Program**

  Lead Field Office — DOE Oak Ridge Field Office
  Lead Technical Contractor — Bechtel National, Inc.

- **Uranium Mill Tailings Remedial Action Project**

  Lead Field Office — DOE Albuquerque Field Office
  Lead Technical Contractor — Jacobs Engineering Group, Inc.

RAPIC serves as a central clearinghouse for information, derived from both foreign and domestic publications, that concerns the scientific, regulatory, and socioeconomic aspects of radioactively contaminated facility and site remedial actions. These remedial actions encompass activities such as:

- performing characterization surveys of radioactively contaminated facilities or sites;
- conducting ongoing security and surveillance programs;
- performing preventive maintenance actions to ensure containment of radioactivity while awaiting permanent facility disposition;
- assessing environmental and engineering aspects of proposed remedial action alternatives;
- drafting detailed remedial action project plans and procedures; and
- performing remedial actions to make facilities/sites available for restricted or unrestricted use.

The 1035 abstracted references herein constitute the thirteenth annual publication of the same title and subject coverage. The contents of this publication are stored in a comprehensive,

computer-retrievable data file that undergoes periodic updating. Most researchers use the published bibliographies as their "first-line" reference tool; however, the cumulative data file can be accessed through RAPIC for the most current additions or for a comprehensive search.

Subject Coverage

The subject matter of this bibliography is presented in 13 sections: (1) DOE Decontamination and Decommissioning Program; (2) Nuclear Facilities Decommissioning; (3) DOE Formerly Utilized Sites Remedial Action Program; (4) DOE Uranium Mill Tailings Remedial Action Project; (5) Uranium Mill Tailings Management; (6) DOE Environmental Restoration Program; (7) DOE Site-Specific Remedial Actions; (8) Contaminated Site Restoration; (9) Remediation of Contaminated Soil and Groundwater; (10) Environmental Data Measurements, Management, and Evaluation; (11) Remedial Action Assessment and Decision-Making; (12) Technology Development and Evaluation; and (13) Environmental and Waste Management Issues.

The DOE Decontamination and Decommissioning (D&D) Program section contains references pertaining to the D&D of structures located primarily on federal reservations.

The Nuclear Facilities Decommissioning section presents references to information relating to D&D at non-DOE nuclear facilities, including those outside the United States.

The DOE Formerly Utilized Sites Remedial Action Program (FUSRAP) section cites documents generated by, or related to, the DOE FUSRAP program. FUSRAP sites were used by the Manhattan Engineer District or by the Atomic Energy Commission from the 1940s through the 1960s for the processing, handling, storage, or shipment of radioactive materials.

The DOE Uranium Mill Tailings Remedial Action (UMTRA) Project section contains information pertinent to UMTRA management or to the 24 UMTRA sites, located primarily in the western United States. These sites are inactive uranium mill sites that were operated under government contract.

The section on Uranium Mill Tailings Management contains foreign and domestic site-specific mill tailings information and basic or applied mill-tailings research information that is not part of UMTRA.

The DOE Environmental Restoration Program section contains references pertinent to activities conducted and plans prepared by the DOE Office of Environmental Restoration (EM-40). Documents which affect or relate to DOE's environmental restoration effort as a whole are included here.

The section on DOE Site-Specific Remedial Actions is made up of references to documents from individual DOE facilities. These documents may address environmental restoration efforts at a DOE facility as a whole; cleanup of operable units, waste area groupings, or other specific sites inside a DOE facility; or remediation of contamination originating from a DOE facility.

The Contaminated Site Restoration section contains references to documents on remediation efforts at non-DOE sites contaminated with hazardous or radioactive materials when such information may prove useful in DOE's environmental restoration activities.

The section on Remediation of Contaminated Soil and Groundwater contains citations to technologies used at both DOE and non-DOE sites to characterize, control, and abate land and water pollution.

The section on Environmental Data Measurement, Management, and Evaluation includes references to documents on instrumentation for measuring radioactive or hazardous materials; sampling protocols; and data collection, validation, and quality assurance methods.

The Remedial Action Assessment and Decision-Making section consists of citations to documents on risk assessment and other models for evaluating environmental restoration projects.

The Technology Development and Evaluation section cites documents which relate to the research and development, demonstration, testing, and evaluation of new technologies for environmental restoration.

The section on Environmental and Waste Management Issues contains citations on hazardous and radioactive waste disposal and treatment and on EPA and NRC policies affecting DOE remediation and waste-management activities.

Indexes

The color-coded indexes are a quick guide to finding needed information. The numbers appearing after each listing in the indexes are citation numbers. The author index (pink pages) lists all authors for each citation. The corporate affiliation index (blue pages) is an alphabetical listing of the institution performing the work. The title word index (yellow pages) provides a permuted index of all major words in each title (except such pervasive words as *decommissioning, decontamination, environmental, restoration, tailings, etc.*). The publication description index (green pages) lists alphabetically all journal names, conference descriptions, report numbers, or other unique document descriptions that would identify the publication. The title of the document is listed below each entry in the publication description index. The geographic location index (gold pages) provides an alphabetical listing of the geographic descriptions of sites referenced in the bibliography; these are divided into domestic sites and foreign sites. A subject category index (white pages) is provided for each of the major sections. The nine subject categories are (1) Design, Planning, and Regulations; (2) Environmental Studies and Site Surveys; (3) Health, Safety, and Biomedical Studies; (4) Decontamination Studies; (5) Dismantlement and Demolition; (6) Site Stabilization and Reclamation; (7) Waste Disposal; (8) Remedial Action Experience; and (9) General Studies. The key word index (buff pages) is an alphabetical index of terms selected from a controlled thesaurus to characterize specific concepts.

Citation Form

Each bibliographical reference is numbered sequentially. The references within each major section are arranged in the subject categories by geographic location and then alphabetically by first

author, corporate affiliation, or title of the document. When an author is not given for a document, the corporate affiliation will appear first. If these two levels of authorship are not given, the title of the document will appear first. The document title is followed by the publication description, publication date, and abstract. A sample reference is given on page xiii.

Scientific Notations and Abbreviations

1. X sub t means X_t or X subscript t.
2. For chemical compounds and elements, NaIO3 means $NaIO_3$.
3. 10(E+3) or X(E-3) (E denoting exponent) means 10^3 or X^{-3}, respectively.
4. Cubic or square dimensions of measurements are shown as 6 cu cm (for 6 cubic centimeters) or 3 sq km (for 3 square kilometers).
5. The following prefixes have been used to indicate multiples or subdivisions of units of measurement:

a	atto	(10^{-18})	da	deca	(10^{1})
f	femto	(10^{-15})	h	hecto	(10^{2})
p	pico	(10^{-12})	k	kilo	(10^{3})
n	nano	(10^{-9})	M	mega	(10^{6})
u	micro	(10^{-6})	G	giga	(10^{9})
m	milli	(10^{-3})	T	tera	(10^{12})
c	centi	(10^{-2})	P	peta	(10^{15})
d	deci	(10^{-1})	E	exa	(10^{18})

6. The following abbreviations have been used in this publication for unit measurements:

A	ampere	l	liter
a	acre	lb	pound
Bq	becquerel	m	meter
C	Celsius	MeV	megaelectronvolt
c.d.	current density	min	minute
Ci	curie	oz	ounce
cpm	counts per minute	ppm	parts per million
cps	counts per second	R	roentgen
deg	degree	rad	radiation absorbed dose
dpm	disintegrations per minute	rem	roentgen-equivalent-man
dps	disintegrations per second	s	second
F	Fahrenheit	Sv	sievert (dose equivalent)
ft	feet	V	volt
g	gram	W	watt
gal	gallon	W(e)	watt (electrical)
ha	hectare	W(t)	watt (thermal)
hr	hour	WL	working level
in.	inch	yd	yard
keV	kiloelectron volt	yr	year

Services

Copies of most documents referenced in this bibliography can be obtained through either the National Technical Information Service, 5285 Port Royal Road, Springfield, Virginia 22161, or the Office of Scientific and Technical Information, U.S. Department of Energy, P.O. Box 62, Oak Ridge, Tennessee 37831.

RAPIC provides information support to a large number of researchers involved in the fields of remedial action and radioactive waste management. Certain services such as providing information from RAPIC resources, performing literature searches of computerized data bases, and providing assistance in locating hardcopies of documents referenced in the bibliography are provided free of charge to the DOE Environmental Restoration staff and their subcontractors. All inquiries for information services should be addressed to:

Remedial Action Program Information Center
Martin Marietta Energy Systems, Inc.
P.O. Box 2003, Building K-1210
Oak Ridge, Tennessee 37831-7256

Telephone: *615/574-7580 or 615/576-0568*

FAX: *615/576-6547*

Telex: *854511 (ORNL IRA-HMI)*

SAMPLE REFERENCE

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

1 — Page Number
2 — Chapter Heading
3 — Record Number (Sequential Number of Reference)
4 — Author(s)
5 — Corporate Affiliation
6 — Document Title
7 — Publication Description
8 — Publication Date
9 — Abstract

[1]*131* [2]***Nuclear Facilities Decommissioning***

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[3]**191**
[4]R.C. Anderson and D.T. Dexheimer, [5]Bechtel Power Corporation, San Francisco, CA

[6]**Incorporating Decommissioning Requirements Into the Design Process for Nuclear Power Plants**

[7]CONF-800359; Decommissioning Requirements in the Design of Nuclear Facilities, Proceedings of a Nuclear Energy Agency Specialist Meeting, Paris, France, March 17-19, 1980, 285 pp.; (pp. 123-134) [8](1980)

[9]As a first step in incorporating decommissioning requirements into the design process, greater effort should be made to optimize designs and select alternatives to facilitate decommissioning without adding to the initial cost of the plant. In this regard, the concept of designing to minimize the plant's bulk quantities of concrete, piping, and electrical cables offers a significant opportunity to make the ultimate decommissioning easier. A major design objective should be to build "smaller and lighter" to facilitate decommissioning through the simple reduction of the amount of equipment and structures requiring decontamination, dismantlement, demolition, and disposal.

DEPARTMENT OF ENERGY (DOE) DECONTAMINATION AND DECOMMISSIONING PROGRAM

1
L.R. Wallis and K.J. Eger, General Electric Company, Nuclear Energy Division, San Jose, CA

Establishment of Criteria for the Unconditional Release of the Shippingport Reactor

EPA/520/1-90-013; CONF-8909236; Residual Radioactivity and Recycling Criteria, A.B. Wolbarst, H. Terada, and A.C.B. Richardson (eds.), Proceedings of a Workshop, St. Michaels, MD, September 27-28, 1989, 311 pp.; (pp. 197-212) (September 1989)

This paper describes the method used to develop site-release criteria for the Shippingport station. It also provides information on initial site characterization, initial radiological conditions, and the application of the Department of Energy document "A Manual for Implementing Residual Radioactivity Guidelines." Although the direct use of release limits is discussed as an alternative to determining the limits on a cost-benefit basis, the paper does show that both the direct use and cost-benefit analysis were important in defining the final release criteria. The development of a procedure which (1) considered the cost of postulated remedial actions and (2) employed an appropriate number of scenarios to demonstrate compliance with applicable limits and the ALARA philosophy is also discussed.

2
U.S. General Accounting Office, Washington, DC

Uranium Enrichment: Analysis of Decontamination and Decommissioning Scenarios - Briefing Report to the Chairman, Subcommittee on Energy and Power, Committee on Energy and Commerce, House of Representatives

GAO/RCED-92-77BR; 12 pp. (November 1991)

This report by the General Accounting Office (GAO) was made at the request of the Chairman of the House Subcommittee on Energy and Power. The GAO was to analyze the adequacy of a $500 million annual deposit into a fund to pay for the cost of cleaning up the Department of Energy's three aging uranium-enrichment plants. The GAO analyzed four different decontamination and decommissioning (D&D) scenarios for the three plants, which are located in Oak Ridge, Tennessee; Paducah, Kentucky; and Portsmouth, Ohio. Cleanup cost estimates and the timing of these expenses were taken from several sources and were presented in 1992 dollars. Estimated cleanup costs were taken from DOE contractor reports, with the preliminary timing of these costs provided separately by the contractors. D&D costs for cleaning the buildings and equipment used in uranium enrichment are expected to be about $16.1 billion, but could increase as much as 50 percent or decrease as much as 30 percent, according to an Ebasco Services, Inc., report. Remedial action costs for cleaning up the surrounding ground and water are estimated at about $3 billion, according to a draft report prepared by Martin Marietta Energy Systems (MMES), Inc. Cleanup costs for converting and disposing of low-level radioactive, uranium waste streams are expected to range from $1.3 billion to $4.1 billion, according to another draft report by MMES. In summary, the GAO found that (1) a fixed annual $500 million dollar deposit into a cleanup fund would not be adequate to cover the total expected cleanup costs, nor would it be adequate to cover the expected D&D costs; and (2) a $500 million annual deposit indexed to an inflation rate would likely be adequate to pay for all expected cleanup costs, including D&D, remedial action, and depleted uranium costs.

3
Oak Ridge National Laboratory, Oak Ridge, TN

Federal Facility Agreement Plans and Schedules for Liquid Low-Level Radioactive Waste Tank Systems at Oak Ridge National Laboratory, Oak Ridge, Tennessee

ES/ER-17/D1; 99 pp. (March 1992)

Although the Federal Facility Agreement (FFA) addresses the entire Oak Ridge Reservation, specific requirements are set forth for the liquid low-level radioactive waste (LLLW) storage tanks

and their associated piping, equipment, and tank systems at Oak Ridge National Laboratory. The stated objective of the FFA as it relates to these tank systems is to ensure that structural integrity, containment and detection of releases, and source control are maintained pending final remedial action at the site. The FFA requires that leaking LLLW tank systems be immediately removed from service. It also requires the LLLW tank systems that do not meet the design and performance requirements established for secondary containment and leak detection be either upgraded or replaced. The FFA establishes a procedural framework for implementing the environmental laws. For the LLLW tank systems, this framework requires that specified plans and schedules be submitted to the U.S. Environmental Protection Agency and the Tennessee Department of Environment and Conservation for approval within 60 days, or in some cases, within 90 days, of the effective date of the agreement.

4

R.L. Stover, Oak Ridge National Laboratory, Oak Ridge, TN

Decision-Making Process to Shut Down, Refurbish/Modify, or Decommission Research Reactors

IAEA-SR-179/22I; CONF-920577; Ageing, Decommissioning, and/or Major Refurbishment of Research Reactors, Proceedings of an IAEA Seminar for Asia and the Pacific, Bangkok, Thailand, May 18-22, 1992; (12 pp.) (May 1992)

The United States Department of Energy (DOE) has more than 30 installations across the country that have supported nuclear research for energy development and defense materials production. These installations include numerous research reactors, some as much as 40 years old, that have fulfilled their original mission and are faced with the options of refurbishment and continued operations, or shutdown and decommissioning. This paper describes the factors considered by DOE in the decision process and illustrates the process with examples from several DOE research reactors. The factors in the decision process are: (1) safety, (2) environmental compliance, (3) programmatic need, and (4) costs. Safety is a primary consideration for DOE. Many of DOE's reactors were constructed and operated with design criteria and operating procedures less stringent than those that exist today. Frequently, numerous safety upgrades are needed to continue reactor operations. Second, compliance with current and potential future environmental requirements is also a critical consideration that must be addressed for continued operations or shutdown and decommissioning. In the U.S., decommissioning conducted now would be accomplished with little regulatory oversight from agencies other than DOE, but in the future, more stringent technical and procedural standards may be required. For all decisions involving potentially significant environmental impacts, DOE employs a formal process required by the National Environmental Policy Act to evaluate the environmental impacts of alternative decisions. The third factor, programmatic need, is the criterion against which the costs of the various options must be compared. Although DOE reactors were built with specific programmatic needs in mind, many reactors have fulfilled those needs and are now simply useful facilities that are available for use by other programs. DOE is increasingly looking to commercial and international sources for programmatic needs and funding. In evaluating the decommissioning option, the mode of decommissioning is an important consideration. Reactors may be shut down and kept in safe storage for an extended period of time. In some cases, the reactor may be entombed indefinitely. Decommissioning may involve decontamination, removal of the reactor vessel and related equipment, and subsequent reuse of the facilities. Alternatively, the facilities may be demolished and left in a "green field " condition. DOE has several research reactors located at the Oak Ridge National Laboratory near Knoxville, Tennessee, that were originally developed to perform research in the areas of health physics, material and shielding studies, criticality experiments, and others. The decision process applied to these reactors is described in the paper to illustrate the application of the above factors.

5

H. Babad, D.A. Reynolds, D.D. Stepnewski, and G.D. Johnson, Westinghouse Hanford Company, Richland, WA

Evaluation of Tanks that Release Flammable Gases

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 227-232) (September 1991)

Of the 177 high-level waste tanks on the Hanford Site, 23 tanks have been identified as having a potential to generate and release flammable gases. Efforts began in 1990 to ensure safe operation of the tanks, to conduct a characterization of the waste, and to develop approaches for mitigating the release of flammable gases. The focus of the efforts has been on Tank 241-SY-101, because it was found to be the most active tank for the release of gases. This tank vents gases about every 100 days, and major components have been determined to be hydrogen, nitrous oxide, and nitrogen. In some cases the venting has resulted in mixtures above the lower flammability limit. Laboratory studies have been performed to determine the chemical and radiolytic mechanisms for the production of the various gases. Major sources for the gases are believed to be degradation products of the chelating agents used in the original waste processing steps, and radiolysis. Analysis and modeling of the behavior of Tank 241-SY-101 have shown that gases are retained in the lower portion of the tank, presumably due to adherence to small crystalline particles. The buildup of the gases produces a density and temperature instability causing the tank contents to eventually "rollover," thereby releasing the gases. Initial concerns about a secondary crust burn initiated by ignition of the combustible gases in the air space above the waste have been partially allayed. The new data from waste sampling and characterization, synthetic waste studies, and from recent modeling are discussed, and a preliminary overview mechanism for tank behavior is introduced.

6
J.M. Cruse and P.M. Heffner, Westinghouse Hanford Company, Richland, WA; Kaiser Engineers Hanford, Richland, WA

Underground Storage Tank-Integrated Demonstration Technical Task Plan Master Schedule

WHC-EP-0431; 48 pp. (January 1992)

The Underground Storage Tank-Integrated Demonstration Technical Task Plan Master Schedule has been developed to present milestone summary schedules for all currently active projects within this program. Enhancements will continue with focus on adding information for the participant sites' underground storage tank remediation programs. The participant site information will include the Federal Facility Consent Agreement and Environmental Restoration and Waste Management milestones. The ultimate goal is development of the Program Master Schedule, which will combine this information and show potential relationships between technologies developed by the demonstration and their use in remediation programs.

7
M.C. Hughes, R.K. Wahlen, and R.A. Winship, Westinghouse Hanford Company, Richland, WA

Hanford Surplus Facilities Plan - Fiscal Year 1990

WHC-EP-0231-2; 118 pp. (September 1989)

The Hanford Surplus Facilities Program (HSFP) is responsible for the safe and cost-effective surveillance, maintenance, and decommissioning of surplus facilities at the Hanford Site. There are currently 115 facilities managed by the HSFP. Two facilities were completed and two facilities were added to the program during fiscal year (FY) 1989. These 115 facilities have been retired from programmatic use and are contaminated with radioactive material. The majority of these facilities are located in the 100 and 200 Areas. They include shutdown production reactors, chemical separators and processing plants, waste-handling facilities, and various support structures. The management of the surplus facilities requires a surveillance and maintenance program to keep them in a safe condition, and the

development of a plan for their ultimate disposition. This document outlines the plan for managing the Hanford surplus facilities to the end of disposition. The surveillance and maintenance cost for the HSFP is approximately $5 million annually in FY 1991 dollar values. The decommissioning costs of this program will total approximately $600 million, projected over a period of 30 years. Appendix A, Work Elements, gives the estimated cost, if available, for decommissioning each of the surplus facilities in the HSFP, and the planned date of startup for each decommissioning operation. Criteria used to evaluate each factor relative to decommissioning are based on the guidelines presented by the U.S. Department of Energy-Richland Operations Office, Defense Facilities Decommissioning Program Office, and are consistent with the Westinghouse Hanford Company's commitment to decommission the Hanford Site surplus facilities in the safest and most cost-effective way achievable. Appendix B consists of Area Site Maps of the surplus facilities, and Appendix C is the HSFP Long Range Cost/Schedule Projection.

8

B. Johnson, G. Mellinger, D. Strachan, and R. Hallen, Pacific Northwest Laboratory, Richland, WA

The Path to Gaining a Defensible Understanding of "Watch List" Tank Risk and Interim Stabilization Needs

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 221-225) (September 1991)

The "Watch List" waste tanks at the Hanford Site are those that the Secretary of the Department of Energy (DOE) is required to report on to Congress because of unresolved safety questions. These Priority 1 safety issues and the number of tanks affected are as follows: (1) flammable gas generation (23 tanks); (2) possible explosive ferrocyanide/oxidant reaction (24 tanks); (3) possible exothermic reaction of organic constituents (8 tanks); and (4) one tank that requires active cooling due to heat generated by undecayed fission products. These tanks are subject to intense surveillance and an enhanced list of controls and safety procedures. The objective of the Waste Tank Safety Program is to mitigate the safety issues with respect to these tanks, thereby allowing their removal from the "watch list." An integrated research and development program is believed to be the most cost-effective means of obtaining the information required to resolve the safety issues. This program would use chemical and physical modeling studies of synthetic waste, substantiated with limited field data and radioactive samples from the tanks, and would employ numerical modeling to extrapolate results to actual tank-scale operations.

9

P.C. Ohl and B.E. Optiz, Westinghouse Hanford Company, Richland, WA

Waste Tank Safety, Operations, and Remediation Strategic Plan

WHC-EP-0501; 74 pp. (September 1991)

This document describes the Waste Tank Safety, Operations, and Remediation (WT) Organization strategy for safe operation of the Hanford Site tank farms. An initial work breakdown structure (WBS) is described, which will be the strategy-implementation tool during fiscal year 1992 to accomplish the vision. The WT Organization is responsible for the operation and maintenance of the Hanford Site waste tanks and associated support facilities. The WT mission is to manage the Hanford Site waste tanks in a safe, efficient, and environmentally responsible manner, in compliance with codes, standards, and regulatory requirements. Once the safety issues are resolved and mitigation/remediation actions are implemented, the WT Organization will transform itself into a more traditional, operational-based division.

10

E.H. Smith, Westinghouse Hanford Company, Richland, WA

Overview of the Closure Approach for the Hanford Site Single-Shell Tank Farm

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp. (pp. 823-827) (September 1991)

The disposal of chemical and radioactive waste stored within the single-shell tanks (SSTs) represents one of the most significant waste management problems at the Hanford Site. A comprehensive program has been established to obtain analytical data regarding the chemical and radiological constituents in these tanks. This information will be used to support the development of a supplemental environmental impact statement, and will ultimately aid in the selection of a final disposal option. This paper discusses some of the technical options and major regulatory issues associated with SST waste retrieval and in situ waste treatment and disposal. Specific waste-retrieval methods being considered include dry mechanical retrieval, hydraulic retrieval, and pneumatic retrieval. In situ treatment technologies include microwave and radio-frequency heating, chemical stabilization, and vitrification. Certain closure options and treatment technologies require further development before they can be implemented or accepted as being useful. In addition, continued negotiations with regulatory authorities (Washington State, U.S. Environmental Protection Agency, U.S. Nuclear Regulatory Commission) will be required to determine the preferred closure option and the regulatory pathway to accommodate such closure.

11

K.D. Boomer, S.K. Baker, A.L. Boldt, M.D. Britton, L.E. Engelsman, J.D. Galbraith, J.S. Garfield, K.A. Giese, C.E. Golberg, B.A. Higley, K.J. Hull, L.J. Johnson, R.P. Knight, J.S. Layman, R.S. Marusich, R.J. Parazin, M.G. Piepho, E.J. Slaathaug, T.L. Waldo, and C.W. Worcester, Westinghouse Hanford Company, Richland, WA

Systems Engineering Study for the Closure of Single-Shell Tanks

WHC-EP-0405 (Draft A); 2410 pp. (August 1991)

This document provides the technical basis and recommends technical alternatives that will be included in the Supplemental Environmental Impact Statement for the closure of single-shell tanks at the U.S. Department of Energy's Hanford Site in Washington State. In preparing this document, the Westinghouse Hanford Company used systems engineering to provide a balanced approach for solving the complicated problem of single-shell tank closure. This systems engineering study includes several conclusions that will aid the U.S. Department of Energy in managing the single-shell tank waste. These conclusions include: (1) recommended alternatives for closure, (2) characterization requirements, (3) closure schedule, (4) development requirements, (5) facility requirements, and (5) integration of double-shell tank and single-shell tank waste processing. The preferred alternative for single-shell tank closure will be determined in the Supplemental Environmental Impact Statement, and will be based on further evaluation of the recommended alternatives.

12

E.P. Barnes-Smith, ICF Kaiser Engineers, Inc., Los Alamos, NM

Capital Cost Development for Decontamination, Demolition and Refurbishment of Radiological Research Facilities

Managing for Quality, Proceedings of the Project Management Institute Annual Seminar/Symposium, Dallas, TX, September 27-October 2, 1991. Project Management Institute, Drexel Hill, PA; (pp. 706-710) (1991)

The environmental restoration (ER) effort is currently one of the hottest topics in Department of Energy (DOE) work plans for the next decade. Many DOE weapons facilities will choose to undergo some form of cleanup in their plutonium research and processing facilities. While the construction of nuclear processing and handling facilities has been ongoing for many years and has accumulated historical records for the cost of construction, the decontamination and demolition (D&D) effort is new to DOE and to the majority of project management personnel assigned to this

work. Los Alamos National Laboratory (LANL) has been a leader in developing cost data for the D&D of radiological research facilities, and is presently progressing with the ER effort for its facilities. In May of 1989, LANL commissioned a Building Planning Study for the future use of the Chemistry and Metallurgy Research Building. This paper is based on the methodology used in preparing the costs for the decontamination, demolition and refurbishment of this facility.

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United States Department of Energy Decontamination & Decommissioning Planning and Operations Experience - A Short Course Lecture

CONF-911135 (Vol. 2); Nuclear Engineering, Proceedings of the First JSME/ASME Joint International Conference, November 4-7, 1991, Tokyo, Japan, Vol. 2, 593 pp. (November 1991)

This lecture provides an outline of the U.S. Department of Energy (DOE) Decommissioning Program. Included in the lecture is an organizational chart reflecting the consolidation of environmental restoration, waste operations, and technology development activities in the Office of Environmental Restoration and Waste Management. A map showing DOE facilities and project sites is given, along with estimated costs of cleanup. DOE estimates that it will cost more than 11 trillion dollars to decontaminate and decommission all project sites. Currently, there are 500 facilities in the Program, but that number is expected to increase over the next few years. To date, only 50 facilities have been completed. The goal for the Program is complete cleanup and compliance for remaining facilities within the next 30 years.

14
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Criteria for Release of Decommissioned Nuclear Facilities for Unrestricted Use

EPA/520/1-90-013; CONF-8909236; Residual Radioactivity and Recycling Criteria, A.B. Wolbarst, H. Terada, and A.C.B. Richardson (eds.), Proceedings of a Workshop, St. Michaels, MD, September 27-28, 1989, 311 pp.; (pp. 251-254) (September 1989)

Effective and workable criteria on which to base the decision to release nuclear facilities and associated equipment and materials for unrestricted use are very important, since unrestricted release means no further regulatory control or monitoring is needed. The author's decommissioning experiences at Battelle Memorial Institute form the basis for his recommendations concerning release criteria. Annex C in fuel-cycle-facility licenses is essentially the non-reactor equivalent to Regulatory Guide 1.86, and both are similar to proposed ANSI Standard N13.12. Annex C is often used as the basis for releasing buildings, equipment, and material for unrestricted use, even though its criteria are primarily applicable to non-residential use only. For example, Annex C's maximum surface contamination level of 5000 dpm/100 cu cm could result in licensable particulate waste material after cleanup. Very conservative criteria should be used for unrestricted release of equipment and materials. Alternatives are no detectible radiation above background (generic criteria), or levels low enough that pathways analysis shows the exposure to the general public to be below the basic dose limit (situation-specific criteria). Adopting a uniform and defensible basic dose limit (proposals range from 4 to 100 mrem above background) is crucial. For contaminated soils, situation-specific release criteria employing a generally accepted pathways-analysis model and uniform basic dose limit are the best approach. Specific concentration limits for release of nuclides in air or water to unrestricted areas have already been established.

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Assessing the Maintenance, Quality Assurance and Control, and Decommissioning of DOE Research Reactors

CONF-900917; Safety of Non-Commercial Nuclear Reactor Research and Irradiation Facilities, Proceedings of the American Nuclear Society Topical Meeting, Boise, ID, September 30-October 3, 1990, 830 pp.; (pp. 172-178) (1990)

This paper reports on the maintenance, quality assurance and control, and decommissioning of U.S. Department of Energy (DOE) research reactors. Existing DOE Orders pertinent to maintenance, quality assurance and control and decommissioning of DOE Class B Research Reactors are identified and compared to relevant NRC regulations and nuclear industry standards and practices. The DOE Orders are evaluated for compatibility with these competing NRC and industrial positions. Differences in these positions are identified and compared, and the consequences are examined. Finally, recommendations for improving and updating DOE Research Reactor operations and procedures are made.

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Application of a Structured Light Source to Waste Surface Mapping in Waste Storage Silos at Fernald, Ohio

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 579-581) (September 1991)

Surface contours inside the large waste storage tanks typical of the U.S Department of Energy complex are, in general, highly irregular. In addition to pipes and other pieces of equipment in the tanks, the surfaces may have features such as mounds, fissures, crystalline structures, and mixed solid and liquid forms. Prior to remediation activities, it is necessary to characterize the waste to determine the most effective remediation approaches. Surface contour data is required both prior to and during remediation. In this paper, the authors describe the use of a structured light source to generate three-dimensional (3-D) surface contour maps of the interior of the K-65 waste storage silos at the Fernald Environmental Management Project in Fernald, Ohio. During the later part of 1991, a layer of bentonite clay (30 cm minimum thickness) is scheduled to be deposited over the waste surfaces in silos 1 and 2 to act as a radon containment. The thickness of the bentonite layer will be measured by calculating the difference between the baseline waste-surface contour data and the bentonite-surface contour data after deposition. The structured light source system used in a demonstration done in the empty silo 4 consisted of three surface-mapping measurements units. These units include a high resolution black and white charge coupled device camera, a 250 W light source, a 30 mW laser light source with a 20 degree fan width, and a pair of high-precision rotary stages for position control. A Sun workstation served as the operator interface. Motor control was provided by a VME computer system, and image acquisition and processing used Datacube VME modules. During the test in silo 4, the equipment measured height accuracy to better than 7.0 mm, height measurement repeatability to better than 2.5 mm, and X-Y measurement accuracy and repeatability to better than 2.5 cm.

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Sampling and Analysis of the Inactive Waste Tanks TH-2, WC-1, and WC-15

ORNL/ER-19; 29 pp. (February 1992)

Thirty-eight inactive, liquid low-level radioactive waste tanks are currently managed by the Environmental Restoration Program at Oak Ridge National Laboratory, Oak Ridge, Tennessee. The contents of these tanks are to be characterized in preparation for future corrective actions and

remediation activities as part of compliance with the pending Federal Facility Agreement for the Oak Ridge Reservation. Twenty-nine of these tanks were sampled and analyzed in 1989. Three of the tanks (TH-2, WC-1, and WC-15) were not accessible from the surface and thus were not sampled until 1990. This report presents the sampling and analytical results of the 1990 sampling campaign. All three tanks in this report had negligible regulatory organic compounds in the samples that were collected. There were no U.S. Environmental Protection Agency (EPA) Target Compound List (TCL) constituents for volatile organics detected in any of the aqueous samples. The only semivolatile organics detected were 2-chlorophenol (52 ug/l) in tank TH-2 and dichloroethane (14-15 ug/l) and diethyl ether (15-17 ug/l) in tank WC-15. A thin oil layer was discovered floating on top of the aqueous contents in tank WC-15. The analysis of the oil layer detected no volatile organics and showed only one EPA TCL constituent, di-n-butylphthalate, at 1900 ug/l. Low levels of Resource Conservation and Recovery Act (RCRA) metals were observed in the samples from tank TH-2, but only the mercury level exceeded the Resource Conservation and Recovery Act (RCRA) limit. Samples from tank WC-1 had elevated levels of the RCRA metals barium, chromium, and lead. There were also finely suspended particles in one of the samples from tank WC-1, which was filtered and analyzed separately. These fine solids contain levels of the transuranium elements Pu-238 and Am-241, high enough to be classified as transuranic waste.

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Preliminary Decommissioning Study Reports - Low-Level Liquid Waste Tanks

ORNL/M-1920; X-OE-231 (Vol. 3); 125 pp. (September 1984)

Twenty-one low-level liquid radioactive waste collection and storage tanks are part of approximately 76 facilities currently managed by the Oak Ridge National Laboratory (ORNL) Surplus Facilities Management Program (SFMP). This program, as part of the U.S. Department of Energy (DOE) national SFMP, is responsible for the maintenance and surveillance and the final decommissioning of radioactively contaminated surplus ORNL facilities. A long-range planning effort is being conducted that will outline the scope and objectives of the ORNL program and establish decommissioning priorities based on health and safety concerns, budget constraints, and other programmatic constraints. In support of this SFMP planning activity, preliminary engineering assessments are being conducted for each of the ORNL surplus facilities currently managed under the program. These efforts are designed to: (1) provide an initial assessment of the potential decommissioning alternatives; and (2) choose a preferred alternative and provide a justification of the decommissioning plan, including cost and schedule estimates. Decontamination and decommissioning of eight of the nine groups of surplus tanks are considered in this report.

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Sampling and Analysis of Radioactive Liquid Wastes and Sludges in the Melton Valley and Evaporator Facility Storage Tanks at ORNL

ORNL/TM-11652; 242 pp. (September 1990)

The sampling and analysis of the radioactive liquid wastes and sludges in the Melton Valley Storage Tanks and two of the evaporator service facility storage tanks at Oak Ridge National Laboratory are described. Aqueous samples of the supernatant liquid and composite samples of the sludges were analyzed for major constituents, radionuclides, total organic carbon, and metals listed as hazardous under the Resource Conservation and Recovery Act. Liquid samples from five tanks and sludge samples from three tanks were analyzed for organic compounds on the Environmental Protection Agency Target Compound List. Estimates were made of the inventory liquid and sludge phases in the tanks. Descriptions of the sampling and analytical activities and tabulations of

the results are included. The report provides data in support of (1) the proposed Waste Handling and Package Plant, (2) the Liquid Low-Level Waste Solidification Project, and (3) research and development activities in developing waste management alternatives.

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Preliminary Decommissioning Study Reports - Molten Salt Reactor Experiment

ORNL/M-1922; X-OE-231 (Vol. 5); 76 pp. (September 1984)

The Molten Salt Reactor Experiment (MSRE) is one of approximately 76 facilities currently managed by the ORNL Surplus Facilities Management Program (SFMP). This program, as part of the DOE national SFMP, is responsible for the maintenance and surveillance and the final decommissioning of radioactively-contaminated surplus ORNL facilities. A long-range planning effort is being conducted that will outline the scope and objectives of the ORNL program and establish decommissioning priorities based on health and safety concerns, budget constraints, and other programmatic constraints. In support of this SFMP planning activity, preliminary engineering assessments are being conducted for each of the ORNL surplus facilities currently managed under the program. These efforts, in general, are designed to: (1) provide an initial assessment of the potential decommissioning alternatives; (2) choose a preferred alternative and provide a justification for that choice, and (3) provide a preliminary description of the decommissioning plan, including cost and schedule estimates. Because of several issues which cannot be evaluated quantitatively at this time, this report on the MSRE does not select a most probable "decommissioning mode," but rather discusses the issues and representative alternatives for disposal of the MSRE fuel salts and decommissioning of the facility. A budget and schedule representative of the types of activities likely to be required is also suggested for preliminary use in the SFMP long-range plan.

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Preliminary Decommissioning Study Reports - Old Hydrofracture Facility

ORNL/M-1924; X-OE-231 (Vol. 11); 90 pp. (September 1984)

The Old Hydrofracture Facility (OHF) is one of approximately 76 facilities currently managed by the Oak Ridge National Laboratory (ORNL) Surplus Facilities Management Program (SFMP). This program, as part of the Department of Energy (DOE) national SFMP, is responsible for the maintenance and surveillance and the final decommissioning of radioactively contaminated surplus ORNL facilities. A long-range planning effort is being conducted that will outline the scope and objectives of the ORNL program and establish decommissioning priorities based on health and safety concerns, budget constraints, and other programmatic constraints. In support of this SFMP planning activity, preliminary engineering assessments are being conducted for each of the ORNL surplus facilities currently managed under the program. These efforts are designed to: (1) provide an initial assessment of the potential decommissioning alternatives, (2) choose a preferred alternative and provide a justification for that choice, and (3) provide a preliminary description of the decommissioning plan, including cost and schedule estimates. This report presents the results of the preliminary analysis for the OHF.

22
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Progress in Evaluating the Hazards of Ferrocyanide Waste Storage Tanks

WHC-SA-1369; CONF-920307; Waste Management '92, R.G. Post (ed.), Proceedings of a Conference, Tucson, AZ, March 1-5, 1992; (21 pp.) (March 1992)

There are 177 high-level waste tanks on the Hanford Site in southeastern Washington state. Twenty-four single-shell tanks are identified as potential safety issues. These tanks contain quantities of potentially explosive ferrocyanide, nitrate, and nitrite salts. Efforts were initiated in September 1990 to determine the reactive properties of the ferrocyanide waste, and to define the criteria necessary to ensure tank safety until mitigation or remediation actions, if required, could be implemented. This paper describes the results of recent chemical and physical studies on synthetic ferrocyanide waste mixtures. Data obtained from monitoring, tank-behavior modeling, and research studies on waste have provided sufficient understanding of the tank behavior. The Waste Tank Safety Program is attempting to determine whether the waste in many of the ferrocyanide tanks actually represents an unreviewed safety question. The General Accounting Office (GAO), in October 1990, suggested that ferrocyanide-tank accident scenarios exceed the bounds of the Hanford Environmental Impact Statement (EIS). Using the same assumptions, Westinghouse Hanford Company (WHC) staff confirmed the consistency of the GAO report calculations. The hypothetical accident scenario in the GAO report, and in the EIS, are based on several assumptions that may or may not reflect actual tank conditions. The Ferrocyanide Stabilization Program at Westinghouse Hanford (summarized in this paper) will provide updated and new data using scientific research on synthetic and actual waste tank characterization. This new information will replace the assumptions on chemical and physical properties of tank wastes, allowing an improved recalculation of current safety and future risks associated with these tanks.

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Extended Tank Use Analysis

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 251-255) (September 1991)

The single-shell tanks (SSTs) at the Hanford Site were originally designed for "temporary" use. The newer double-shell tanks (DSTs) were designed for fifty years of use. A number of SSTs failed their original design criteria to contain liquid waste soon after they were constructed. These SSTs and DSTs now will be required to contain semi-solid high-activity waste well beyond their design lives. It must be determined that the waste contained in these tanks will remain stable for up to an additional 30 years of storage. This paper describes the challenge of demonstrating that the tanks which have exceeded, or will exceed, their design lifetime can safely store high-level waste until planned disposal actions are taken. Factors to be considered include structural and chemical analyses. This paper reviews tank design data, temperature data, and structural evaluation activities. The task of evaluating the SSTs, which began in the early 1980's, requires periodic reviews and updates using current material properties and analytical techniques. Inspections to determine the in situ material properties, along with comparison to past operation loads to estimate the projected degradation, are key to assessing the tank life expectancy.

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Annual Surveillance and Maintenance Report for the Retired Hanford Site Facilities

WHC-EP-0535; 66 pp. (December 1991)

Implementation of the surveillance and maintenance activities in the contaminated inactive facilities in accordance with applicable laws and regulations is the responsibility of Inactive Facilities Surveillance and Maintenance. The fundamental goal is to ensure that risks to the environment and to human health and safety posed by the inventory of contaminated inactive facilities and sites from past U.S. Department of Energy operations are maintained at prescribed, safe levels in a timely and cost-effective manner until they can be fully decommissioned. The inventory of inactive facilities will continue to increase as additional programs are modified or phased out as part of the changing mission at the Hanford Site. Of the funding received for inactive facilities, a growing

percentage is being used for maintaining the confinement structures to ensure contamination control. With equipment and structures approaching three times their original design life, the probability of contamination release to the environment will increase. Even with continued facility maintenance, the probability of contamination releases to the environment will always exist.

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High Organic Containing Tanks - Assessing the Hazard Potential

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 243-246) (September 1991)

Eight tanks on the Hanford Site contain organic chemicals at concentrations believed to be greater than 10 mole percent sodium acetate equivalent mixed with the oxidizing salts sodium nitrate/nitrite. Three of the hydrogen and ferrocyanide tanks also appear on the organic tank list. Concentrations of organics that may be present in some tanks could cause an exothermic reaction given a sufficient driving force, such as high temperature. However, the difference between ignition temperatures and actual measured tank temperatures is so large that the probability of such a reaction is considered to be very low. Although work on this issue is just beginning, consideration of hazards associated with heating nitrate-nitrite mixtures containing organic materials is an integral part of both the hydrogen and ferrocyanide tank efforts. High concentrations of organic compounds have been inferred (from tank transfer, flow sheet records, and limited analytical data) in eight single-shell tanks. Many organic chemicals, if present in concentrations above 10 dry weight percent (sodium acetate equivalent), have the potential to react in an exothermic manner with nitrate-nitrite constituents at temperatures above 200 deg C. The concentrations of the organic materials in the listed single-shell tanks, and their chemical identity, are not known. A tank sampling program has been planned to provide more information on the contents of these tanks and to serve as a basis for laboratory testing and safety evaluations. Evaluation of records relating to material transfers to the remaining single-shell tanks and the double-shell tanks continues. If additional tanks are identified that meet the organic concentration requirements, the tanks will then be added to the Organic Tank Program list.

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Development of Tank Instrumentation - The Search for Appropriate Monitoring

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 257-259) (September 1991)

For the past 40 years, data on waste tanks at the Hanford Site has been collected and stored. The type and amount of data needing collection is growing exponentially. The present challenge is to collect the more detailed and varied data while keeping costs low. More sensitive and extensive surveillance and monitoring instrumentation must be installed, data must be collected and made available to staff in a form that maximizes retrievability and ease of interpretation, and the data management process must accommodate real time trending, meet data quality objectives, and generally conform to best management practices. This paper describes surveillance and monitoring needs for waste tank safety and operations. Tables present the physical, chemical, operational, and tank integrity parameters that need to be measured. Specific candidate methods and equipment to meet these needs are described, and survivability in the hostile tank environment is considered.

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Visual System for Waste Tank Cleanup

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 567-571) (September 1991)

The single-shell underground radioactive waste storage tanks at the U.S. Department of Energy's Hanford Site are briefly described, and the physical complexities of their cleanup discussed. A remote robotic system operated by human control is the most likely mechanism for working inside the hostile tank environment. The productivity and safety of this operation will depend largely on the quality (depth perception, clarity, color, spatial correspondence) of the visual information provided to the operator through a remote visual system. The Naval Ocean Systems Center's TeleOperator/TelePresence System (TOPS) is an existing system that, except for color, provides these qualities. The TOPS comprises a dexterous, master-slave manipulator system and a spatially correspondent, stereoscopic vision system. Characteristics and components of the TOPS helmet-mounted display are described. The TOPS can, in principle, be modified to accept color if required. Productivity might also be improved if a wireframe virtual model of the tank contents were superimposed onto the 3-D image. It has been shown, in principle, that the graphics computers envisioned to provide a "world model" of the tank can provide acceptable input to the TOPS display electronics, which can then overlay the virtual image onto the video image.

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Ferrocyanide-Containing Waste Tanks: Ferrocyanide Chemistry and Reactivity

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 233-242) (September 1991)

During the 1950's, ferrocyanide and nitrate-bearing wastes were added to the Hanford radioactive waste tanks because of a need to increase the amount of free tank space. To provide additional tank space, the aqueous wastes were decontaminated by coprecipitating the radiocesium with other alkali-nickel ferrocyanides and disposing of the decontaminated liquids separately. In recent years a concern has arisen because of the potential explosive reactions of ferrocyanides with nitrates and the nitrate radiolytic degradation product, nitrite. Because of this concern, the Department of Energy and the Hanford Site managers established a program to ensure continued safe operation of the Hanford radioactive waste storage tanks containing ferrocyanides. This paper discusses briefly the history of the ferrocyanide wastes and the four basic components of the program, with special emphasis on the chemical reactivity and explosivity research and development studies. These studies with synthetic ferrocyanide bearing wastes indicate that reactions begin at temperatures greater than 200 deg C, and that reactions within these wastes are not initiated by mechanical impact, friction, or low energy electrical spark, but are initiated by a very high energy spark.

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Graphical Presentation of Ferrocyanide Tank Compositions

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 911-914) (September 1991)

This paper illustrates the composition of the Hanford Site single-shell, ferrocyanide tanks by using three-component diagrams. The three-component diagrams have been especially

useful for clarifying safety work and chemistry issues related to the single-shell tanks. Twenty-four of the single-shell tanks are known to contain ferrocyanide. Eight of these tanks contain a total of 100 tons of ferrocyanide. Concern exists that, at elevated temperatures, the ferrocyanide and the sodium nitrate in the tanks will react, thus releasing heat and gases. The three-component diagrams define the compositions that can sustain a ferrocyanide reaction, depict how the reaction temperature changes with varying compositions. and estimate the location of the Hanford Site tanks' compositions on the diagrams. The diagrams show the thermodynamic and physical relationships between reactants and diluents as a function of concentration. The three-component diagrams act as an aid to understanding both possible and probable tank layer compositions. Most overall tank compositions appear to be nonreactive. This indicates that only a small fraction of the total material in the tank might react inside the tank. The results of the diagramming of the probable tank contents have been (1) a focusing of effort on compositions that can actually propagate, and (2) a deemphasizing of the many possible combinations that are endothermic. As sampling data from the tanks becomes available, actual compositions in the tanks will be plotted on the diagrams. Burn propagation tests and kinetic tests are also planned.

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Waste Tank 241-A-105 Supporting Documentation - Miscellaneous Reports, Letters, Memoranda, and Data

WHC-MR-0250; 489 pp. (July 1991)

This report presents references, mostly internal memoranda and letters, used to support a task team investigation of Waste Tank 241-A-105 at the Hanford Reservation. These documents are presented in chronological order and are cross-referenced by author. The references may provide insight with respect to the operation and status of Waste Tank 241-A-105. The documents contain little technical information and data on Waste Tank 241-A-105; the reader is referred to the extensive references cited in WHC-EP-0409, titled "241-A-105 Waste Tank Program: Summary Report and Plans."

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Radiological Survey Manual for Decommissioning

NUREG/CR-5849 (Draft); ORAU-92/C57 (Draft); 197 pp. (June 1992)

This document describes a process for conducting radiological surveys during decommissioning that will demonstrate that the amount of residual radioactive material on the decommissioning site satisfies criteria established by the U.S. Nuclear Regulatory Commission (NRC) for the termination of a nuclear facility license. The manual describes procedures for the design and conduct of surveys to a standard that will provide a high degree of assurance that NRC guidelines and conditions have been satisfied. The manual also describes methods for documenting the survey findings in a final report to the NRC. This manual updates information contained in NUREG/CR-2082, "Monitoring for Compliance with Decommissioning Termination Survey Criteria" (ORNL 1981). The manual incorporates statistical approaches to survey design and data interpretation that are used by the Environmental Protection Agency for the evaluation of hazardous materials sites under the Comprehensive Environmental Response, Compensation, and Liability Act (Superfund). Quality assurance is emphasized throughout the document.

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Shippingport Neutron Shield Tank Sampling and Analysis Program

Innovative Approaches to Irradiation Damage and Fracture Analysis, Proceedings of the 1989

Pressure Vessels and Piping Conference, Honolulu, HI, July 23-27, 1989. American Society of Mechanical Engineers, New York, NY; (pp. 109-113) (1989)

The U.S. Department of Energy (DOE) and the U.S. Nuclear Regulatory Commission (NRC) are supporting work at Sandia National Laboratories (SNL) and Argonne National Laboratory (ANL), respectively, to obtain disc samples from the Shippingport Station neutron shield tank (NST) and to characterize the low-temperature (less than 90 deg C), low-flux neutron embrittlement of reactor pressure vessel (RPV) support structures. Pacific Northwest Laboratory (PNL), funded jointly by DOE and NRC, developed and demonstrated the sampling technology. A total of eleven six-inch diameter discs have been removed from the one-inch thick NST inner wall, representing base-metal and weld-metal at three fluence levels. Sample preparation and preliminary analysis will be performed by ANL, SNL, and PNL. The sample evaluation plan, developed by ANL and SNL, involves an initial composition analysis and neutron exposure-level determination of each disc, followed by a representative Charpy V-notch test to indicate the extent of embrittlement. The preliminary Charpy results support the decision for a more extensive testing program.

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Hanford High-Activity Waste Tank Safety Issues

WHC-SA-1017; CONF-910270; Waste Management '91: Working Towards a Cleaner Environment - High-Level Waste, Low-Level Waste, Mixed Waste and Environmental Restoration, R.G. Post (ed.), Proceedings of a Conference, Tucson, AZ, February 24-28, 1991; (28 pp.) (February 1991)

A description of seven primary safety issues associated with continued storage of high-activity wastes in Hanford single- and double-shell storage tanks is presented. Extensive management controls are employed to assure that the tanks continue to be maintained in a safe manner. In addition, comprehensive monitoring, characterization and applied research efforts have been initiated to support resolution of issues and to prevent creation of future problems associated with potentially incompatible wastes or actions related to the planned disposal of the wastes in these storage tanks. Such efforts will also provide the basis for safe, near-future remediation of tanks and will define the envelope of safety to support the disposal of all high-activity waste in the Hanford tanks.

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Hanford Waste Tank Safety Issues: A Program Overview

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 215-220) (September 1991)

This paper presents an overview of potential high-activity waste safety issues in the 177 underground radioactive waste storage tanks at the Hanford Site. A table lists priority 1, 2, and 3 safety issues in the tanks and the number of tanks affected by each. High priority safety issues discussed include flammable gas generation in the tanks, potentially explosive ferrocyanide mixtures, potential organic-nitrate reactions, and cooling required for high-heat generation tanks. Also included is a discussion of the strategy and plans to remedy hazardous conditions and to remove other deficiencies related to the operation of the tanks. A three-pronged multimillion dollar program has been initiated that (1) assesses and defines remediation and mitigation actions as needed to allow interim stabilization of high risk waste tanks; (2) upgrades existing facilities and instrumentation to meet current nuclear facility operations standards; and (3) addresses and upgrades the conduct of operations. For tanks considered at risk, extensive management controls are employed to ensure that the tanks continue be maintained in a safe manner. Comprehensive monitoring, characterization and applied research, and

engineering efforts have been initiated to support resolution of safety issues. A key element of the Westinghouse Hanford Company effort is prevention of future problems by avoiding potentially incompatible waste combinations. These efforts also will provide the basis for safe near future remediation of tanks and will define and maintain the envelope of safety to support the ultimate disposal of all high-activity waste in Hanford Site tanks.

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Waste Tank Properties and Contents Program Plan - Waste Tank Safety Program

WHC-EP-0403; 114 pp. (June 1991)

The activities that will occur through 1997 related to Hanford Site waste tank safety include: (1) develop criteria for safety evaluation and tank content evaluation; (2) tank structural and seismic evaluation; (3) tank content stability evaluation (excluding ferrocyanide, hydrogen and organics); and (4) support for the tank safety evaluation database. The evaluation criteria will allow continued safe operation of double-shell tanks and remediation of single-shell tanks. A formal review process will be developed for all 177 tanks to insure there are no unresolved safety issues and to outline the process used to determine which tanks can be removed from the formal tank watch list. Results from the tank-by-tank reviews will support future safety analysis reports. Two issues, (a) determination of tank safe-operating life and (b) characterization of tank contents, will be addressed and closed as part of this program.

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Waste Tank Safety Programs Overview Plan

WHC-EP-0426 (Rev. 2); 219 pp. (January 1992)

Waste Tank Safety Programs was established in mid-1990 to address the hazards associated with storage of radioactive mixed waste in the large, underground radioactive-waste storage tanks at the Hanford Site. An initial goal is to ensure safety of the tanks and their contents during the interim period before final disposal operations begin. The purpose of this plan is to present an overview of the Waste Tank Safety Programs activities for the planning period of fiscal year (FY) 1992 through FY 1997 and to present the FY 1992 workscope, milestones, and priorities for a baseline FY 1992 budget of $29.2 million expense and $3.2 million capital. This plan is based on more detailed planning contained in Activity Data Sheets of the U.S. Department of Energy Environmental Restoration and Waste Management FY 1993 Five-Year Plan. The scope of this plan is to define the Waste Tank Safety Programs objectives, strategy, scope, interfaces, resource requirements, and schedules for remediating/mitigating waste-tank safety issues for which the N2 End Function is responsible.

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Long-Term Public Health Impacts of Decommissioning the Hanford Surplus Production Reactors: Implications for CERCLA Remedial Actions at Hanford

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 839-840) (September 1991)

The public-health impacts of decommissioning the eight Hanford surplus production reactors are not significant. The risk to the downstream population of in situ decommissioning cannot be distinguished from the risk of moving the reactors to the 200 Area. Based on similar presumptions concerning aquifer recharge conditions (0.1 cm/yr of moisture through the Hanford permanent isolation barrier system) and radionuclide inventories, the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) risk assessments will also likely show that the public

health impacts are not significant for either leaving CERCLA wastes where they are (in situ remediation), or removing wastes and disposing of them at other Hanford sites. Thus, some CERCLA remedial-action decisions may be driven by land-use decisions rather than risks to the public.

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Hanford Site Radioactive Waste Storage Tank Safety Issues: The Path to Resolution

WHC-SA-1328; CONF-920307; Waste Management '92, R.G. Post (ed.), Proceedings of a Conference, Tucson, AZ, March 1-5, 1992; (14 pp.) (January 1992)

High-level radioactive waste has been stored in large underground storage tanks at the U.S. Department of Energy (DOE) Hanford Site in eastern Washington state since 1944. Since then, more than 227,000 gallons of waste have been accumulated in 177 tanks. These caustic wastes consist of many different chemicals. The waste forms include liquids, slurries, salt cakes, and sludges. A number of safety issues have been raised about these wastes, and resolution of these issues is a top priority of DOE. A Waste Tank Safety Program has been established and a series of logic charts have been developed that show relationships of the major activities and the steps necessary to resolve the issues. The path to safety issue resolution has been defined, and the effort is well underway.

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An Evaluation of Alternative Reactor Vessel Cutting Technologies for the Decommissioning of the Experimental Boiling Water Reactor at Argonne National Laboratory

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 345-350) (September 1991)

This paper gives a brief overview of the current status of the Experimental Boiling Water Reactor (EBWR) Decontamination and Decommissioning Project at Argonne National Laboratory (ANL). The EBWR, which was first a nuclear power plant test reactor, and later was part of a plutonium recycle program, was permanently shut down and put into a dry lay-up condition in 1967. The facility was placed in the U.S. Department of Energy's Surplus Facilities Management Program in 1976. The project overview is followed by the results of a study performed by Nuclear Energy Services at ANL to evaluate the metal cutting technologies available to segment the EBWR reactor vessel. The cutting techniques evaluated were: (1) plasma arc, (2) arc saw, (3) oxyacetylene, (4) electric arc gouging, (5) mechanical cladding removal/flame cutting, (6) exothermic reaction, (7) diamond wire, (8) water jet, (9) laser, (10) mechanical milling, (11) controlled explosives, and (12) electrical discharge. After a detailed review of these twelve techniques, ANL decided that the most appropriate method for segmenting the EBWR reactor vessel would be to lift the vessel from the vessel cavity and cut the reactor vessel with an abrasive water jet positioned on the main floor. ANL based their decision on the following considerations: (a) abrasive water jet cutting causes very little airborne contamination; (b) ANL has a treatment facility to handle contaminated water; (c) work would start on the least radioactive portion of the vessel first; (d) abrasive water jet cutting does not create a fire hazard; (e) the abrasive water jet can be used to decontaminate or scabble concrete and steel; and (f) abrasive water jet cutting is one of the least expensive methods. A radiation survey of the inside of the reactor vessel and corings into the reactor vessel wall indicate that the primary source of radiation is from the reactor internals and not the reactor vessel. Therefore, removal and segmenting of the EBWR reactor vessel will pose less threat of occupational exposure than will the removal of the reactor vessel internals.

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Facility Design to Apply Cover Material over Radioactive Residue in Storage Silos

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 517-526) (September 1991)

This paper discusses the BentoGrout application system designed by Parsons under contract to the U.S. Department of Energy (DOE) for the Environmental Remediation Action (ERA) Project, Fernald Environmental Management Project (FEMP), Fernald, Ohio, as defined by the K-65 removal action work plan prepared by Theta Technologies, Inc., and Westinghouse Environmental Management Company of Ohio (WEMCO). The objective of this system is to reduce radon emissions from the waste storage silos by covering the processed uranium and radium ore stored there (called K-65 material) with a uniform gas barrier layer consisting of bentonite. The paper discusses support activities undertaken to develop the design basis and design criteria for the K-65 Silos' BentoGrout covering system. The development and execution of an application demonstration program is described and the results presented. Also addressed is the design of the full-scale application system and the philosophy of operational control. The instrumentation and monitoring subsystems are illustrated in system schematics. The success of this demonstration project, along with the design packages for the full-scale application facility and specification of equipment/system test and performance criteria, installation sequence, and construction criteria, all help establish the existence of a fully checked and proven system prior to beginning the application of cover material over the radioactive residue in the waste storage silos at the FEMP.

41
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Characteristics of Fernald's K-65 Residue Before, During and After Vitrification

FMPC/Sub-035; 83 pp. (February 1991)

Pacific Northwest Laboratory (PNL) recently completed vitrification tests of material from the Feed Materials Production Center in Fernald, Ohio. Vitrification is the process of converting material to a glass form, and is attractive for application to wastes for many reasons: It produces an extremely durable, chemically stable glass product; it can greatly reduce the volume of waste; and it is a cost-effective treatment process. Two silos, designated as K-65, at the Fernald Site contain residues from the processing of pitchblende ores. This residue contains uranium, uranium daughter products, and some heavy metals (primarily lead). PNL received approximately 7 kg of the K-65 residue for vitrification tests. The objectives of the tests were to determine the quantity and composition of off-gas evolved during vitrification, the radon-emanation rate from both the original K-65 residue and the vitrified product, and the leachability of the vitrified material. To meet these objectives, samples of the residue were vitrified on a bench scale. The off-gas from the vitrification process was collected, measured (volume), and analyzed for radon and other constituents.

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SRS Waste Removal and D&D Program for Underground Waste Tanks

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 351-356) (September 1991)

At the Savannah River Site (SRS), high-level radioactive liquid waste resulting from fuel processing in the Canyon Buildings is stored in 51 large underground storage tanks. The tanks are built of carbon steel and reinforced concrete. The waste consists of supernate, soluble salts, and insoluble sludge. The waste is stored in these

tanks until it can be processed through in-tank operations (precipitation and sludge-washing) that prepare it as feed for the Defense Waste Processing Facility (DWPF). The DWPF includes the Vitrification Facility and the Saltstone Facility. The Vitrification Facility is designed to convert the high-level liquid waste into a stable form for disposal. There, the high-activity sludge and precipitated radionuclides will be immobilized in borosilicate glass and encased in stainless steel containers for interim storage until a repository becomes available. At the Saltstone Facility, the decontaminated salt solution remaining after in-tank precipitation will be combined with a specially-formulated cement to form saltstone, which will be stored in a vault at SRS. Waste removal equipment and techniques were demonstrated in one tank (Tank 16) in 1980. Remote inspection techniques were used to monitor the demonstration. The demonstration provided the basis for planning the waste removal from the 50 remaining tanks, which will allow decontamination and decommissioning (D&D) of the tanks. Several different D&D alternatives have been evaluated. General criteria for the Tank 16 D&D were: (1) the tank will be entombed with a backfill of grout that will remain stable over 300 years; (2) an intrusion barrier/radiation shield with an effective life of 500 years will be placed on top of the tank; (3) the tank will be isolated from all other tanks and systems; and (4) decommissioning will be in accordance with that required for Class C waste, as defined in 10 CFR 61. Because some liquid waste escaped from Tank 16 into the ground, the area was made a Resource Conservation and Recovery Act Facility Investigation/Remedial Investigation (RFI/RI) site. Further planning of Tank 16 D&D was put on hold until 1992, when the RFI/RI will be complete. A plan will be submitted for regulatory review in 1994.

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Disposal Concepts for Waste in Underground Single-Shell Storage Tanks at the Hanford Site

WHC-SA-1344; CONF-920307; Waste Management '92, R.G. Post (ed.), Proceedings of a Conference, Tucson, AZ, March 1-5, 1992; (13 pp.) (January 1992)

The Hanford Site is preparing for the future remediation of single-shell underground storage tanks. A significant portion of that task is the disposal of radioactive and hazardous components of the wastes that are in the tanks, the tanks themselves, and any residual contamination (e.g., soil) resulting from tank operations. This report discusses disposal concepts being studied for application on wastes stored in the single-shell tanks.

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Hanford Single-Shell Tank Waste-Preliminary Pretreatment Testing of Simulated Waste

PNL-SA-20048; CONF-9110168; Proceedings of the 1991 DOE Model Conference, Oak Ridge, TN, October 14-17, 1991; (19 pp.) (October 1991)

Remediation and closure of the Single-Shell Tanks (SSTs) located on the Department of Energy's Hanford Site may depend on innovative waste removal, pretreatment, and disposal technologies. This report describes preliminary studies conducted to support pretreatment processing of SST waste. This presentation looks specifically at the following types of activities: (1) development, synthesis and characterization of a nonradioactive simulated SST waste; (2) preliminary sequential dissolutions of simulated tank sludge; and (3) thermochemical reduction of nitrate, a major component in SST waste.

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Operating Watch List Tanks: A Study in Control

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 247-249) (September 1991)

This paper describes the controls and processes that Westinghouse Hanford Company uses to manage characterization and maintenance of waste tanks with unresolved safety questions. The Waste Tank Safety, Operations, and Remediation Division (WT) is responsible for daily operations of the Tank Farm and for addressing the 23 priority one, two, and three safety issues identified in Section 3137 of Public Law 101-510 (known as the Wyden Bill). The primary management objectives of the WT organization are ensuring safe and disciplined work procedures around potentially hazardous high-activity Hanford waste tanks, and upgrading personnel skills, antiquated equipment, and control systems with limited growth in financial expenditures. Reorganization of groups to improve plant maintenance efficiency, tracking, and prioritization is described, including the establishment of a unique internal review committee of line managers and operators. Methods of enhancing the plant's ability to respond to anomalies in monitoring data or other tank-related events through the use of a "Joint Test Group" structure (i.e., on-call teams of representatives from affected organizations), and to assure that all activities involving "watch list tanks" remain within the defined safety envelope, are discussed.

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Program Plan for Evaluation and Remediation of the Generation and Release of Flammable Gases in Hanford Site Waste Tanks

WHC-EP-0416; 254 pp. (August 1991)

This program plan describes the activities being conducted for the resolution of the flammable-gas problem that is associated with 23 high-level waste tanks at the Hanford Site. The classification of the wastes in all of these tanks is not final, and some wastes may not be high-level wastes. However, until the characterization and classification is complete, all the tanks are treated as if they contain high-level waste. Of the 23 tanks, Tank 241-SY-101 (referred to as Tank 101-SY) has exhibited significant episodic releases of flammable gases (hydrogen and nitrous oxide) for the past 10 years. The major near-term focus of this program is for the understanding and stabilization of this tank. An understanding of the mechanism for gas generation and the processes for the episodic release will be obtained through sampling of the tank contents, laboratory studies, and modeling of the tank behavior. Additional information will be obtained through new and upgraded instrumentation for the tank. A number of remediation or stabilization concepts will be evaluated for near-term (within 2 to 3 yrs) applications to Tank 101-SY. Detailed safety assessments are required for all activities that will occur in the tank (sampling, removal of equipment, and addition of new instruments). This program plan presents a discussion of each task, provides schedules for near-term activities, and gives a summary of the expected work for fiscal years 1991, 1992, and 1993.

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Fiscal Year 1992 Program Plan for Evaluation and Remediation of the Generation and Release of Flammable Gases in Hanford Site Waste Tanks

WHC-EP-0537; 85 pp. (January 1992)

The Waste Tank Flammable Gas Stabilization Program was established in 1990 to provide for resolution of a major safety issue identified for 23 of the high-level waste tanks at the Hanford Site. This safety issue involves flammable gas mixtures, consisting mainly of hydrogen, nitrous oxide, and nitrogen, that are generated and periodically released in concentrations that exceed the lower flammability limit. Initial activities of the program have been directed at Tank 241-SY-101, because it exhibits the largest risk. The purpose of this document is to provide a brief description of the FY 1992 priorities, logic, work breakdown structure and task descriptions for the Waste Tank

Flammable Gas Stabilization Program. A major change for FY 1992 involves the core sampling and sample analyses. All activities associated with these tasks will be conducted under the Tank Waste Characterization Program (1N4). Resource requirements for the Waste Tank Flammable Gas Stabilization Program for fiscal years beyond 1992 are given in the Waste Tank Safety Program Overview.

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Innovative Technologies and Unit Operations Available for Potential In Situ and Ex Situ Treatment of Waste and Residuals for Hanford Single-Shell Tanks

WHC-SA-0999; CONF-910270; Waste Management '91: Working Towards a Cleaner Environment - High-Level Waste, Low-Level Waste, Mixed Waste and Environmental Restoration, R.G. Post (ed.), Proceedings of a Conference, Tucson, AZ, February 24-28, 1991; (31 pp.) (1991)

In July 1990, the "Third Party Technical Workshop - Hanford Site Single-Shell Tank Waste and Residuals" was held in Spokane, Washington. The objective of the workshop was to identify, discuss, and rate innovative technologies that have not been seriously explored for treatment of single-shell tank waste and residuals. Ten nationally-recognized waste management experts were asked to attend the workshop and to bring their ideas on how to treat this unique waste stream either "in situ" (treat in place) or "ex situ" (remove and treat). The long-term objective of this initiative was to assist the U.S. Department of Energy-Richland Operations Office and Westinghouse Hanford Company in partially fulfilling a milestone to identify an appropriate means of disposing of waste, tanks, contaminated piping and soils by January 1999. A total of 11 ex situ and 11 in situ applied technologies with potential applicability to single-shell tank waste and residuals were identified and discussed in the workshop. An additional 12 nonapplied, innovative (brainstormed) technologies were also identified.

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TA-2 Water Boiler Reactor Decommissioning Project - Final Project Report

LA-12049; 59 pp. (June 1991)

This final report addresses the Phase 2 decommissioning of the Water Boiler Reactor at Los Alamos National Laboratory. Phase 2 included the decommissioning of the biological shield, other components within the biological shield, and piping pits in the floor of the reactor building. External structures and underground piping associated with the gaseous effluent (stack) line from the Technical Area 2 (TA-2) Water Boiler Reactor were removed in 1985-86 as Phase 1 of the reactor decommissioning. The cost of Phase 2 was approximately $623,000. The decommissioning operation produced 173 cubic meters of low-level solid radioactive waste and 35 cubic meters of mixed waste.

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Decommissioning a Nuclear Reactor

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 367-376) (September 1991)

This paper presents the general approach to decommissioning the Water Boiler Reactor (SUPO) at Los Alamos National Laboratory. Discussions of the following technical objectives are included: (1) thorough physical, chemical, and radiological assessment of the contamination at the site; (2) the safe and cost-effective dismantlement of a highly contaminated and activated nuclear reactor; and (3) minimizing radioactive and hazardous waste. The SUPO reactor, deactivated in 1974, was located in Los Alamos Canyon, isolated from the rest of the laboratory. The reactor, its biological shield structure, and the control room were housed in a frame building approximately 20 m by 20 m by 8 m.

Contamination from fission products was distributed throughout the reactor-related systems. Neutron activation of the reactor vessel and nearby components ranged from 1 R/h to 150 R/h. Radiation surveys of floor tunnels indicated less than 1 mR/h in accessible areas. The laboratory had to decontaminate and decommission the reactor inside Room 122 of the building to provide reusable space and eliminate the hazard of accidental intrusion into a contaminated structure. Following site characterization, the contaminated filter plenum was removed and the graphite thermal columns and removable shielding were unstacked. Next, the recombiner assembly, reactor vessel, and remaining shielding materials, including the biological shield, were removed. Remedial action activities and final restoration were then completed. Through proactive efforts in safe decontamination and decommissioning, the Waste Management Group at Los Alamos National Laboratory ensured that the facility was safely decommissioned and that wastes from the operation pose no harm to the public or the environment.

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Post-Remedial Action Report for the Water Boiler Reactor Site

LA-12012; 54 pp. (May 1991)

The TA-2 Water Boiler Reactor Decommissioning Project decontaminated and decommissioned the Water Boiler Reactor, TA-2-1-122, at Los Alamos National Laboratory in Los Alamos, New Mexico, to provide reusable space at the TA-2 site and to eliminate the hazard of accidental intrusion into a contaminated structure. This report documents the radiological condition of the site after the decommissioning and decontamination, which took place between June 1989 and April 1990.

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Decommissioning of a Grout- and Waste-Filled Storage Tank in the 200 East Area of the Hanford Site

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 357-360) (September 1991)

Tank 241-CX-72 at the Strontium Semiworks Facility on the Hanford Site was installed in 1955 as an experiment for determining the characteristics of self-concentrating waste from pilot plant studies for the plutonium and uranium recovery process. Tank 241-CX-72 is an upright cylindrical vessel 1.02 m in diameter and 10.9 m high with 0.9 cm-thick walls of carbon steel. A drywell, agitator rod, sparger system, and instrument diptubes are mounted in the tank. The tank was in operation for less than a year. It was recorded empty in March 1978, and again in 1986, and was then decommissioned and filled with grout. In 1988, 4.6 m of the agitator rod were accidentally pulled from the tank and found to be radioactively contaminated. Radiometric survey and analysis of the tank contents indicated that the tank probably contains about 3.1 m of dry transuranic (TRU) waste, covered by about 6.3 m of grout with some contamination, and an upper 1.5 m of grout with little contamination. Three alternatives are available for decommissioning the tank: (1) stabilize the waste and leave it where it is; (2) remove the tank and treat/dispose of the waste; or (3) remove the waste from the tank in place. In-place waste removal was recommended because of its low radiation exposure, relative ease of operation, and comparative cost. An engineering study concluded that the in-place waste removal would proceed in three phases: (a) grout removal, (b) waste layer sampling and analysis, and (c) waste removal and disposal. The grout removal will be done by dry mining, with waste vacuumed out through the interior pipe of the drill bit. An air curtain and a containment building were designed to ensure that no airborne radioactivity is released to the atmosphere. Soil was excavated to the top of the tank and a concrete pad for the containment was poured around the excavation. The drilling platform is being tested over a radiologically clean test pit. Once the grout is removed to just above the waste layer, the drill will be removed. A core sampling truck will then sample the waste layer through the remaining grout cap. The samples will be analyzed and the waste removal phase will be developed. When the waste removal is complete,

the decommissioning of the Strontium Semiworks Facility can be finished.

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Experimental Boiling Water Reactor (EBWR) Progress Report - Compiled for the Technical Advisory Group Meeting, April 22-26, 1991

OECD/NEA Co-Operative Program on Decommissioning, 10th Meeting of the Technical Advisory Group, Karlsruhe, Federal Republic of Germany, April 22-26, 1991; (2 pp.) (April 1991)

Decommissioning operations at the Experimental Boiling Water Reactor (EBWR) at Argonne National Laboratory were shut down between November 1990 and February 1991, because of a U.S. Department of Energy (DOE) plant-wide review of Argonne National Laboratory construction work. At the time of the shutdown, workers were completing the reactor vessel radionuclide inventory estimate and preparing the fuel pool plumbing for transfer of shielding water during segmentation of the reactor internals. The DOE internal review will significantly alter the conduct of Argonne National Laboratory operations, including the EBWR decommissioning, by increasing management oversight of contractor work and adding documentation requirements. Also, there will be increases in the scope of support activities, such as radiation worker training, quality assurance measures, contract administration and procurement, and environmental safety and health. Waste management costs were also forecast to increase because shipments had to be re-directed from Idaho to Hanford, Washington. In April 1991, the EBWR project had cost $5.51 million of an estimated total cost of $15.9 million.

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An Overview of the U.S. Department of Energy Experimental Boiling Water Reactor Decontamination and Decommissioning Project

CONF-911135 (Vol. 2); Nuclear Engineering, Proceedings of the First JSME/ASME Joint International Conference, November 4-7, 1991, Tokyo, Japan, Vol. 2, 593 pp.; (pp. 21-24) (November 1991)

This paper provides an overview of the U.S. Department of Energy's Experimental Boiling Water Reactor Decontamination and Decommissioning (D&D) Project. Physical decommissioning work started in 1986 and is scheduled for completion in 1994. The estimated total cost for the project is 14.3 million (1990, U.S.) dollars. The reactor pressure vessel will be removed by segmentation. Another notable project feature is that D&D operations were planned for and carried out with a small work force, comprised of four to six D&D laborers, one or two health physics technicians, an engineer, and a project manager. When D&D is work is completed, the facility will be recycled for other productive uses.

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Summary of an Assessment of Potential Waterborne Accidents During Transport of the Shippingport Reactor Pressure Vessel and Neutron Shield Tank Assembly

WHC-SA-1147; CONF-910774; Proceedings of the 32nd Annual Institute of Nuclear Materials Management Meeting, New Orleans, LA, July 28-31, 1991; (18 pp.) (July 1991)

The Shippingport Atomic Power Station in Shippingport, Pennsylvania, was constructed in the mid-1950's to demonstrate pressurized water reactor technology and to generate electric power. The Shippingport reactor reached the end of its design life in 1984 and was turned over to the U.S. Department of Energy (DOE) for decommissioning. The reactor pressure vessel/neutron shield tank (RPV/NST) was

removed as a unit and transported by barge from the Shippingport Station Decommissioning Project (SSDP) Site on the Ohio River to the DOE Hanford Site in Richland, Washington, for interment. This paper summarizes the work performed to provide supplemental information to the SSDP Safety Analysis Report for Packaging on hazards associated with transporting the RPV/NST package by water. Potential waterborne accident scenarios were identified along with the probable accident recovery mitigation measures, which could have been initiated if required. The risk evaluations are based on an assessment of the probabilities of (1) an accident in which the barge does not sink; (2) an accident in which the barge sinks, but with no damage to the reactor pressure vessel/neutron shield tank; (3) an accident in which the barge sinks, but with possible damage to the package; and (4) an accident resulting in a postulated fire.

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Mechanical-Property Degradation of Cast Stainless Steel Components from the Shippingport Reactor

ANL/CP-74953; CONF-911079; Proceedings of the 19th Water Reactor Safety Information Meeting, Bethesda, MD, October 28-31, 1991; (17 pp.) (October 1991)

The mechanical properties of cast stainless steels from the Shippingport reactor have been characterized. Baseline properties for unaged materials were obtained from tests on either recovery-annealed material or material from a cooler region of the component. The materials exhibited a modest decrease in impact energy and fracture toughness, and a small increase in tensile strength. The fracture toughness J-R curve, J sub IC value, tensile flow stress, and Charpy-impact energy of the materials showed very close agreement with estimations based on accelerated laboratory aging studies. The kinetics of thermal embrittlement and degree of embrittlement at saturation, i.e., the minimum impact energy that would be achieved after long-term aging, were established from materials that were further aged in the laboratory at temperatures between 320 and 400 deg C. The results showed very close agreement with estimates: the activation energies ranged from 125 to 250 kJ/mole and the minimum room temperature impact energy was less than 75 J/cm (E+2).

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Embrittlement of the Shippingport Reactor Shield Tank

NUREG/CP-0105 (Vol. 3); CONF-8910222 (Vol. 3); Primary Systems Integrity, Plant Performance Testing and Analysis, Piping and Non-Destructive Examination, and Plant Aging, A.J. Weiss (ed.), Proceedings of the 17th Water Reactor Safety Information Meeting, Rockville, MD, October 23-25, 1989, Vol. 3, 529 pp.; (pp. 105-120) (March 1990)

The irradiation embrittlement of the Shippingport neutron shield tank material has been characterized. Irradiation increases the Charpy transition temperature (CTT) by approximately 25 deg C (45 deg F) and decreases the upper shelf energy. The shift in CTT is not as severe as that observed in the High Flux Isotope Reactor (HFIR) surveillance specimens. However, the actual value of CTT is higher than that for the HFIR data, and the toughness at service temperature is low. The increase in yield stress is 51 MPa (7.4 ksi), which is comparable to the HFIR data. The results also indicate a low impact strength and higher transition temperature for the TL orientation than that for the LT orientation. Some effects of the location across the thickness of the wall are also observed for the LT specimens; CTT is slightly greater for the specimens from the inner region of the wall. The data agree well with results from high-flux test reactors. Annealing studies indicate complete recovery of embrittlement after a 2-hr anneal at 400 deg C. The transition curve for the annealed inner wall specimens is virtually identical to that for the as-received outer wall. The results for weld specimens from the inner and outer walls are also presented.

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Radiation Embrittlement of the Neutron Shield Tank from the Shippingport Reactor

ANL-91/13; 45 pp. (October 1991)

The irradiation embrittlement of neutron shield tank (NST) material (A212 Grade B steel) from the Shippingport reactor has been characterized. Irradiation increases the Charpy transition temperature (CTT) by 23-28 deg C and decreases the upper-shelf energy. The shift in CTT is not as severe as that observed in high-flux isotope reactor (HFIR) surveillance specimens. However, the actual value of the CTT is higher than that for the HFIR data. The increase in yield stress is 51 MPa (7.4 ksi), which is comparable to HFIR data. Annealing studies indicate complete recovery from embrittlement after 1 hr at 400 deg C. Although the weld metal is significantly tougher than the base metal, the shifts in CTT are comparable. The shifts in CTT for the Shippingport NST are consistent with the test and Army reactor data for irradiations at less than 232 deg C, and show very good agreement with the results for HFIR A212-B steel irradiated in the Oak Ridge Research Reactor. The effects of irradiation temperature, fluence rate, and neutron flux spectrum are discussed. The results indicate that fluence rate has no effect on radiation embrittlement at rates as low as 2 X 10(E+8) n/sq cm x s and at the low operating temperatures of the Shippingport NST (55 deg C).

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D. Duerr, 2DM Associates Inc., Houston, TX

Transportation of Shippingport Reactor Pressure Vessel

Journal of Construction Engineering and Management 117(3):551-564 (1991)

The Shippingport Atomic Power Station in Pennsylvania is the first nuclear electric generating station to be decommissioned with the goal of restoring the site to a radiologically clean condition acceptable for unrestricted use. In February 1989, the 921-ton (836-metric ton) reactor pressure vessel/neutron-shield tank assembly was hauled from a storage area on the plant site to a barge slip; loaded onto an oceangoing barge; shipped from Pennsylvania to Hanford, Washington; and hauled overland to a burial site on the U.S. Department of Energy's Hanford Reservation. This paper reviews the engineering requirements for the land and marine transportation operations. Engineering criteria for the hauling equipment and marine vessels, testing requirements, and operational methodology employed during the multimodal transportation are examined. Recommendations are made for future work of this nature which would be performed as part of nuclear plant maintenance and decommissioning projects, with particular emphasis placed on hauling-equipment performance requirements.

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J.J. Schreiber, U.S. Department of Energy, Shippingport Station Decommissioning Project Office, Shippingport, PA

Completion of the Shippingport Reactor Decommissioning

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 828-835) (1990)

Planning for the decommissioning of the Shippingport Atomic Power Plant began in 1979 and ended with publication of the Decommissioning Plan in 1983. The site was available for occupation by the Decommissioning Operations Contractor in September 1984 and physical work on decommissioning began in September 1985. The physical work was completed 3.75 years later, almost 6 months ahead of schedule. The total cost will be 92 million dollars, which is 6 million dollars less than the 98 million dollars estimated. A breakdown of planned and actual statistics is presented for various aspects of the decommissioning work, including cost schedules, manpower requirements, radiation exposure, waste arisings, and shipments. Various

aspects concerning contracts, decontamination, asbestos, safety, lessons learned and technology transfer are also presented.

61
U.S. General Accounting Office, Resources, Community, and Economic Development Division, Washington, DC

Nuclear Research and Development: Shippingport Decommissioning - How Applicable are the Lessons Learned

GAO/RCED-90-208; 26 pp. (October 1990)

In examining the decommissioning of the Shippingport, Pennsylvania, nuclear power plant by the Department of Energy (DOE), the General Accounting Office (GAO) has found that DOE generally met the goals it set for decommissioning Shippingport, and completed its activities four months ahead of schedule and $7 million under budget. DOE used eight contractors on the project and produced many annual or topical reports that officials believe will be useful to the commercial nuclear industry. However, because Shippingport was a smaller reactor and less radioactive than other reactors, the lessons learned from its decommissioning are limited. Further, many years may elapse before utilities dismantle a larger number of plants. In the interim, decommissioning activities on higher radioactivity-contaminated pressure vessels here and abroad will advance the state of the art beyond the lessons learned at Shippingport. Efforts made by the United Kingdom, Japan, and the United States (e.g., Three Mile Island) to identify technology to reduce worker exposures may also be more useful than the information derived from Shippingport.

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T.R. Cannon, M.K. Ford, and L. Holder Jr., Oak Ridge National Laboratory, Environmental Restoration Division, Oak Ridge, TN

Annual Summary Report on Surveillance and Maintenance Activities of the Surplus Contaminated Facilities Program at Oak Ridge National Laboratory for Period Ending September 30, 1991

ORNL/ER-60; 10 pp. (September 1991)

The Surplus Contaminated Facilities Program (SCFP) was established at the Oak Ridge National Laboratory (ORNL) in 1985 to provide support for inactive contaminated facilities that were largely abandoned by the programs that they formerly served. This support provides for routine surveillance and maintenance (S&M) and special projects beyond a routine nature when such actions are needed to ensure adequate protection of personnel or the environment. The facilities included in SCFP have been used for research, technology development, isotope production and processing, and waste management. Support for the facilities in SCFP previously have been provided by the Department of Energy's (DOE) Office of Energy/Multiprogram Energy Laboratories-Facilities Support (ER/KG), because of multiprogram use of the facilities or because of the landlord responsibility of Energy Research. Recently, an integrated Decontamination and Decommissioning (D&D) program within the DOE Office of Environmental Restoration and Waste Management has been established to collectively manage the former Surplus Facilities Management Program, Defense D&D Program, and the KG-funded, ORNL-originated SCFP. This report gives an overview of the S&M planning, routine S&M, and special maintenance projects which took place at the SCFP facilities during the 1991 fiscal year. Included in the summary of SCFP activities: (1) operations for the 3110 Filter House filter change will resume when approval for National Environmental Protection Act documentation is approved; and (2) corrective actions will continue, as funding permits, at the 86-Inch Cyclotron, the East End Basement, and the High-Level Radiation Analytical Facility.

63
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Annual Summary Report of the Decontamination and Decommissioning Surveillance and Maintenance Program at Oak

Ridge National Laboratory for Period Ending September 30, 1991

ORNL/ER-61; 15 pp. (September 1991)

The Surplus Facilities Management Program and Defense Facilities Decommissioning Program were established at Oak Ridge National Laboratory (ORNL) in 1976 to provide collective management of all surplus sites under ORNL control on the Oak Ridge Reservation. Some 34 facilities, classified into 3 civilian-related and 8 defense-related projects, are currently managed by the recently-integrated ORNL Decontamination and Decommissioning Program. The program objectives are (1) to ensure adequate containment of residual radioactive materials remaining in the facilities, (2) to provide safety and security controls to minimize the potential hazards to on-site personnel and to the general public, and (3) to manage the facilities in the most cost-effective manner while they await decommissioning. Program support includes (a) surveillance and maintenance (S&M) planning, (b) routine S&M, and (c) special maintenance projects. This report documents routine S&M, special projects, and special maintenance performed on these facilities for the period of October 1990 through September 1991. A summary of program highlights notes that asbestos abatement and Occupational Safety and Health Act (OSHA) compliance upgrades at the Low Intensity Test Reactor (LITR) and the Homogeneous Reactor Experiment (HRE) will continue pending approval of National Environmental Policy Act (NEPA) documentation; sampling and analysis of the HRE fuel pool and 3002 Filter House fuel canal and the repair of the Waste Evaporator roof will continue as schedules permit.

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Martin Marietta Energy Systems, Inc., Oak Ridge, TN

Decontamination and Decommissioning Surveillance and Maintenance Report for FY 1991

ES/ER/TM-25; 57 pp. (December 1991)

The Decontamination and Decommissioning (D&D) Program has three distinct phases: (1) surveillance and maintenance (S&M); (2) decontamination and removal of hazardous materials and equipment, which Department of Energy (DOE) Headquarters calls Phase I of remediation; and (3) decommissioning and ultimate disposal, regulatory compliance monitoring, and property transfer, which DOE Headquarters calls Phase II of remediation. A large part of D&D is devoted to S&M at each of the sites. S&M activities, which are performed on facilities awaiting decommissioning, are designed to minimize potential hazards to human health and the environment by ensuring adequate containment of residual radioactive and hazardous materials and providing physical safety and security controls to minimize potential hazards to on-site personnel and the general public. Typically, maintenance activities are classified as either routine or special (major repairs). Routine maintenance includes such activities as painting, cleaning, vegetation control, minor structural repairs, filter changes, and building systems checks. Special maintenance includes Occupational Safety and Health Act facility upgrades, roof repairs, and equipment overhaul. Surveillance activities include inspections, radiological measurements, reporting, records maintenance, and security (as required) for controlling and monitoring access to facilities. This report summarizes FY 1991 S&M activities for the Tennessee plant sites, which include the K-25 Site, the Gas Centrifuge facilities, Oak Ridge National Laboratory, and the Y-12 Plant.

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V.C. Boyles, Westinghouse Hanford Company, Richland, WA

DOE Hanford Site Tank Farm Interim Stabilization During 1990

WHC-SA-1071; CONF-910603; Proceedings of the 1991 American Nuclear Society Annual Meeting, Orlando, FL, June 2-6, 1991; (21 pp.) (May 1991)

Three single-shell nuclear waste storage tanks at the U.S. Department of Energy Hanford Site were interim stabilized during 1990 using a jet-pump system. This paper discusses the pumping system, processes, stabilization criteria, and problems encountered during interim stabilization of these

tanks. An upgraded pumping system that was developed from a previous jet-pumping campaign, completed in 1985, was used.

66
Pacific Northwest Laboratory, Richland, WA

Resource Book: Decommissioning of Contaminated Facilities at Hanford - Volume 3

PNL-7008 (Vol. 3); PNL-MA-588 (Vol. 3); 280 pp. (September 1991)

In 1942, Hanford was commissioned as a site for the production of weapons-grade plutonium. The years since have seen the construction and operation of several generations of plutonium-producing reactors, plants for the chemical processing of irradiated fuel elements, plutonium and uranium processing and fabrication plants, and other facilities. There has also been a diversification of the Hanford site with the building of new laboratories, a fission product encapsulation plant, improved high-level waste management facilities, the Fast Flux test facility, commercial power reactors, and commercial solid waste disposal facilities. Obsolescence and changing requirements will result in the deactivation or retirement of buildings, waste storage tanks, waste burial grounds, and liquid waste disposal sites that have become contaminated with varying levels of radionuclides. This Resource Book was established as a written repository of information pertinent to decommissioning planning and operations at Hanford. The Resource Book contains, in several volumes, descriptive information of the Hanford Site and general discussions of several classes of contaminated facilities found at Hanford. Supplementing these discussions are appendices containing data sheets on individual contaminated facilities and sites at Hanford. Twelve appendices are provided, corresponding to the twelve classes into which the contaminated facilities at Hanford have been organized. Within each appendix are individual data sheets containing administrative, geographical, physical, radiological, functional and decommissioning information on each facility within the class.

67
R.K. Wahlen, Westinghouse Hanford Company, Richland, WA

Summary of the Hanford Site Decontamination, Decommissioning, and Cleanup, FY 1974-FY 1990

WHC-EP-0478; 170 pp. (August 1991)

At the end of World War II, the demand for more production, along with process and military surveillance changes at the Hanford Site, caused a continuing cycle of building and obsolescence. This trend continued until 1964, when the cutback in plutonium production began. The cutback caused the shutdown of excess production facilities. The last of eight reactors was shut down in 1971. Since that time, N Reactor has been the only production reactor that has operated. In addition, changes in the method of separating plutonium caused a number of excess facilities in the 200 Areas. Before 1973, no structured program existed for the disposal of unusable facilities or for general cleanup. Following a plant-wide safety and housekeeping inspection in 1973, a program was developed for the disposal of all surplus facilities. Since the start of FY 1974, a total of 46 radioactively contaminated sites have been demolished and disposed. In addition, 28 buildings have been decontaminated for in situ disposal or for reuse, 21 contaminated sites have been stabilized, 131 clean structures have been removed, and 93 clean sites have received special remedial action to eliminate potential safety and/or environmental hazards. This report summarizes these activities.

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B.L. Burks, G.A. Armstrong, P.L. Butler, and P. Boissiere, Oak Ridge National Laboratory, Oak Ridge, TN

Combined Long Reach and Dexterous Manipulation for Waste Storage Tank Applications

CONF-911107; Proceedings of the American Nuclear Society Winter Meeting, San Francisco, CA, November 10-15, 1991; (17 pp.) (1991)

One of the highest priority environmental restoration tasks within the Department of Energy (DOE) is the remediation of single-shell waste storage tanks (WSTs), especially those suspected of, or documented as, leaking. Most currently proposed approaches for remediation of large underground WSTs require application of remotely operated long-reach (greater than 10 m), high-lift capacity (greater than 200 kg) manipulator systems. Because of the complexity of in-tank hardware, waste forms, remediation tasks, and the variety of end-effector tools, these manipulator systems must also be capable of performing a diverse set of dexterous manipulations. This presentation will describe the integration of a Spar RMS 2500 manipulator system with a Schilling Titan-7F manipulator, using control systems developed at Oak Ridge National Laboratory and Sandia National Laboratory, to provide a combined long-reach and dexterous manipulation system. The purpose of integrating these two manipulator systems was to study and demonstrate their combined performance, evaluate design requirements for a deployed system, and provide a testbed for control and end-effector technologies that might be applicable to remediation of WSTs.

NUCLEAR FACILITIES DECOMMISSIONING

69

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Sacramento Municipal Utility District; Ranch Seco Nuclear Generating Station: Exemption

Federal Register 56(223):58407-8 (November 19, 1991)

The Sacramento Municipal Utility District (SMUD, or the licensee) holds Facility Operating License DPR-54. The facility consists of a pressurized water reactor located at the licensee's site in Sacramento, California, which is currently defueled with the fuel stored in the spent-fuel pool. By letter dated July 24, 1990, the licensee requested an exemption from CFR 50.75(e)(1)(ii) regarding the requirement to have all decommissioning funds collected when operations are terminated. The Rancho Seco Nuclear Generating Station was permanently shut down on June 7, 1989 and completely defueled on December 8, 1989. The intent of the decommissioning regulations is to provide reasonable assurance that sufficient funds to decommission power plants are available at the time operations are permanently ended. The Nuclear Regulatory Commission (NRC or the Commission) has acknowledged that decommissioning funding requirements in instances in which reactors have shut down prematurely must be determined on a case-by-case basis, since requiring such plants to comply fully with 10 CFR 50.75(e) regulations might impose severe financial burdens on plants that have not operated long enough to accumulate sufficient funds for decommissioning. In SMUD's request for an exemption to the regulation, it outlined the following plan to assure decommissioning funding: (1) initial contribution of approximately $90 million into an external sinking trust fund; (2) annual contributions of approximately $8 million prior to decommissioning plan approval and $12 million thereafter; (3) annual contributions to continue until October 11, 2008 (funding to be complete at this time); and (4) dispersal starting in September 1992 to cover decommissioning related costs only. The NRC has concluded that (a) the financial stability of SMUD; (b) their history of decommissioning fund payments; (c) their rate regulatory function, and (d) their other (state) legal obligations to decommission Rancho Seco, provide mitigation to the absence of full decommissioning funding at the termination of operations. The NRC has concluded that these four factors, along with SMUD's financial assurance plan, provide adequate assurance that funds will be available to decommission the facility in a manner which protects public health and safety. Accordingly, the Commission has determined this exemption is authorized by law, and is effective upon issuance.

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M. Laraia, International Atomic Energy Agency, Vienna, Austria

End-of-Life Planning for the Decommissioning of Research Reactors and Other Small Nuclear Facilities

IAEA-SR-179; CONF-920577; Ageing, Decommissioning, and/or Major Refurbishment of Research Reactors, Proceedings of an IAEA Seminar for Asia and the Pacific, Bangkok, Thailand, May 18-22, 1992; (15 pp.) (1992)

A decommissioning plan shall be produced for each radioactive facility as an essential prerequisite to ensure that decommissioning activities can be accomplished in a safe, timely, and cost-effective manner. The licensee shall be responsible for this planning. The regulatory body may provide guidance in this respect, and shall review and approve the decommissioning plan as appropriate. Three phases of planning are envisioned: initial planning, ongoing planning, and final planning. When the date and circumstances of the final shutdown of a facility are known, an application for permission to decommission the facility shall be submitted to the regulatory body for approval along with a copy of the proposed final decommissioning. In many cases, steps such as the final shutdown, reductions of staff, management of operational wastes, measurements to verify the radioactive inventory, transport of fissile materials off-site, and decontamination to facilitate decommissioning may be carried out under provisions applying to the operating phase. If the final stages of decommissioning are deferred, the

decommissioning plan shall be reviewed, revised if necessary, and submitted for approval before final dismantlement begins.

71
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Design Features Adopted to Facilitate Decommissioning

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 161-166) (1990)

Analysis of the design of 900 MW(e), 1300 MW(e), and future 1450 MW(e) PWR units show that the design improvements for reducing occupational dose exposure of maintenance personnel and the development of automated tools for performing maintenance and repairs of major components contributes to facilitate future dismantling and decommissioning operations.

72
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Influence of Design Features on Decommissioning of a Large Fast Breeder Reactor

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 139-148) (1990)

The evolution of fast-breeder-reactor (FBR) design in Europe shows that pool-type design will become the reference design for future FBRs. The projected European Fast Reactor (EFR) is based on this concept. The identification of design features shows that the main contributors to activity in the reactor sodium and structures are Co-60 for gamma radiation source and low decay; and Ni-63, Nb-94, and Ni-59 for long-term decay. The technical benefits of a Co content reduction are interesting for the highly-activated structures. For diagrid thimbles coating, proposals were made to lower the Co content in steels or alloys and to substitute coatings. Measures are identified which facilitate both the sodium draining and the cleaning of the reactor block and internals, all of which improve the gravity draining and downing of the sodium flow, and facilitate the penetration of cleaning products. The features connected with the dismantling of the highly-activated internal structures, the roof, and the lay-out are discussed.

73
Belgoprocess NV, Dessel, Belgium

Comparative Synthesis on the Estimate for the Decommissioning Costs of Buildings 6A/B and the Real Costs

OECD/NEA Co-Operative Program on Decommissioning, 10th Meeting of the Technical Advisory Group, Karlsruhe, Federal Republic of Germany, April 22-26, 1991; (14 pp.) (April 1991)

Cost estimates for the decommissioning of buildings 6A/B at the former Eurochemic Reprocessing Plant were performed in 1987. These estimates were based on the following factors: (1) assumed dismantling rates; (2) assumed decontamination levels to be attained; (3) assumed labor costs; and (4) assumed costs for waste treatment, intermediate storage, and final storage of known wastes. The actual costs for the decommissioning operations were collected based on: (a) bookkeeping data for labor hours, capital equipment, materials, and expenses; (b) decommissioning group data on preparation of the decommissioning plan, decommissioning studies, and licensing documentation; (c) five-year depreciation rates for equipment; (d) financing costs, based on eight percent interest rates; (e) overhead costs; and (f) actual costs for waste treatment and for intermediate and final disposal. This report gives an overview of the actual total

costs of the decommissioning operations (including direct and indirect costs), and compares these costs to the 1987 estimates.

74
Atomic Energy Control Board, Ottawa, Ontario, Canada

Policy on the Decommissioning of Nuclear Facilities

INIS-mf-12921; 16 pp. (August 1988)

This Regulatory Policy Statement describes the policy of the Atomic Energy Control Board (AECB) on the decommissioning of those facilities defined as nuclear facilities in the Atomic Energy Control (AEC) Regulations. It is intended as a formal statement, primarily for the information of licensees or potential licensees, of the regulatory process and requirements generally applicable to the decommissioning of nuclear facilities licensed and regulated by the AECB pursuant to the authority of the AEC Act and Regulations.

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Operators' View of Key Issues Confronting Nuclear Power Plant Decommissioning

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 20-27) (1990)

Within some Union Internationale des Producteurs et Distributeurs d'Energie Electrique (UNIPEDE) member countries, the first generation of nuclear power plants are reaching or have reached the end of their working lives after more than 25 years of successful operation. In the UNIPEDE countries, many past studies are available that demonstrate the technical and financial feasibility of decommissioning. From the operators' viewpoint, all relevant factors are discussed, and the key issues confronting the present planning of decommissioning of nuclear power plant decommissioning are identified. It is shown that all the possible present options cannot be used, because the necessary requirements have not been met.

76
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The Community's R&D Activities in the Field of Decommissioning - Objectives, Scope, and Implementation

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 28-35) (1990)

The European Community has just concluded its second five-year program (1984-88) in the field of decommissioning, and has started its third program (1989-93). The objective of these activities is to reinforce the scientific and technological basis for the safety and protection aspects and the economic evaluation of decommissioning. Increased emphasis is placed on the demonstration of relevant techniques. Through the new program, the experience to be gained from the dismantling of the first large-scale nuclear installations in the Community will be made available to all Member States. The programs are implemented mainly through shared-cost research contracts with public organizations and private companies in the Member States. The 1984-88 programme has comprised 75 contracts. Emphasis has been placed on the exchange and dissemination of the scientific and technical results obtained. This has been done through regular meetings of people working in the same area and through publication of annual progress reports of the program and final reports of individual research contracts.

77
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Strategy of NPP Decommissioning in the IEA NPPD Member States

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 43-50) (1990)

Member states of the International Economic Association (IEA) for Nuclear Power Plant Decommissioning (NPPD) have developed a concept of closure of NPP units after final shutdown. The concept includes both extension of lifetime and decommissioning according to different options. The basis for scientific technical support of the effort is the Council for Mutual Economic Assistance (CMEA) member states' program for closure of VVER reactor plants and the national USSR program for NPPs with other reactor types. Codes and standards documents have been formulated and are under development, and cover such areas as nuclear and radiation safety and unrestricted use of the materials of NPP units being dismantled. A code regarding the funding of NPP decommissioning efforts has been prepared. Pilot versions of remotely controlled manipulators to dismantle the graphite layer of Belovarskaya NPP Unit 1 have been developed; other types of manipulators for dismantling are under development. Decontamination techniques are being improved, including processes of hard decontamination and remelting. Efforts are under way to decommission NPP units in the USSR and Czechoslovakia.

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Planning Structure for Normal Decommissioning Procedures

Kerntechnik 56(6):358-361 (1991)

The decommissioning of a nuclear power plant with a light water reactor at the end of its projected operational period requires careful planning. By the time the nuclear power plant has gone on line, the operator will already have proven the feasibility of decommissioning, developed a model, and calculated the relevant costs involved. The funds required for subsequent decommissioning, based upon the cost calculations, are accumulated over the period during which the power plant is in operational use. This paper describes the planning structure, with particular emphasis on the fact that planning must begin at an early stage, so that the operating license can be replaced by the decommissioning license in a timely fashion. Early planning ensures that the necessary financial resources will be commensurate with the reserve funds that have been accumulated.

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Economic Aspects of the Decommissioning of a Nuclear Power Plant

Kerntechnik 56(6):385-387 (1991)

According to German Atomic Law, nuclear power plants require licensing. The license covers the construction, operation and decommissioning of a nuclear power plant. The obligation of decommissioning causes a cost burden which influences the costs of operation. These expenses create a variable liability which must be provided for by establishing a liability reserve. Because of its high monetary value, this liability reserve obtains an increasing importance for the accounting policy.

80

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Tools to be Used in Planning the Decommissioning of Nuclear Power Plants

ATW, Atomwirtschaft, Atomtechnik 36(12):548-551 (December 1991)

As more nuclear power plants are decommissioned and disposed of in the future, such projects will be

assessed with regard to economic considerations. Technical feasibility problems have already been solved in research and development programs, and in actual decommissioning projects. The economic aspects of decommissioning and disposal imply comparisons among variants, estimates of complete and lengthy activities, or the recognition of consequences and impacts, all in the light of conditions specific to a certain plant. Such weighing is very time consuming, and in some cases the criteria which are to be used to weigh pros and cons must first be developed. Computer codes specially developed for this purpose can help achieve the required planning performance. This article describes three computer programs useful for decommissioning planning.

81
T. Roser

Making the Polluter Pay in Germany

Nuclear Engineering International 36(447):33-34 (October 1991)

With more shutdown nuclear power plants than anywhere else in the world, Germany has a costly decommissioning problem on its hands. Its strict licensing laws for dismantling and the lack of decommissioning funds for the eastern-German plants have only made matters worse. The German government has responded by determining that all future plants should have money set aside for their decommissioning from day one.

82
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Legal Requirements for Post-Operation Period Licensing of Nuclear Plants

Kerntechnik 56(6):349-353 (1991)

In 1976, the German Nuclear Law (Atomgesetz) was supplemented by a passus concerning decommissioning. After 30 years of nuclear power plant operation, jurisdiction and jurisprudence now focus on this passus, occasioned by the untimely and unexpected shutdown of 14 nuclear power plants and the continuing debate over de-emphasizing nuclear energy. The progressive differentiation in technology and law is reflected by the narrowing of the definition of decommissioning and by the strong distinction of decommissioning cases that require licensing according to the new passus. The judicial complexity and ambiguity in this field is outlined in this article, and a pragmatic orientation towards the reduced risk potential of the specific reactor in the specific situation is suggested.

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Comparing the Costs of Decommissioning Nuclear Power Plants in the USA and in Germany

ATW, Atomwirtschaft, Atomtechnik 36(5): 232-236 (May 1991)

Decommissioning and disposal of nuclear power plants is a subject of controversial debate, increasingly centered on economic aspects. This article discusses the allegation that estimated costs of decommissioning in the U.S. have risen sharply over the past few years, and, as a consequence, the present cost estimates made in the Federal Republic of Germany also should be revised drastically upward in the near future. As a result of this development, nuclear power might well become economically non-viable. These allegations cannot be assessed in detail on scientific grounds, because they are based on biased reports with extrapolations and conversions whose parameters cannot be verified. However, a comparison of unbiased American and German studies shows that while the costs of decommissioning have risen in the U.S. over the past twelve years, their absolute level is still clearly below the high cost level in Germany. Upon examination of the causes, it is seen that stricter criteria were applied and different boundary conditions assumed in Germany from the outset.

Consequently, no major corrections were or are necessary. In view of the different boundary conditions existing in the two countries, the studies conducted in each are meaningful and correct.

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Decommissioning of the Karlsruhe Reprocessing Plant (WAK) - Preliminary Planning Results

CONF-911135 (Vol. 2); Nuclear Engineering, Proceedings of the First JSME/ASME Joint International Conference, November 4-7, 1991, Tokyo, Japan, Vol. 2, 593 pp.; (pp. 21-35) (November 1991)

After nearly twenty years of operation, WAK-GmbH, the company operating the Karlsruhe Reprocessing Plant (WAK), discontinued operation of the plant. A mixture of manual and remote disassembly was chosen for dismantling operations, taking into account cost factors and regulations of the Atomic Energy Act. The results of preparatory decommissioning planning are reported here.

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Cost Estimation of the Decommissioning of Nuclear Fuel Cycle Plants

CONF-910413; Nuclear Fuel Reprocessing and Waste Management, Proceedings of the Third International Conference, Sendai, Japan, April 14-18, 1991. Japan Atomic Industrial Forum, Tokyo, Japan, 1186 pp.; (pp. 953-959) (1991)

Most studies conducted on the cost of decommissioning nuclear facilities pertain to reactors. Few studies have been performed on the cost of decommissioning nuclear fuel cycle plants, particularly spent fuel reprocessing plants. Operators of these plants need to assess such costs, in order to include the related expenses in their short-, medium- or long-term projections. These operators also need to determine suitable production costs to propose to their customers. Unlike nuclear reactors, for which a series effect is involved (e.g., pressurized water reactors and boiling water reactors), and where radioactivity is relatively concentrated, industrial-scale reprocessing plants are large, complex installations for which decommissioning is a long and costly operation. This paper presents a computerized calculation model for assessing total decommissioning costs for large reprocessing plants. The methodology is also applicable to other complex nuclear facilities, such as laboratories and nuclear auxiliaries of reactor cores.

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T. Hoshi, Japan Atomic Energy Research Institute, Department of Japan Power Demonstration Reactor, Tokai, Ibaraki, Japan

Policy and Regulation for Decommissioning Reactors in Japan

IAEA-SR-179/19I; CONF-920577; Ageing, Decommissioning, and/or Major Refurbishment of Research Reactors, Proceedings of an IAEA Seminar for Asia and the Pacific, Bangkok, Thailand, May 18-22, 1992; (15 pp.) (May 1992)

As a basic policy for the decommissioning of nuclear reactors, especially nuclear power plants, stage 3 decommissioning has been recommended in Japan so that the sites may be reused for the construction of new reactors. Construction, operation, and decommissioning of reactors are strictly governed by regulatory laws. A reactor licensee must submit a decommissioning plan describing the method of decommissioning, schedule, and waste disposal to the regulatory body prior to the start of decommissioning. Some research reactors and critical facilities have been or are being decommissioned; however, most research and development (R & D) activities on

decommissioning have been carried out under the auspices of the "Long-Term Program for Development and Utilization of Nuclear Energy." The Japan Power Demonstration Reactor (JPDR) decommissioning program is one of the national programs carried out by the Japan Atomic Energy Research Institute under contract with the Science and Technology Agency. Under this program, extensive R & D on reducing worker radiation exposure, decommissioning costs, etc. is in progress. This paper describes decommissioning policy and regulation in Japan, and relates some experiences from the JPDR program.

87
H. Yamamoto and M. Oshino, Japan Atomic Energy Research Institute, Department of Health Physics, Tokai, Ibaraki, Japan

Current Status of Residual Radioactivity Criteria in Japan

EPA/520/1-90-013; CONF-8909236; Residual Radioactivity and Recycling Criteria, A.B. Wolbarst, H. Terada, and A.C.B. Richardson (eds.), Proceedings of a Workshop, St. Michaels, MD, September 27-28, 1989, 311 pp.; (pp. 193-196) (September 1989)

In this paper, current Japanese regulations concerning residual-radioactivity criteria and efforts to establish such criteria are reviewed. Although some governmental organizations state policies on reusing nuclear facilities, lands or materials, and efforts to establish criteria have been started, no conclusions have been reached. Considering these circumstances, the authors describe their ideas on desirable forms of residual-radioactivity criteria for reusing facilities, lands or materials.

88
S. Yanagihara, M. Nakano, T. Saiki, and K. Fujiki, Japan Atomic Energy Research Institute, Department of Japan Power Demonstration Reactor, Tokai, Ibaraki, Japan

Systems Engineering for Decommissioning the Japan Power Demonstration Reactor

CONF-911135 (Vol. 2); Nuclear Engineering, Proceedings of the First JSME/ASME Joint International Conference, November 4-7, 1991, Tokyo, Japan, Vol. 2, 593 pp.; (pp. 65-70) (November 1991)

The Japan Power Demonstration Reactor (JPDR) decommissioning program is developing new technology for reactor decommissioning, and is establishing a decommissioning database. Various data about the JPDR dismantling have been accumulated in the database. The data collected is being used for (1) managing on-going dismantling activities; (2) verifying the code system for management of reactor decommissioning (COSMARD), developed for the purpose of forecasting management information; and (3) planning future decommissioning of commercial reactors. COSMARD and the database are expected to be useful for planning future decommissioning of commercial nuclear power reactors.

89
International Atomic Energy Agency, Vienna, Austria

Order of 31 July 1990 Cancelling the Third Condition in the Annex to the Order of 29 April 1982 Granting the Final Operating License for the Vandellos I Nuclear Power Plant, and Fixing the Conditions to be Complied with by the Operator for the Phase Prior to its Dismantling and Closing Down, to Maintain the Plant in Safe Conditions and Remove the Fuel from the Site

INIS-XN-338; 4 pp. (August 1990)

This order sets out the updated technical conditions for dismantling and decommissioning the Vandellos I nuclear power plant.

90
R. Kanyukt, P. Sriyotha, and P. Yamkate, Office of Atomic Energy for Peace, Bangkok, Thailand

Conceptual Decommissioning Plan for Thai Research Reactor-1/Modification 1

IAEA-SR-179/12C; CONF-920577; Ageing, Decommissioning, and/or Major Refurbishment of Research Reactors, Proceedings of an IAEA Seminar for Asia and the Pacific, Bangkok, Thailand, May 18-22, 1992; (13 pp.) (May 1992)

The Thai Research Reactor-1 was commissioned in 1962 and has served various purposes, including the production of radionuclides for medical uses and research and development on nuclear science and technology. The Thai cabinet resolved on December 27, 1989 that the existing reactor site should be abandoned and relocated to a new suitable site. The decommissioning projects for the TRR1/M1 are being planned in concert with the research reactor relocation project. This paper summarizes the Office of Atomic Energy for Peace opinion and concept for decommissioning the sole research reactor available in Thailand, based on strategies and methods recommended by International Atomic Energy Agency experts and publications.

91

Nuclear Electric Reconsiders its Back-End Arrangements

Nuclear Engineering International 35(435):11 (October 1990)

Nuclear Electric aims to reduce its back-end fuel cycle liabilities and is considering new options for waste management, reprocessing and decommissioning. The extent of Nuclear Electric's back-end liabilities were discussed at great length when Great Britain was considering privatization of its nuclear industry. Uncertainty over the size of the liabilities was partly responsible for the decision to keep the nuclear industry in public ownership. Nuclear Electric has made provisions to cover its back-end liabilities, much of which is for reprocessing, waste storage and disposal, and decommissioning. In the area of waste management, Nuclear Electric is considering the following options to reduce its costs: (1) dry storage, (2) wet storage, and (3) reprocessing. Options for reducing the costs of decommissioning operations include "safestore", in which a containment is built around the plant after limited dismantling, and "in situ" decommissioning, in which buildings would not be dismantled but would be filled, mounded over and landscaped.

92

R.F. Dudley, U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, Washington, DC

Environmental Assessment and Finding of No Significant Impact Regarding Proposed Order Authorizing Dismantling of and Disposition of Component Parts - University of Kansas Research Reactor

Federal Register 56(181):47253 (September 18, 1991)

The U.S. Nuclear Regulatory Commission (NRC) is considering issuance of an order authorizing the University of Kansas (UK) to dismantle its research reactor facility, located on the licensee's campus in Lawrence, Kansas, and to dispose of the reactor components in accordance with the application dated December 17, 1990. In order to prepare the property for unrestricted access and use, the dismantling and decontamination activities proposed by UK must be accomplished. All decontamination will be performed by trained personnel in accordance with previously reviewed procedures and will be overseen by experienced health physics staff. Solid and liquid waste will be removed from the facility and managed in accordance with NRC requirements. The UK staff has calculated that the collective dose equivalent to the staff and public for the project will be less than 3 person-rem. These conclusions were based on all proposed operations being carefully planned and controlled, all contaminated components being removed, packaged, and shipped off-site, and having radiological control procedures in place that help ensure that releases of radioactivity from the facility are within the limits of 10 CFR part 20 and are as low as reasonably achievable (ALARA). Based upon the foregoing environmental assessment, NRC has determined not to prepare an environmental impact statement for the proposed action. The NRC concludes that the proposed action will not have a significant effect on the quality of the human environment.

93
R.F. Dudley, U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, Washington, DC

Long Island Lighting Company - Shoreham Nuclear Power Station - Environmental Assessment and Finding of No Significant Impact

Federal Register 56(226):58931-2 (November 22, 1991)

The U.S. Nuclear Regulatory Commission (NRC) is considering issuance of an exemption from the requirements of 10 CFR 50.75(e)(iii) (A), (B), and (C) to the Long Island Lighting Company (LILCO) for the Shoreham Nuclear Power Station, Unit 1 located in Suffolk County, New York. The proposed action would grant an exemption from the conditional requirements of using a surety method as financial assurance for decommissioning. The decommissioning funding requirements of 10 CFR 50.75(e) were designed to provide reasonable assurance that at the time of permanent end of operations, sufficient funds are available to decommission the facility in a manner which protects the public health and safety. LILCO's proposed financial assurance plan, which includes a $300 million line of credit (LOC), meets the intent of the option described in 10 CFR 50.75(e)(iii) for using a surety method. Their available LOC, however, does not meet all the conditional requirements of the regulations. LILCO's financial assurance plan more than adequately compensates for this noncompliance. In addition to the $300 million LOC, their plan includes: (1) $10 million external account to cover unexpected decommissioning complications, (2) a commitment to deposit into an external account decommissioning funds projected for the third month following decommissioning, and (3) a commitment to fund the Shoreham decommissioning, unconditionally. The proposed exemption does not adversely impact the ability of LILCO to provide adequate assurance that funds will be available to decommission the Shoreham facility. The licensee's remaining financial assurance plan provides adequate assurances that funds will be available to decommission Shoreham while protecting the public health and safety. Therefore the NRC concludes that there are no measurable environmental impacts associated with the proposed exemption.

94
J. Rubenstein, U.S. Nuclear Regulatory Commission, Office of Administration, Washington, DC

Financial Assistance Award - Babcock & Wilcox

Federal Register 58(176):46602 (September 13, 1991)

The Department of Energy (DOE) announces that, pursuant to 10 CFR 600.7(b)(2)(i)(B) and (F), it is making a noncompetitive award to Babcock & Wilcox (B&W) under Grant Number DE-FG01-91EW40017. The total projected costs are $65,381,000. B&W will cost share in this award by contributing 55% of the total projected costs, and the DOE share will be 45% or $30,000,000 of the total costs, whichever is less. The purpose of the grant is to provide funding towards the final decontamination and decommissioning of the Nuclear Fuel Facility located in Apollo, Pennsylvania, which is to be accomplished by January 1993, as required by Public Law 101-511. B&W, an established and experienced nuclear firm, well-recognized in the area of nuclear decontamination and decommissioning, is the site owner and licensee of the Nuclear Regulatory Commission, and has been proceeding with decontamination and decommissioning of the Apollo facility for nearly 20 years as corporate funding would permit. This organization is the most appropriate to administer funds provided by Congress for the cleanup. Use of any other contractor would not be as efficient, as another contractor would have to coordinate closely with the site owners before attempting any effort at the facility. The period of performance is from September 1982 through January 31, 1993.

95
R.F. Dudley, U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, Washington, DC

Environmental Assessment and Finding of No Significant Impact Regarding Proposed Order

Authorizing Dismantling and Disposition of Component Parts - University of Utah AGN-201M Research Reactor

Federal Register 56(148):36850 (August 1, 1991)

The U.S. Nuclear Regulatory Agency (NRC) is considering issuance of an order authorizing the University of Utah (UU) to dismantle its AGN-201M research reactor facility, located on the licensee's campus in Salt Lake City, Utah, and to dispose of the reactor components in accordance with the application dated July 17, 1990, as supplemented on July 18, 1990 and June 21, 1991. All decontamination will be performed by trained personnel in accordance with previously reviewed procedures and will be overseen by experienced health physics staff. Solid and liquid waste will be removed from the facility and managed in accordance with NRC requirements. The UU staff has calculated that the collective dose equivalent to the staff and public for the project will be less than 0.5 person-rem. These conclusions were based on all proposed operations being carefully planned and controlled, all contaminated components being removed, packaged, and shipped off site, and having radiological control procedures in place that help ensure that releases of radioactivity from the facility are within the limits of 10 CFR part 20 and are as low as reasonably achievable (ALARA). Components not removed have been transferred to the University's byproduct material or TRIGA reactor licenses. The UU staff has determined that there will be no significant increase in the amounts of effluents that may be released off site, and no significant increase in individual or cumulative occupational or population radiation exposure. The staff has also determined that the proposed activities will not result in any significant impacts on the air, water, land, or biota in the area. Based upon foregoing environmental assessment, NRC has determined not to prepare an environmental impact statement for the proposed action. The NRC concludes that the proposed action will not have a significant effect on the quality of the human environment.

96

R.P. Allen, Pacific Northwest Laboratory, Richland, WA

Residual Radioactivity Cost Impact Evaluation

EPA/520/1-90-013; CONF-8909236; Residual Radioactivity and Recycling Criteria, A.B. Wolbarst, H. Terada, and A.C.B. Richardson (eds.), Proceedings of a Workshop, St. Michaels, MD, September 27-28, 1989, 311 pp.; (pp. 132-146) (September 1989)

Studies are in progress at Pacific Northwest Laboratory to evaluate the cost differentials (impacts) for compliance with residual radioactivity limits governing release of land and structures for unrestricted use following the decommissioning of licensed nuclear facilities. The initial work has focused on the decommissioning of a reference uranium fuel fabrication facility to achieve alternative effective dose equivalent levels ranging from 80 to 1 mrem/yr for the maximally exposed individual. Concrete and soil removal and disposal costs were calculated for the reference uranium fuel fabrication facility as a function of these target levels. The disposal cost evaluation considered both low-level waste (LLW) disposal and the effect of establishment of a below regulatory concern (BRC) disposal option based on compliance with a 1, 4, or 10 mrem/yr individual dose level. The results indicate that removal plus disposal costs for concrete structures are relatively insensitive to decreasing target levels for the LLW waste disposal option, but costs decrease at the lower target levels for the BRC waste disposal option. The availability of the BRC waste disposal option favors demolition over the preservation of decommissioned structures. For contaminated soil, the removal plus disposal costs increase with the decreasing target levels for the LLW disposal option, but similarly can decrease at the lower target levels for the BRC waste disposal option.

97

R.F. Dudley, U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, Washington, DC

Dairyland Power Cooperative: La Crosse Boiling Water Reactor (LACBWR) - Issuance of Environmental Assessment and Finding of No Significant Impact

Federal Register 56(152):37574 (August 7, 1991)

The U.S. Nuclear Regulatory Commission (NRC) is considering the issuance of an order authorizing decommissioning and issuance of a renewal and amendment of Possession Only License DPR-45 for the Dairyland Power Cooperative's (DPC's) La Crosse Boiling Water Reactor (LACBWR). The decommissioning plan involves long-term storage of the facility (SAFSTOR) followed by dismantlement. LACBWR has been shut down since April 30, 1987. All spent fuel has been removed from the reactor and is stored at the LACBWR Fuel Element Storage Well. Approval of the decommissioning plan and renewal of License DPR-45 will allow storage of spent fuel on site until a Federal repository is available, and SAFSTOR of LACBWR until March 29, 2031. The NRC staff has renewed the proposed decommissioning, the proposed renewal and amendment of the possession only license, and DPC's Supplemental Environmental Report with respect to 10 CFR 51.53(b). To document its review, the staff has prepared an Environmental Assessment. The proposed SAFSTOR of LACBWR will prevent unrestricted use of a small area of land for the SAFSTOR period, but will result in a reduced exposure of workers that do final dismantling and also in a reduced volume of radioactive waste. The staff has reviewed the proposed decommissioning, license renewal, and amendment. Based on the Environmental Assessment, the staff concluded that there are no significant environmental impacts associated with the proposed action and that the proposed action will not have a significant effect on the quality of the human environment. Therefore, the NRC has determined not to prepare an environmental impact statement for the proposed amendment.

98

O.V. Busekist, Societe Francaise d'Energie Nucleaire, Paris, France

Dismantling Cost and Strategy

CONF-8803283; Decommissioning of Fuel Cycle Nuclear Facilities, Proceedings of a Meeting, Paris, France, March 15, 1988. Societe Francaise d'Energie Nucleaire, Paris, France, 301 pp.; (pp. 108-122) (1988)

The shutdown of nuclear facilities includes decontamination and dismantling processes. These steps are well established at a theoretical level by responsible international organizations. The deployment of such strategies for radiochemical facilities (at a national level) is just beginning. An example of such an operation is presented. In 1974, the shutdown of the waste processing plant was performed by the Eurochemic Society.

99

D.M. Crutchfield, U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, Washington, DC

The University of Utah (The Utah AGN-201M Research Reactor) - Order Authorizing Dismantling of Facility and Disposition of Component Parts

Federal Register 56(153):37733 (August 8, 1991)

By application dated July 17, 1990, as supplemented on July 18, 1990 and June 12, 1991, the University of Utah (the licensee) requested authorization to dismantle the AGN-201M research reactor facility and to dispose of its component parts in accordance with the decommissioning plan submitted as part of the application. The U.S. Nuclear Regulatory Commission (NRC) has reviewed the application and has found that the dismantling and disposal of component parts as stated in the licensee's decommissioning plan will be consistent with applicable regulations, and will not be inimical to the common defense and security or to the health and safety of the public. The NRC has prepared an Environmental Assessment and Finding of No Significant Impact for the proposed action. Based on this Assessment, NRC has determined that the proposed action will not result in any significant environmental impact and that an environmental impact statement need not be prepared. Accordingly, the NRC has ordered the licensee to proceed with dismantlement, and to dispose of the component parts in accordance with its decommissioning plan and NRC's rules and regulations.

100

D.M. Crutchfield, U.S. Nuclear Regulatory Commission, Division of Advanced Reactors and Special Projects, Washington, DC

Dairyland Power Cooperative - La Crosse Boiling Water Reactor Order Authorizing Decommissioning of Facility

Federal Register 56(159):40927 (August 16, 1991)

Dairyland Power Cooperative (DPC) has requested approval of its proposed decommissioning plan for the La Crosse Boiling Water Reactor (LACBWR) and an amendment to License DPR-45. The U.S. Nuclear Regulatory Commission (NRC) has reviewed the application and has found that the decommissioning as stated in DPC's plan will be consistent with applicable rules and regulations, and will not be inimical to the common defense and security or to the health and safety of the public. NRC has prepared an Environmental Assessment and Finding of No Significant Impact for the proposed action. Based on that assessment, NRC has determined that the proposed action will not result in any significant environmental impact and that an Environmental Impact Statement need not be prepared. Accordingly, NRC has ordered DPC to decommission the reactor facility in accordance with its decommissioning plan and NRC's rules and regulations.

101

R.J. Francis, United Kingdom Atomic Energy Authority, Harwell Laboratory, Harwell, United Kingdom

Planning and Implementation of Decommissioning for Research Reactors

IAEA-SR-179/21I; CONF-920577; Ageing, Decommissioning, and/or Major Refurbishment of Research Reactors, Proceedings of an IAEA Seminar for Asia and the Pacific, Bangkok, Thailand, May 18-22, 1992; (21 pp.) (May 1992)

In common with many other member states of the International Atomic Energy Agency (IAEA), the United Kingdom (UK) has a number of research reactors that have already been retired from service and others are coming to the end of their useful lives. The Atomic Energy Agency, Decommissioning and Radwaste is the leading organization currently involved in the decommissioning of UK research reactors. Six projects are underway at present and others are being planned. The paper summarizes the key issues involved in the planning and implementation of research reactor decommissioning projects, and indicates solutions and options based on experience derived from these UK projects. Particular reference is made to the prototype advance gas-cooled reactor (WAGR) and to the graphite piles at Windscale, the prototype steam-generating heavy-water reactor (SGHWR) at Winfrith, the DIDO and Pluto heavy-water materials-testing reactors at Harwell, and the GLEEP graphite pile at Harwell. Of these, WAGR is a European demonstration project that is scheduled for decommissioning to stage 3 (unrestricted release). The other reactors are likely to be decommissioned to stage 2 (restricted release), followed by a substantial period of surveillance and maintenance, after which deferred-stage 3 would be implemented. The paper discusses important planning and management considerations that apply for stage 3 and deferred-stage 3 options. These considerations, while derived from experience on particular reactor types, are presented in ways that should be of assistance to any IAEA member state, including those who do not have research reactors of the types currently being decommissioned in the United Kingdom. Key issues are addressed in a logical sequence starting from the time when a date for final shut down of a research reactor has been agreed, through to completion of stage 3. These issues include: (1) strategic considerations (including technical options and funding); (2) data acquisition (radiological surveys, technical and financial inventories); (3) resource identification and acquisition (funds, staff, facilities, possible new developments); (4) staff appointments and training; (5) decommissioning plan (including outline of contents, safety justification considerations, and waste routes; (6) project management (including team structure, support services, progress monitoring and, reporting); (7) safety management (including appointments, reporting, dose management, and action plans); and (8) responsibilities of the project team and its

interfaces in relation to the operator and the regulatory body. Particular emphasis is given to the justification of the safety of the decommissioning plan and to the identification and successful management of waste routes, since these are crucial to the safe and efficient progress of any decommissioning project.

102
Internal Revenue Service, Washington, DC

Nuclear Decommissioning Fund Qualification Requirements

Federal Register 56(160):41102-5 (August 19, 1991)

This document contains proposed regulations relating to the qualification requirements of nuclear decommissioning funds that combine their assets for investment purposes. Final regulations (T.D. 8184), published March 3, 1988, contain the requirement that nuclear decommissioning funds invest directly in permissible assets as well as a provision that permits more than one such fund to combine assets for investment purposes. These proposed regulations describe the types of pooling arrangements that are permissible under the regulations.

103
Nuclear Energy Agency, Paris, France

Decommissioning of Nuclear Facilities - An Analysis of the Variability of Decommissioning Cost Estimates

Book, Organisation for Economic Co-operation and Development, Paris, France; 129 pp. (1991)

This study presents an international review of cost estimates for decommissioning of nuclear facilities. The objective of the study is to illustrate reasons why the published estimates for decommissioning vary so widely and to what extent various political, institutional, technical and economic factors could explain the variation. The report is intended for the general reader with an interest in the topic. The work was carried out by an international group of experts under the auspices of the Nuclear Energy Agency's Committee for Technical and Economic Studies on Nuclear Energy Development and the Fuel Cycle.

104
P.C. Stimes and R.T. Flaherty, Flaherty and Crumrine, Inc., Pasadena, CA

Investment Management for Nuclear Decommissioning Trusts

Public Utilities Fortnightly 126(11):32-33 (November 22, 1990)

According to Nuclear Regulatory Commission estimates, and assuming a four percent annual inflation rate, minimum decommissioning requirements for a single reactor could total almost $350 million after 30 years. Consequently, reducing customer contributions to decommissioning funds is a potentially rewarding activity. In fact, improving the after-tax return earned on a nuclear decommissioning trust (NDT) fund by as little as one percentage point can reduce customer contributions to the fund by 15 percent over its life. Unfortunately, many electric utilities are headed in the wrong direction and are unlikely to achieve satisfactory results. The main problem is the prevalence of the conventional wisdom, most of which has been appropriated from the area of pension fund management. This is an area which is familiar to most utility managements, but which has only superficial similarity to the issue of NDT investing. The differences are pronounced: NDTs, unlike pensions, are fully taxable at corporate income tax rates. In addition, NDT managers should be concerned with protecting the inflation-adjusted or real value of fund investments at a single, future decommissioning date. Pension managers, on the other hand, may be concerned with satisfying nominal contractual obligations spread over an extended future time horizon. In view of the large stakes involved in the management of NDTs, the authors summarize five key tenets of the conventional wisdom in this area and demonstrate where they feel they are in error.

105
J.M. Taylor, U.S. Nuclear Regulatory Commission, Washington, DC

Decommissioning Funding for Prematurely Shutdown Power Reactors

Federal Register 56(162):41493 (August 21, 1991)

The Nuclear Regulatory Commission (NRC) proposes to amend its regulations on the timing of the collection of funds for decommissioning for those nuclear power reactors that have shut down before the expected end of their operating lives. Current regulations allow several methods by which power reactor licensees may provide assurance that they will have sufficient funds to decommission their plants by the time the plants are permanently shut down. In adopting the current rule, NRC acknowledged that in certain instances reactors might be shut down prematurely. However, the NRC determined that such instances would occur infrequently, and thus did not explicitly include in its regulations remedies for these situations. Since publication of NRC's final decommissioning rule in 1988, three power reactor facilities shut down prematurely. The NRC staff sought guidance on the appropriate period for collecting funds to compensate for any shortfall of decommissioning funds for these plants. The NRC decided that the appropriate collection period for each licensee should be determined on a case-by-case basis by evaluating each licensee's long-term financial stability. The NRC believes that this approach will ensure that licensees are treated consistently, that reasonable assurance of the availability of decommissioning funds will be maintained, and that flexibility of funding will be provided to financially healthy licensees.

106

J.M. Taylor, U.S. Nuclear Regulatory Commission, Washington, DC

General Electric Company and Westinghouse Electric Corporation - Filing of a Petition for Rulemaking

Federal Register 56(186):48445-8 (September 25, 1991)

The General Electric Company and the Westinghouse Electric Corporation request that the Nuclear Regulatory Commission (NRC) amend its regulations establishing general requirements for decommissioning licensee facilities. These regulations are contained in 10 CFR parts 30, 40, 50, 70, and 72. The petitioners request that the NRC issue a rule that would provide a means for self-guarantee of decommissioning funding costs by certain NRC non-electric utility reactor licensees who meet stringent financial assurance and related reporting and oversight requirements. The petitioners state that, under the current rule, companies like the petitioners are unable to guarantee decommissioning funding costs when they themselves are NRC licensees. However, less financially strong institutions such as banks, insurance companies, and savings and loans, are permitted to guarantee the decommissioning funding costs of NRC licensees without providing any evidence of financial strength. Furthermore, according to the petitioners, licensees without the financial capabilities of the petitioners may provide qualifying parent company guarantees solely because these parent companies are legal entities distinct from the subsidiary licenses whose decommissioning funding they guarantee. The petitioners state the lack of an internal decommissioning funding method imposes unwarranted compliance costs upon them. The petitioners suggest that the NRC amend its regulations to allow a licensee to provide a self-guarantee of funds if specific stringent financial conditions are met. The text of the petitioners' actual suggested amendments to 10 CFR chapter I is reproduced. The NRC is soliciting comments on the petition and any other issues relating to licensee self-guarantee of decommissioning funds.

107

Towards an International Decommissioning Industry

Nuclear Engineering International 36(447):31-33 (October 1991)

This article summarizes the achievements of the International Cooperative Program for the Exchange of Scientific and Technical Information Concerning Nuclear Installation Decommissioning Projects during its first five-year term. The program was initiated in 1985 by the Organization for Economic Cooperation and Development (OECD) through its Nuclear Energy Agency (NEA). The program's primary objective is to

facilitate the exchange of information and application-related experience concerning decommissioning. As the program began its second five-year term in September 1990, a total of 19 decommissioning projects in eight countries were participants. These projects are listed and characterized by type, size, time period, cost, and other factors. Currently the program covers 13 reactors of various types, four fuel reprocessing plants, one MOX fuel fabrication plant, and one radioisotope processing facility. The program has been involved in six major technical areas: (1) activity inventory assessment; (2) decontamination methods; (3) cutting techniques; (4) remote operation; (5) radioactive waste management; and (6) health and safety.

108
W. Harbecke, Kernkraftwerk Lingen GmbH, Lingen, Federal Republic of Germany

Consequences of Suppression of Negative Pressure in the KW-Lingen Containment

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 68-75) (1990)

Since the beginning of 1988, the decommissioning status of the Lingen plant has been that of safe enclosure. The aim of the work described in this paper is to point out the behavior of the plant in respect to the air exchange to the environment and the atmosphere inside the plant. It is common practice to maintain a negative pressure in the containment of shut-down nuclear reactors to avoid a transfer of radioactivity to the outside. The objective of this investigation was to assess, from the standpoint of environmental radiation protection, the acceptability of suppressing the negative pressure ventilation. The Lingen safe enclosure is operated with a small off-air system.

109
P.B. Woollam, Nuclear Electric plc, Berkeley Nuclear Laboratories, Berkeley, United Kingdom

Measurement Techniques Applicable to Residual Radioactivity on a Decommissioned Reactor Site

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 365-372) (1990)

During the likely deferral period between Stages 2 and 3 of the decommissioning of National Power's reactors, there is an incentive to move the present security fence inward to encompass the minimum possible area of the site. This could release land which might be made available to the local population for certain recreational purposes, and would be more attractive than an unused security controlled zone. In addition, there will be a significant financial saving in not maintaining a long security fence, and possibly security personnel, over a 100 year period. Before the Authorizing Ministries accept any proposal to reduce the area of the secure site, they must be assured that the radiological consequences of such a change will be acceptable. National Power will still own the land and will still be responsible for safety; there need not be an unconditional release of any part of the site. The public might be allowed to use the land as they would a municipal park or managed woodland. This paper discusses techniques by which the site could be monitored to assure compliance with some possible criteria, together with the implications of existing levels of radioactive contamination resulting from airburst nuclear weapons tests and the Chernobyl accident.

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P.B. Woollam, Central Electricity Generating Board, Berkeley Nuclear Laboratories, Berkeley, United Kingdom

The Potential Radiological Consequences of Deferring the Final Dismantling of a Magnox Nuclear Power Station

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium,

October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 76-84) (1990)

It is proposed that final dismantling of National Power's nuclear stations be deferred to take advantage of natural decay of residual radioactivity. A deferment of 100 to 130 years would reduce the dose commitment to the dismantling personnel and remove the need to depend on robotic systems. Deferment would lead to large savings, especially when totalled over all of National Power's Magnox stations. However, the possibility must be considered that residual radioactivity from the structure might return to man during the deferment period, mainly through rainwater leakage and transport through the groundwater system, and also through airborne releases. The principal objective in assessing such safety issues is to examine the engineering standards required of the residual structure in the deferred-dismantling scenario. Dungeness A presents a limiting case, since it is the only National Power nuclear site built on an aquifer from which large quantities of water are extracted for the nearby population. This paper first determines the potential radiological consequences which might result from possible leakage of radioactive materials from the Dungeness A reactor structure if final dismantling were deferred. It then discusses any engineering constraints which these radiological consequences might impose.

111

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Development of Measuring Systems for Contamination Measurements on Regularly and Irregularly Shaped Surfaces

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 321-324) (1990)

In 1983 and 1984, Reaktorwartungsdienst und Apparatebau GmbH, in cooperation with Kernforschungsanlage Juelich GmbH (KfA), began work on closing the gaps which existed in contamination measurement technology, representing standard practice at the time. Fundamental developments led to measuring processes which made possible for the first time the recording of alpha and beta contaminations on surfaces with difficult accessibility, such as pipes and angular sections. The laboratory models conceived by KfA were to be optimal in efficiency, dimensions, performance characteristics, and practical handling considerations, and were to undergo further development until ready for production. Accordingly, particular attention was paid to the construction of a complete family of radiation counters for all conceivable applications, including the basic electronic units and appropriate connection elements.

112

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Radiation Exposure of the Personnel During Decommissioning

Kerntechnik 56(6):383-384 (1991)

The assessment of the ensuing collective dose plays an important role in planning the decommissioning of a nuclear power station. The assessment is outlined according to principles which minimize the collective dose. Assessments for the decommissioning of nuclear plants still in operation result in collective doses between 6 and 15 Sv (around 2 Sv per year).

113

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Removal of Nuclear Reactors by Lowering - Results of Individual and Long-Term Safety Assessment

CONF-8911319; Status Report 1989 of the Central Bureau for Management and Coordination of Projects Concerning the Decommissioning of Nuclear Facilities, Proceedings of a Conference, Hanover, Federal Republic of Germany, November 15-16, 1989, 350 pp.; (pp. 151-180) (April 1990)

Questions of engineering, safety, and costs arising from a total lowering of the containment building as well as from a partial lowering of the biological shield area of a pressurized water reactor were analyzed. As lowering methods largely dispense with contaminated-components processing, as well as radioactive waste management and final disposal, a reduction of the individual dose and emissions can be expected. In this analysis the contamination of groundwater was also taken into consideration.

114

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Estimation of Collective External Dose During Dismantling of JPDR (BWR, 90 MWt)

Nippon Genshiryoku Gakkaishi 33(6):574-584 (June 1991)

The collective external dose in the dismantling of the Japan Power Demonstration Reactor (JPDR), a 90 MW(t) boiling water reactor (BWR), was estimated. First, the radioactive inventories of components to be dismantled were evaluated, using the operation history of the JPDR. Then the dose-equivalent rate at each working area was calculated on the basis of the obtained radioactive inventories. To evaluate the man-hours in a radiation environment relating to the JPDR dismantling, the activities were further categorized as preparation, dismantling, packaging, shipping, and cleaning up. Man-hours were calculated according to occupations, such as a dismantling worker, a supervisor and a radiation officer. Through these studies, the collective external dose was evaluated to be approximately 300 man-mSv. This is relatively small compared with that of the Elk River Reactor in the United States (750 man-mSv). It was found that remotely operated dismantling machines are effective for radiation protection, and that this method of estimating collective external dose is useful in comparison with the actual value.

115

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Safety Related Aspects of Decommissioning Projects

IAEA-SR-179/20I; CONF-920577; Ageing, Decommissioning, and/or Major Refurbishment of Research Reactors, Proceedings of an IAEA Seminar for Asia and the Pacific, Bangkok, Thailand, May 18-22, 1992; (21 pp.) (May 1992)

Decommissioning of nuclear facilities requires adequate safety considerations on a par with safety precautions taken during the operational period. National supervisory authorities must set up the relevant safety rules for the decommissioning program or specified projects. The International Atomic Energy Agency (IAEA) is currently formulating and specifying standards and recommendations for national application. The safety-related aspects of decommissioning are dependent on the type of facility and the stage being considered in the process from shutdown of the plant or system to the ultimate green field level. The main safety goals are: (1) an adequate working environment for the personnel during decommissioning, and (2) protection of the public. In principle, the measures to achieve safe working conditions are similar to those applied during operation. Measures to protect the public may include special features like decontamination and monitoring before the safe release of materials, buildings, or areas for unrestricted use. Classification of waste and safe final disposal are other typical measures. This paper discusses safety from the perspective of ten years experience at Studsvik in fruitful cooperation with the national authorities. The types of facilities or systems decommissioned include research reactors, laboratories for the investigation of irradiated

materials, tritium and alpha-contaminated systems, and vessels containing liquid wastes. Methods, procedures, and facilities for handling and disposing of waste from decommissioning are also discussed.

116
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Radiation Protection on Decommissioning of Nuclear Facilities: Problems, Needs and Perspectives

ETDE-IT-91-26; CONF-9006337; Low Level Radiation Achievements, Concerns and Future Aspects, Proceedings of the Third Italian-Yugoslav Symposium, Plitvice, Yugoslavia, June 11-13, 1990; (24 pp.) (1990)

With increasing numbers of nuclear reactors now reaching the end of their useful lives, decommissioning is becoming more and more important. Decommissioning is defined as actions taken at the end of a facility's useful life to retire the facility from service in a manner that provides adequate protection for the health and safety of the decommissioning workers, the general public, and the environment. These actions can range from merely closing down the facility (with a minimal removal of radioactive material and continuing maintenance and surveillance), to the complete removal of residual radioactivity in excess of levels acceptable for unrestricted use of the facility and its site. Decommissioning actions have been grouped into three major "stages." The stages are determined by the physical state of the plant and its equipment and the surveillance, inspections and tests associated with that state. The intention of this paper is to analyze the activities of the health physicist during the three most important phases which characterize the whole decommissioning of a nuclear installation: (1) planning, (2) operating, and (3) final surveying.

117
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Some Remarks About Decontamination

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 615-621) (1990)

Decontamination in itself is not the elimination of a problem, but corresponds to moving that problem from one place to another. Decontamination is beneficial only if the contamination is less of a nuisance when moved to the "other place." Therefore, any prospective decontamination process is to be considered essentially in terms of cost benefit, and in particular in terms of reducing the burden on the waste management systems. The paper is not intended to deal with or critically review the technical aspects of the various decontamination processes which are currently available. Rather, its aim is to bring this perspective to the attention of those who may be faced with the problem of large-scale decontamination, so that decontamination is carried out only after all practical aspects have been examined.

118
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The Experience - 6th Case - Rinsing and Decontamination of Liquid Waste Storage Containers of Intermediate and High-Level Radioactivity

CONF-8803283; Decommissioning of Fuel Cycle Nuclear Facilities, Proceedings of a Meeting, Paris, France, March 15, 1988. Societe Francaise d'Energie Nucleaire, Paris, France, 301 pp.; (pp. 158-180) (1988)

During the operation of the Eurochemic fuel reprocessing plant, a large quantity of intermediate- and high-level radioactive liquid wastes were produced and stored. All containers with intermediate-level radioactive wastes and part of those with high-level radioactive wastes were emptied. Asphalting and vitrifying processes were applied. The characteristics of the liquid waste

storage facilities and the rinsing and decontamination operations are described.

119
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Decontamination Tests on Stainless Steel Tubing Removed from the Darlington Tritium Removal Facility

MIC-91-02127; 12 pp. (1990)

Modifications to process tubing in the high-tritium columns associated with the Darlington Tritium Removal Facility are necessary to permit reliable determination of liquid tritium levels. Before these modifications could be undertaken, samples of tubing with similar tritium exposure history were characterized for total tritium inventory, amount of HTO relative to HT, and the amount of smearable tritium activity to determine the effect on the working environment when the actual field tubing is cut and welded.

120
J. Knajfl and J. Severka

Procedure for Decontamination of Surfaces Contaminated with Radioactive Substances

Procedure Number CS 268300 B1; 3 pp. (July 31, 1990)

A foam containing complexants such as EDTA, DTPA or citric acid is applied to the surface to be decontaminated, and allowed to act for a period of time no shorter than 5 minutes. The foam is then removed with a filter paper. This procedure produces a minimal amount of radioactive waste. The foam can be applied to horizontal and vertical surfaces of buildings, objects, machinery and equipment.

121
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Optimized Coating Removal by Cold Shock Treatment

CONF-8911319; Status Report 1989 of the Central Bureau for Management and Coordination of Projects Concerning the Decommissioning of Nuclear Facilities, Proceedings of a Conference, Hanover, Federal Republic of Germany, November 15-16, 1989, 350 pp.; (pp. 181-206) (April 1990)

This method of removing coatings from nuclear power plant components (especially those with residual contamination) utilizes self-contained stress that is developed during heat extraction. A nitrogen application process with preheating by means of hot air, infrared, and microwave radiation was tested. The problem of auxiliary coatings was examined, and model coatings were developed.

122
C. Koch and R. Gruner

Decontamination During Decommissioning

Kerntechnik 56(6):372-375 (1991)

The strategy selected for decommissioning of a nuclear facility depends to a great extent on the radiological conditions of the facility prior to its dismantling. Therefore, to facilitate decommissioning, the activity inventories should be reduced by decontamination. The history of decontamination is closely related to the maintenance, repair and backfitting of nuclear power plants. Because a wide variety of contamination forms exist, special decontamination processes have been established, which are also suitable for decommissioning. An example of a recent development in chemical decontamination, the CORD process, which was successfully applied to the primary loop of the reactor BR-3, is described in detail.

123
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Heidelberg, Federal Republic of Germany; Kernforschungszentrum Karlsruhe GmbH, Karlsruhe, Federal Republic of Germany; Bundesministerium fuer Forschung und Technologie, Bonn, Federal Republic of Germany

Residue-Free and Residue-Poor Jet Methods to Decontaminate Nuclear Plant Components

CONF-8911319; Status Report 1989 of the Central Bureau for Management and Coordination of Projects Concerning the Decommissioning of Nuclear Facilities, Proceedings of a Conference, Hanover, Federal Republic of Germany, November 15-16, 1989, 350 pp.; (pp. 207-220) (April 1990)

A possible method of decontaminating tightly adherent layers, such as varnish and oxide layers, is to treat them with abrasive shotblasting media which become contaminated themselves and, therefore, have to be disposed of like radioactive waste. In these shotblasting tests on varnished and rusty sheets, solid carbon dioxide dry-ice, ammonium tartrate, coke, polyamide and thermosetting plastic were used. The percentage purity was appraised on DIN 55928. The decontamination factors were in the range of 8 to 100.

124

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A Process for the Complete Decontamination of Entire Systems

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 531-536) (1990)

The oxidic layers of the samples examined from the primary system of the Nuclear Power Station Lingen (KWL) contain more than 99% of the activity deposited on the surface. The rest is distributed by grain-boundary diffusion in the base material up to a penetration depth of 90 micrometers. In order to achieve a complete decontamination, it is necessary to take down not only the oxidic layers, but also the surface of the base material up to the penetration depth of the radioisotopes. When applying this process, the oxide layer is completely removed by treatment with a LOMI reagent. Then the required layer thickness is separated from the base material by treatment with a mixture of nitric acid and hydrochloric acid. A DN-50 primary steam pipe piece was decontaminated with this process. The effect of the different treatment stages was checked by the determination of the surface-depth profiles of the essential elements.

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Aged Stainless Steel Corrosion Tests with LOMI and AECL Decontamination Processes

CONF-891026 (Vol. 2); Water Chemistry of Nuclear Reactor Systems, Proceedings of the Fifth International Conference, Bournemouth, United Kingdom, October 23-27, 1989. British Nuclear Energy Society, London, United Kingdom, Vol. 2, 194 pp.; (pp. 123-130) (1989)

Experience has been gained in evaluating corrosion impacts of soft chemical decontamination reagents. Absence of localized corrosion or its origin, whenever it occurs, has been demonstrated. The general weight loss of metal has been precisely evaluated, especially on new materials. However, the specific problem of aged stainless-steel corrosion has not been investigated, except on some contaminated coupons. Framatome, which owns Atomic Energy of Canada Limited (AECL) and LOMI licenses, has implemented aged stainless-steel corrosion tests to complete its corrosion file. No localized corrosion has been found and general material weight loss remains in the range observed for non-aged stainless steel.

126

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Centre d'Etudes Nucleaires de Cadarache, Saint-Paul-lez-Durance, France; Commission of the European Communities, Luxembourg, Luxembourg

New Decontamination Techniques: Chemical Gels, Electropolishing and Abrasives

EUR-13497; 92 pp. (1991)

The decommissioning of nuclear installations requires decontamination techniques that are efficient, simple to apply, and produce a small amount of easily processed waste. Three decontamination methods that appear to be particularly suited to decommissioning have been studied. These three methods are: (1) spraying of gels carrying chemical decontaminating agents; (2) electropolishing with a swab device; and (3) abrasives blasting. After parametric tests on non-radioactive and active samples, the industrial application of these methods in the dismantling of installations was studied. These industrial applications concern: (1) decontamination of pieces coming from the German boiling water reactor ISAR by immersion and gel spraying; (2) decontamination, mainly by gel spraying, and dismantling of the BRENNILIS bituminization plant; (3) decontamination of part of the cooling circuit of the graphite gas reactor G2 by gel spraying; and (4) decontamination of a component of the fast breeder reactor SuperPhenix, using dry abrasives blasting. During the first three applications, generated secondary wastes volume and form were determined.

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Decontamination During Dismantling of the Rapsodie Primary Coolant Circuit

EUR-13489; 78 pp. (1991)

The large-scale decontamination of FBR sodium loops is a novel task, as only a limited number of laboratory-scale results are available to date. The principal objective of this work is to develop a suitable decontamination procedure for application to the primary loops of the RAPSODIE fast-breeder reactor as part of decommissioning to Stage 2.

128

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Decontamination Before Dismantling: Is It of Interest?

CONF-8803283; Decommissioning of Fuel Cycle Nuclear Facilities, Proceedings of a Meeting, Paris, France, March 15, 1988. Societe Francaise d'Energie Nucleaire, Paris, France, 301 pp.; (pp. 260-269) (1988)

There are two advantages to applying a fast decontamination technique before dismantling: improved safety and allowance of classic dismantling techniques. In this context, two situations are considered: (1) the decontamination of a peripheral circuit at COGEMA (Compagnie Generale des Matieres Nucleaires) and (2) the decontamination of a glove box. The cost reduction attained in the operation, although real, is difficult to compute.

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Decontamination Before Dismantling a Fast Breeder Reactor Primary Cooling System

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 554-566) (1990)

The large-scale decontamination of fast-breeder-reactor sodium loops is a novel task, as only a limited number of laboratory-scale results are available to date. The principal objective of

this work is to develop a suitable decontamination procedure for application to the primary loops of the RAPSODIE fast breeder reactor as part of decommissioning to Stage 2. After disconnecting the piping from the main vessel, the pipes were treated by circulating chemical solutions and the vessels by spraying. The dose rate in the areas to be dismantled was reduced by a factor of ten. A decontamination factor of about 300 was obtained, and should allow austenitic steel parts to be melted in special furnaces for unrestricted release.

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Decontamination of the Main Circuits of the G2 Gas-Graphite Reactor

IAEA-TECDOC-511; Decontamination and Decommissioning of Nuclear Facilities - Final Report of Three Research Coordination Meetings Held Between 1984 and 1987. International Atomic Energy Agency, Vienna, Austria; (pp. 47-53) (April 1991)

The decommissioning program for the G-2 gas-cooled graphite reactor at Marcoule, France, requires decontamination of the facility in a way that the minimizes waste volumes and allows remote decontamination. Large amounts of low-level radioactive construction materials led to the selection of decontamination procedures which allow the reuse or recycle of the materials. Two decontamination approaches were considered: (1) in-situ decontamination, and (2) dismantling and subsequent decontamination in a central facility. Laboratory tests included the application of various acids and mixtures of gels and foams, use of high-pressure water jets, and electrochemical decontamination. Using acidic solutions, decontamination factors of over 100 were obtained in less than two hours; using gels and foams, similar results were obtained with a smaller volume of secondary waste. Full-scale tests using the gels were performed in 1986 and 1987 on 30 tons (300 sq m) of steel. The results of these tests confirmed that the gel technique can be used successfully where the contaminated surface is accessible to the spray. Further tests will be needed to adapt the gel technique reagent to the various types of base material and the different contaminants.

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Decontamination for Decommissioning: Enhancement of Aggressive Chemical Decontamination by Using Electropolishing or Ultrasound

CONF-891026 (Vol. 2); Water Chemistry of Nuclear Reactor Systems, Proceedings of the Fifth International Conference, Bournemouth, United Kingdom, October 23-27, 1989. British Nuclear Energy Society, London, United Kingdom, Vol. 2, 194 pp.; (pp. 179-181) (1989)

In the decommissioning of nuclear power plants, Energie Nazionale l'Energia Ellectrica-CRTN and Centro Informazioni Studi Esperienze jointly carried out a series of testing on decontamination processes not yet optimized, such as electrodecontamination and ultrasound with chemicals. Both laboratory and full-scale testing have been performed. An overview of the results is presented.

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Decontamination for Decommissioning Purposes

Energia Nucleare 8(2):117-126 (1991)

This paper summarizes the research and development activities made by ENEL (the Italian National Electricity Board) regarding decontamination for decommissioning purposes. After a general overview on decontamination

requirements and procedures is presented, the main results obtained in experimental activities in the following fields are discussed: (1) decontamination of the tube bundle of a Garigliano boiling water reactor feedwater preheater by ultrasonic waves in aggressive chemicals; (2) treatment of the wastes arising from aggressive chemical decontamination; (3) electrochemical decontamination; (4) chemical decontamination by commercial non-aggressive processes; and (5) characterization of contamination layers. Some of these activities were supported by the European Communities within the framework of the Communities' program on decommissioning of nuclear installations.

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Aggressive Chemical and Ultrasound Decontamination Tests on Small Valves and Tubes from a Feedwater Preheater of Garigliano-BWR

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 537-553) (1990)

Decontamination tests performed on components of the Garigliano boiling water reactor (BWR) using processes based on the action of aggressive chemicals are described. Decontamination tests carried out on small 1-2 in. valves showed that some residual radioactivity remains in deep crevices. Therefore, these kinds of complex components cannot be totally decontaminated, even if decontamination can reach residual average values of less than 1 Bq/g. For decontaminating the tube-bundle of feedwater preheaters, a new decontamination process based on the simultaneous use of ultrasound and aggressive chemicals was developed and tested under real conditions. One thousand tubes 1 m long were fully decontaminated at less than 0.3 Bq/g.

134
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Decontamination Device for Radiation-Contaminated Metal

Japanese Patent 3-2596/A; Japanese Patent Application 1-134622; 5 pp. (May 30, 1989; January 8, 1991)

Liquid electrolytes in an electrolytic decontaminating vessel are supplied by a recycling pump through a hose line to a jet nozzle. In the decontaminating vessel, the jet nozzle is directed toward the contaminated metal to be processed. Trivalent curium ions contained in an aqueous solution of nitric acid or sulfuric acid are converted into tetravalent ions by electrolytic oxidation in the electrolytic vessel. Liquid electrolytes with the oxidizing power of the tetravalent cerium ions are thus formed. These liquid electrolytes are mixed with lightly corrosive blasting particles, such as glass beads, and are jetted out from the nozzle. The radiation-contaminated metal surfaces are peeled off by the impact of the blasting particles. The metals are dissolved and decontaminated by the oxidizing effect of the tetravalent cerium ions. In this way, the uneven surfaces of radioactive metals can be reliably dissolved, reducing the amount of secondary wastes formed.

135
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Peeling/Removing Device for Surface Layer of Radiation-Contaminated Concrete by Microwave Irradiation

Japanese Patent Application 1-136590; Japanese Patent 3-2595/A; 8 pp. (May 30, 1939; January 8, 1991)

A microwave generator is brought close to a radioactively contaminated concrete surface. Waveguide tubes are used to control the output of

the microwave generator and to determine the direction of microwave radiation and the distance between the top end of the generator's electromagnet horn and the concrete surface. Microwave power from the generator is radiated through the electromagnetic horn to the concrete surface. The surface layer of the concrete to be removed is peeled off at a predetermined depth by controlling the vertically moving mechanism. The microwaves penetrate the surface layer of the concrete and heat its water content. Steam pressure is thus built up within the heated concrete. From this localized heating of the concrete surface, thermal stress strain develops between the heated portion and the unheated, peripheral portion of the concrete, causing the pulverization and peeling of the surface portion. The resulting rubble and powdery dust are simultaneously removed and recovered by a vacuum device. The vacuuming prevents recontamination and reduces radiation exposure to the operators.

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Method of Removing Hazardous Material Deposited on Concrete Surface

Japanese Patent 3-211498/A; 4 pp. (January 16, 1990; September 17, 1991)

A salt compound containing a carbonate group, such as sodium carbonate or potassium carbonate, is dissolved in water, and the aqueous solution is sprayed on the surface of contaminated concrete, allowed to remain on the surface for a predetermined period, and then is dried off the surface, leaving a deposit of carbonate on the concrete. Then, an aqueous solution of an organic acid, such as oxalic acid or citric acid, is sprayed onto the surface. The acid solution reacts with the carbonate to form bubbles of gaseous carbon dioxide (CO2). Radioactive materials and heavy metals, such as hexavalent chromium or lead, that are imbedded in the irregularities on the surface of the concrete are picked up by the bubbles of gaseous CO2 and removed from the surface. By removing the CO2 bubbles, the hazardous materials adhering to the concrete surface thus can be removed without generating powdery dusts, without requiring a large-scale decontamination device, and without changing the physical characteristic of the concrete.

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T. Onuma, A. Tanaka, and H. Akimoto, Hitachi Plant Engineering and Construction Company Limited, Tokyo, Japan

Decontamination Method for Radioactive Metal Waste

Japanese Patent Application 1-134143; Japanese Patent 2-311797/A; 4 pp. (May 29, 1989; December 27, 1990)

When radioactively-contaminated material from a nuclear facility is decontaminated, radioactive dusts may be deposited on portions of the material that were not contaminated during use, creating secondary wastes. In order to reduce as much as possible the volume of secondary wastes, paint is used to coat the portions of the material that are considered to be uncontaminated. Next, chemical decontamination is applied to the material. The paint suppresses the dissolution of metals in the uncontaminated portions of the material. After the material is decontaminated, the paint is removed. Any type of paint may be used, except for aqueous paints that react adversely with the decontaminating liquids. This process prevents the unnecessary dissolution of metals from uncontaminated portions of the material, extends the usable life of the decontaminating liquids, and reduces the volume of secondary wastes.

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Decontamination Method for Radiation-Contaminated Metal Waste

Japanese Patent Application 1-147046; Japanese Patent 3-12599/A; 7 pp. (June 9, 1989; January 21, 1991)

Radiation-contaminated metal wastes are immersed in a sulfuric acid solution, thereby removing radioactive depositions (crud). The sulfuric acid solution also dissolves the surface of the matrix metal, eliminating radioactive contamination there. When, due to the increase of the amount of metal ions leached from the crud and the matrix material, the potential of the sulfuric acid solution is greater than a certain level, the leached metal ions are electrolytically reduced to maintain the potential of the sulfuric acid solution at less than the predetermined level. Although the dissolution rate increases as the concentration of the sulfuric acid solution becomes higher, it preferably ranges from 0.5 to 2 mol/l, since a higher concentration increases the amount of dissolved contaminants that must be removed through processing of the waste liquid. The temperature for the solution is set higher than room temperature, preferably from 50 to 90 deg C. Further, the potential level of the solution, although it varies somewhat, depending on the concentration of the leached metal ions and the temperature, is preferably controlled to less than 0.1 to 0.2 V. This process can attain high decontamination rates in a short time using only a sulfuric acid solution.

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Method of Decontaminating Metal Waste

Japanese Patent Application 1-139679; Japanese Patent 3-4198/A; 5 pp. (June 1, 1989; January 10, 1991)

This invention provides a method of decontaminating metal wastes from radiation-contaminated facilities within a nuclear power plant. In this new method, only a portion of the coating on the surface of the radiation-contaminated metal wastes is peeled and removed to form an supply face for the electric current. Previously, all of the coating was scraped off before electrolytic decontamination. Using the earlier process, electric resistance on the surface of the metal matrix material is lower than that of the inner crud, decreasing the efficiency of the electrolytic current. Furthermore, if all of the coating is scraped off, non-contaminated matrix materials are also dissolved, increasing the amount of spent electrolytes. In the new method, only a portion of the coating is removed by abrasive blasting of the metal surface, creating a surface for application of the electric current. The metal wastes are then decontaminated using electrolytic decontamination methods and the remaining coating is peeled off and removed. Thus the contamination can be completely removed from the metal wastes without increasing secondary wastes.

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Decontamination Method for Radioactive Metal Waste

Japanese Patent 3-188398/A; 6 pp. (August 16, 1991)

Among methods for removing contamination from the inside of metal substrates, a blast decontamination method for scraping metals and an electrolytic removal method for dissolving metals are promising. However, each of these methods has drawbacks, and a faster dissolution rate is desired. In the present invention, it is noted that the scraping speed or the dissolving speed of the metal substrate is higher than that of surfaces coated with oxide films in both the blast decontamination and the electrolytic decontamination methods. That is, in a decontamination method for radioactive metal wastes in which the contamination is diffused and penetrating, or activation extends as far as the inside of the metal substrate, the metal wastes are first stored under circumstances which promote the growth of an oxide film layer. Thereafter, the oxide layer is removed. This can remarkably shorten the time for decontamination of radioactive metal wastes.

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Japan; Hitachi Limited, Ibaraki, Japan; Japan Atomic Energy Research Institute, Department of Chemistry, Tokai, Ibaraki, Japan

Decontamination Techniques for Radioactive Metal Waste Using a Neutral Electrolyte and a Sulfuric Acid Solution

CONF-911135 (Vol. 2); Nuclear Engineering, Proceedings of the First JSME/ASME Joint International Conference, November 4-7, 1991, Tokyo, Japan, Vol. 2, 593 pp.; (pp. 567-574) (November 1991)

Two decontamination techniques have been developed for reducing the contamination of metal wastes generated in nuclear power plants to the background level: (1) an alternating electrolysis method using a NaSO4 electrolyte, and (2) a chemical method using a H2SO4 solution. Generally, the former is suitable for decontamination of simple-shaped metal wastes, while the latter is suitable for complex-shaped ones. Secondary wastes from the decontamination process are minimized for subsequent disposal. The once-used electrolyte is recycled by separating migrated radioactive sludge from the original electrolyte, and the volume of radioactive sludge is reduced to 1/7 through a freeze-thaw process. Regarding the chemical method, stainless steel requires a two-step process (H2SO4 and H2SO4 containing CE4), while carbon steel requires a single-step process (H2SO4 only). By combining these two decontamination techniques, most radioactive metal wastes can be decontaminated.

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Chemical Decontamination Method for Stainless Steel

Japanese Patent 3-61900/A; 4 pp. (March 18, 1991)

Decontamination liquids are not effectively circulated through the inner surfaces of objects that contain restricted portions. To solve this problem, through holes are drilled into the restricted portions. The objects are then immersed in a sulfuric acid solution, and further immersed in an aqueous solution in which oxidative metal salts are added to the sulfuric acid. This procedure exposes substrates at the inner circumference of the holes (even if they are fine holes), and a local cell is formed between the substrate and oxidized membranes. This may cause dissolution due to the reduction of the oxidized membranes. Since it is possible to discharge bubbles that form on the solution, decontamination can be conducted effectively.

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Decontamination Technology for Decommissioning of Nuclear Facilities

EPA/520/1-90-013; CONF-8909236; Residual Radioactivity and Recycling Criteria, A.B. Wolbarst, H. Terada, and A.C.B. Richardson (eds.), Proceedings of a Workshop, St. Michaels, MD, September 27-28, 1989, 311 pp.; (pp. 64-81) (September 1989)

During the decommissioning of a nuclear reactor facility, appropriate decontamination is required for each stage of the process before and after dismantling of the facility. As part of the technology development for the Japan Power Demonstration Reactor (JPDR) decommissioning program, several new decontamination methods have been developed. This paper describes the decontamination methods for the JPDR decommissioning and discusses their application for the reuse of dismantled components. JPDR used four system decontamination methods: (1) CAN-DECON, (2) modified NP/NS-1, (3) redox, and (4) flowing abrasive. Electropolishing was also used in the JPDR decontamination studies. Contaminated simple-shape components contaminated at about 3.7 X 10(E+2) Bq/sq cm (1.0 X 10(E+2) uCi/sq cm) could be decontaminated to below the lower limit of detection. However, measuring components decontaminated to low levels was difficult. At

JPDR, a GM survey meter with a detection area of 20 sq cm was used for measuring decontaminated components. Measuring the residual contamination in a 400 mm-diameter pipe 700 mm long required 100 minutes, with the lower limit of detection at 1.4 X 10(E-1) Bq/sq cm (3.88 X 10(E-6) uCi/sq cm). The decontamination of the pipe was finished in 30 minutes to the level of no detectable contamination. Most components produced by decommissioning could be completely decontaminated. Cost and occupational exposure are the limiting factors.

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Experience in Decontamination and Reuse of the Large-Scale Radiochemical Laboratory and the Research Reactor at the Japan Atomic Energy Research Institute

EPA/520/1-90-013; CONF-8909236; Residual Radioactivity and Recycling Criteria, A.B. Wolbarst, H. Terada, and A.C.B. Richardson (eds.), Proceedings of a Workshop, St. Michaels, MD, September 27-28, 1989, 311 pp.; (pp. 149-157) (September 1989)

This paper reviews, from a health physics standpoint, experience in decontamination and reuse of a heavy-water cooled research reactor and a large-scale radiochemical laboratory at the Japan Atomic Energy Research Institute. The research reactor was decommissioned with plans for its reactor containment to be reused for a new reactor. Residual radioactivity particular to this case was tritium remaining in concrete matrices of the reactor containment. The primary health risk in reusing this type of facility would be caused by the inhalation of gaseous tritium released from the concrete. The radiochemical laboratory was decontaminated and reused as office space. The health risk from reusing this facility would result from both internal and external exposure to various forms of radioactivity. Generalizing from this experience, the information needed for estimating the risks in reusing these types of facilities is examined. Possible forms of residual radioactive criteria for each of these cases are discussed.

145

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Development of Techniques to Decontaminate the WAGR Heat Exchangers

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 567-578) (1990)

A method of decontaminating the four large heat exchangers of the Windscale Advanced Gas-Cooled Reactoir (WAGR) is described. Samples of the boiler tubes were removed and examined in the Laboratory. The contamination present was characterized, and a number of reagents were tested. The final recommendation was that a mild acid wash be used for the heat-exchanger decontamination. Keeping in mind dose uptake and effluent-disposal aspects, this method was then converted to a fully engineered system . In a demonstration experiment using dilute nitric acid and a recirculating spray technique, some 70% of the activity was removed from the superheater section of one heat exchanger.

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Effect of Long-Living Products of Concrete Structure Activation on Decommissioning of NPPs with LWR Reactors

Atomnaya Tekhnika za Rubezhom 2:7-12 (February 1990)

The problem of the neutron activation of materials and structures influencing radiation safety during decommissioning of nuclear power plants with

light water reactors is considered. Calculational and experimental data on the accumulation and decay of long-living radionuclides occurring due to trace impurities in concrete fillers are compared. Maximum activated-element content permits are chosen as a method of minimizing the quantity of radioactive wastes.

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Gross Decontamination Experiment Report

GEND-034; GPU/T-4083; 800 pp. (July 1983)

The U.S. Department of Energy (DOE) proposed in July 1981 that a gross decontamination experiment be performed within the reactor building of Three Mile Island (TMI) Unit 2. Agreement was reached with General Public Utilities (GPU) and approval was obtained from the U.S. Nuclear Regulatory Commission. Work began in late January 1982 and was concluded in March 1983. The purpose of the experiment was to provide the nuclear industry with the fullest possible access to applicable engineering and operational experience that can be gained from decontamination of the reactor building of TMI Unit 2, and to document the following activities: gross decontamination effectiveness, decontamination criteria, decontamination techniques and procedures, radiation monitoring and mapping, and support systems and organization. The objectives of the experiment were to evaluate the safety, effectiveness, and efficiency of various methods and equipment for performing gross decontamination of large, complex, contaminated surfaces within the reactor building. Support systems and organization for such a large decontamination effort were also evaluated. An additional objective was to reduce the contamination present on selected surfaces within the reactor building in a manner consistent with ALARA (as low as reasonably achievable) principles for personnel radiation-exposure management. The scope of the work included testing various decontamination techniques on major equipment, stairs, and floor surfaces on elevations from 305 to 347.5 feet, and on the polar crane, refueling canal, bridges, D-rings, and missile shields. The major decontamination techniques tested were: (1) high pressure flush, using water lances directed manually to apply water at pressures between 2000 and 6000 psig; (2) low pressure flush, using water lances to apply water at flow rates of about 25 gpm; (3) spin jet, or high pressure, water applied through rotating nozzles to scrub floors; (4) strippable coatings, used to decontaminate exposed concrete surfaces; (5) a mechanical scrubbing device; and (6) wet vacuums used to reduce squeegee operations. Decontamination factors were calculated from contact-beta and -gamma results, and gamma dose-rate reductions were calculated to measure the efficacy of each technique. These results, as well as detailed descriptions of experiment design, diagrams and photographs illustrating the work, conclusions concerning effectiveness, and recommendations for future decontamination efforts are presented in this report.

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Electrochemical Decontamination in Easily Processed Electrolytes

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 587-597) (1990)

Metallic surfaces can be reduced to very low levels of residual activity by electrochemical decontamination, thus reducing decommissioning and disposal costs. Two electrolyte systems have been developed which minimize the volume for disposal of secondary waste containing the bulk of the activity. Kraftanlagen AG has developed a system for use in an immersion tank based on a KBr solution of acetylacetone. This leads to a continuous precipitation of the insoluble acetylacetonates of ferrous substrates together with such active species as cobalt-60. The bath performance can be maintained by continuous

acetylacetone addition. From pilot scale trials, a solid waste volume of 1.1 cu dm per sq m of surface decontaminated has been determined. Harwell has developed both immersion and in situ processes based on nitric acid, as the spent electrolyte is compatible with existing United Kingdom waste-treatment philosophy, potentially yielding an immobilized product volume of 0.6 cu dm per sq m of area treated. Nitric acid has the additional advantage of suppressing any hydrogen production. Both processes have been developed from laboratory to microprocessor controlled pilot scale units which have been demonstrated successfully for the treatment of genuine waste. The immersion tank process uses electroetching at low current densities for the treatment of extended areas, while the in situ technique uses electropolishing in 6M HNO3 in an engineered head connected to a service trolley by an umbilical. This has also shown potential for incorporation in an integrated monitoring/decontamination system under robotic control.

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Closed Electropolishing System for Decontamination of Underwater Surfaces/Development of Vibratory Decontamination with Abrasive Media

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 598-603) (1990)

Electropolishing is one of the most efficient techniques for decontamination of stainless steel surfaces. An underwater, closed electropolishing system has been developed to decontaminate large stainless steel areas. It was specially designed for pool liners, so that electrolyte spillage would be avoided. Vibratory finishing is commonly used for non-nuclear applications as surface finishing. This project is directed to the nuclear decontamination field, and consists of selecting the optimum blast for decontamination purposes and developing a cleaning and degreasing method for physically removing soluble and low-adherent contamination from pieces normally existing at nuclear power plants.

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Chemical Decontamination for Beneficial Metal Re-Use from Nuclear Applications

CONF-910430; Proceedings of the 93rd American Ceramic Society Annual Meeting and Exposition, Cincinnati, OH, April 28-May 2, 1991, 475 pp.; (158 pp.) (1991)

Westinghouse Electric's Scientific Ecology Group of Oak Ridge, Tennessee has teamed with its parent corporation's Science and Technology Center and East Tennessee Engineering to evaluate the technical and economic feasibility of four decontamination technologies, to permit the beneficial recycle of radio-contaminated metals after processing. The key technologies evaluated were: (1) melt refining, (2) electrowinning plus ion exchange, (3) electrowinning plus solvent extraction, and (4) electrorefining. Results of the study are presented.

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Decontamination Using Chemical Gels, Electrolytical Swabs, and Abrasives

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 579-586) (1990)

Decontamination for decommissioning purposes differs from usual in-service decontamination

procedures. The main factors which have to be considered in setting up decontamination procedures for nuclear installation decommissioning are: (1) rapidity and ease of application, (2) efficiency of decontamination, (3) possibility of remote operation, and (4) small quantities of secondary generated wastes. The aim of this research is to develop three decontamination methods which appear to be well adapted to dismantling. After laboratory tests where several procedures were compared, actual nuclear-installation dismantling operations were performed. Among the decontamination procedures developed by CEA Cadarache, the following have been the subject of extensive studies: (a) spraying of gels containing decontaminating agents, (b) electropolishing with swab device, and (c) abrasive blasting. Examples of industrial applications of these three techniques are: (i) gel spraying performed on pieces from the German Reactor ISAR; (ii) Brennilis Bituminization Plant decontamination and dismantling; (iii) gel spraying decontamination performed on the cooling circuit of the graphite gas reactor G2; and (iv) a mechanical sodium cleaning method using abrasive blasting on the SuperPhenix fuel storage drum inner vessel. For each of these in situ decontamination operations, a balance had to be made between the quantity of decontaminated metallic wastes and the amount of chemical reagent used, as well as the quantity of secondary wastes generated.

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Clean-Cut Removal System for Concrete Decontamination

CONF-911135 (Vol. 2); Nuclear Engineering, Proceedings of the First JSME/ASME Joint International Conference, November 4-7, 1991, Tokyo, Japan, Vol. 2, 593 pp.; (pp. 109-114) (November 1991)

This report addresses the Clean-Cut Removal System (CCRS), which can accurately scrape contaminated surfaces by the rotation of special cutters and simultaneously collect the scraped debris in a drum. The cutters used in this system can accurately scrape the concrete surface to a few millimeters depth in one pass. The debris is a uniform powder and almost 100% is collected by a vacuum collecting system. This system has many advantages, such as radioactive-waste reduction, prevention of internal exposure to workers, recontamination prevention, and easy measurement of residual radioactivity after decontamination.

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Chemical Decontamination Method for Radioactive Metal Waste

ORNL/TR-91/20; 20 pp. (1991)

The invention relates to a decontamination method for radioactive metal waste products derived from equipment whose surfaces have been contaminated; in particular, it concerns a decontamination method that reduces the amount of radioactive waste by decontaminating radioactive waste substances to a level of radioactivity in line with normal waste products. Carbon steel waste is treated using only a primary process, in which the waste is immersed in a sulfuric acid solution. Stainless steel waste must be treated with both the primary process and a secondary process that uses a solution of sulfuric acid mixed with oxidizing metal salts. The method used to categorize metal waste into carbon steel waste and stainless steel waste involves determining the presence or absence of magnetism. Voltage is applied for a fixed duration; once that has stopped, electrolytic reduction repeats the operative cycle of applying and then stopping voltage until the potential of the radioactive metal waste is retained in the active region.

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Optimization of Electrodecontamination Processes for Decommissioning

CONF-9104345; Water Chemistry in Nuclear Power Plants, Proceedings of the 1991 Japan Atomic Industrial Forum International Conference, Fukui, Japan, April 22-25, 1991. Japan Atomic Industrial Forum, Inc., Tokyo, Japan, 811 pp.; (pp. 235-240) (1991)

In the course of Ente Nazionale per l'Energia Elettrica-Centro Informazioni Studi ed Esperienze (ENEL-CISE) research and development activities in the decommissioning field, electrodecontamination tests in various electrolytes have been performed in order to obtain the unrestricted release of both stainless steel and carbon steel materials. Results show that an optimum process configuration has been determined for the electrodecontamination of stainless steel in a HNO3 bath and of carbon steel in a HCOOH 8% plus HF 1.5% bath.

155
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Decontamination Device for Radioactive Contaminated Equipment

Japanese Patent 3-179298/A; 6 pp. (August 5, 1991)

Bubbles of an inert gas with liquid decontaminant deposited at their surfaces are formed in a container holding equipment (for example, a sodium pump) contaminated with radioactivity. Since the contaminated equipment is decontaminated by the bubbles of the inert gas with the liquid decontaminant at their surfaces, a larger surface area can be decontaminated with a smaller amount of liquid decontaminant. The amount of liquid wastes thus can be decreased. Further, if nitrogen is used as the inert gas, the oxygen concentration in the decontamination container can be reduced. This results in reduced formation of oxide films, which improves the decontamination effect. For example, in a case where bubbling using N2 gas is conducted under the following conditions: liquid decontaminant, 1% oxalic acid plus citric acid; temperature of the liquid decontaminant, 70 deg C; decontamination time, 100 hours, it is confirmed that the decontamination effect can be increased by a factor of about 2 compared with decontamination without bubbling.

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Method for Electrolytic Decontamination of Radioactive Contaminated Metals

ORNL/TR-91/17; Japanese Patent Application 1987-37719; 17 pp. (1991)

The invention relates to an electrolytic decontamination method for radioactive contaminated metals. The contaminated sections are eluted by electrolysis after the surface of a piece of equipment used with radioactive substances has been immersed in an electrolyte. Metal contaminated by radioactive substances acts as the anode.

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Westinghouse, Morris-Knudsen Get Fort St. Vrain Decommissioning Work

Nuclear News 34(9):79 (July 1991)

Westinghouse Electric Corporation and Morrison-Knudsen Corporation have signed a contract with Public Service Company of Colorado for the decommissioning of the Fort St. Vrain nuclear power plant. The value of the contract is estimated to be more than $100 million. Westinghouse will manage the decommissioning of the 330 MW gas-cooled reactor, and will also perform engineering and planning, tooling design, licensing and quality assurance support, and environmental and radiological engineering, including waste characterization, cleanup, and removal. Morrison-Knudsen will provide: (1) the site implementation activities, including work specification and procedures; (2) procurement and supply of materials, services, and equipment; and (3) craft labor and associated site management for the decommissioning. The planning and engineering portions of the project are under way. Decommissioning activities will begin after the spent nuclear fuel has been removed from the

reactor building, which is scheduled for completion in mid-1992. Also to be performed under the terms of the contract is physical dismantlement of radioactive portions of the plant's concrete reactor vessel and support systems. The entire project is expected to be completed by late 1995. Public Service Company of Colorado plans to convert the plant, which has been shut down since mid-1989, to a 330 MW natural gas-fired facility.

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B. Breen

Dismantling Nuclear Power Plants

Garbage (March/April 1992):40-47 (March 1992)

The 330-mW Fort St. Vrain gas-cooled commercial reactor in Platteville, CO has been shut down by its operator, Public Service Company of Colorado, following years of poor performance and technical problems. At the time of its closure, Fort St. Vrain was the worst-performing plant in the United States, operating at less than 15 percent of its electrical capacity. The dismantling process will begin after the reactor's highly radioactive spent fuel has been removed. Workers will remove the top of the 107-foot vessel surrounding the reactor and flood it with 400,000 gallons of water, which will shield workers from air-borne contaminants. Plasma arc torches will be used to cut radioactive components that will be removed from the core by remote-controlled grapples. Diamond-wire saws will be used to cut the concrete vessel into 42-ton chunks. High-pressure water jets and chemical solvents will be used to decontaminate radioactive piping. Dismantling of Fort St. Vrain will produce approximately 140,000 cu ft of low-level radioactive waste, which will be buried in shallow graves. By 1998 the facility will be converted into a clean-burning, natural-gas plant with 35 acres of photovoltaic cells for generating an additional 14 mW of solar power.

159
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Polyjointed Robot with Integrated Laser Beam

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 171-180) (1990)

Full details are given of a project in which a robot laser beam is used as a cutting tool in decommissioning work in hot cells. Results obtained with the complete system, i.e., robot plus industrial CO2 laser, are described. Also, the potential for laser cutting in a non-active working environment is described.

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Underwater Cutting Techniques Developments

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 229-238) (1990)

The primary circuit structures of nuclear power plants are constructed of stainless steels, ferritic steels, plated ferritic steels, and alloys of aluminium. Depending on the level of specific contamination these structures, it may be necessary to use remote-controlled cutting techniques in the dismantling process. The most successful way to protect the working crew against exposure to radiation is to operate under water at different depths. Different thermal cutting processes have been developed to work under water. For ferritic steels only, there is flame cutting; for ferritic steels, stainless steels, cladded steels and aluminium alloys, there are oxy-arc cutting, arc-waterjet cutting with a consumable electrode, arc-saw cutting, plasma-arc cutting, and plasma-arc sawing. Flame cutting is a burning process, while all the other processes listed are melt-cutting processes.

This paper explains the different techniques and discusses of the possibilities, advantages, and disadvantages of each process. The paper also introduces further research work in this field.

161
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Analyses and Testing of Model Prestressed Concrete Reactor Vessels with Built-in Planes of Weakness

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 119-127) (1990)

This paper describes the design, construction, analyses and testing of two small-scale, single-cavity, prestressed concrete reactor vessel models. One model was without planes of weakness and one had planes of weakness immediately behind the cavity liner. This work was carried out to extend a previous study that suggested the likely feasibility of constructing regions of prestressed concrete in reactor vessels and biological shields that become activated. The design calls for using easily removable blocks, separated by a suitable membrane. The paper describes the results obtained and concludes that the "planes of weakness" concept could offer a means of facilitating the dismantling of activated regions of prestressed concrete reactor vessels, biological shields and similar structures.

162
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The TELEMAN Programme

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 217-224) (1990)

The TELEMAN program is a five year cost-shared research program covering remote handling in hazardous and disordered nuclear environments. TELEMAN's objective is to strengthen the scientific and engineering bases upon which the design of teleoperators rests. This is done by providing new solutions to problems of manipulation, material transport, mobile surveillance in nuclear environments, and by demonstrating their feasibility. The Commission is motivated by the potential that teleoperators have to improve the separation of workers from radioactive equipment. The same technology will also enable plant operators and public authorities to deal more effectively with nuclear accidents. Finally, gains in productivity, particularly in the repair and maintenance area, can be expected. Community support is justified by the cost of the reliability and autonomy required for the nuclear teleoperator, the need to rationalize research and development investment in an area of increasing industrial potential, and a common interest in coherent responses to emergencies.

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Component and Large Glove Boxes Dismantling at the MOX Nuclear Fuel Fabrication Plant

CONF-8803283; Decommissioning of Fuel Cycle Nuclear Facilities, Proceedings of a Meeting, Paris, France, March 15, 1988. Societe Francaise d'Energie Nucleaire, Paris, France, 301 pp.; (pp. 137-150) (1988)

Information is given concerning the systems and techniques applied during dismantling operations at the Belgonucleaire mixed oxide (MOX) fuel fabrication plant. The systems and the techniques were chosen by taking into account the dimensions of the glove boxes, the possibility of carrying them out of the building and transporting them by road, and the inner contamination level. The different techniques used are described.

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Adaptation to Teleoperation of an Existing Air-Tight Modular Workshop for Remotely Controlled Operations

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 191-200) (1990)

The purpose of the research program is to extend the capabilities of an existing air-tight modular workshop, dedicated to the treatment of alpha-contaminated materials, to other beta-gamma contaminated materials. In this connection, new elements have been developed and tested in a modular workshop used as a testing facility. Operations previously carried out by operators wearing ventilated suits should now be controlled by teleoperation from outside the workshop. The test results enabled qualifying dedicated materials, which enlarged to some extent the field of applications of the air-tight modular workshop.

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Development of a Prototype System for Remote Underwater Plasma Arc Cutting and Secondary Emission Measurements

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 208-216) (1990)

The authors of this conference paper give an account of the dismantling of nuclear installations by plasma-arc cutting. The research and development tests on the plasma-arc tool relate to its use under varying conditions, i.e., working parameters, remote piloting, cutting environment, radioactive or non-radioactive materials, and maintenance. An assessment is made of the secondary emissions (gases and aerosols) from the cutting process. The nature and concentration of the different gases and aerosols are defined, as is the size distribution of the aerosols. The balance of solid secondary emissions is also determined in certain tests.

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Definition of a Dismantling Project

CONF-8803283; Decommissioning of Fuel Cycle Nuclear Facilities, Proceedings of a Meeting, Paris, France, March 15, 1988. Societe Francaise d'Energie Nucleaire, Paris, France, 301 pp.; (pp. 280-292) (1988)

After it was decided to close the Eurochemic fuel reprocessing plant, Belgoprocess conducted a study to determine which facilities should be dismantled and how best to do it. The cost of the operation was estimated by site investigation and by a pilot project on the dismantling of the waste storage building. Work completed to date and the problems to be solved are summarized.

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The Experience - 4th Case - The Rinsing of the Waste Processing Plant, the Dismantling of Some Components and of the Laboratories of Analysis, Safety Aspects

CONF-8803283; Decommissioning of Fuel Cycle Nuclear Facilities, Proceedings of a

Meeting, Paris, France, March 15, 1988. Societe Francaise d'Energie Nucleaire, Paris, France, 301 pp.; (pp. 126-136) (1988)

When it was decided to shut down the waste processing plant in 1974, Eurochemic and the Belgian authorities established the operating procedures to be followed. The operation began in 1975 by rinsing the system to determine fission products. The second step involved the decontamination of all the workrooms to allow inspection. Some non-recyclable components were destroyed. The operation and the procedures are described and the means for personnel protection are reviewed.

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Measurements of Secondary Emissions from Plasma Arc and Laser Cutting in Standard Experiments

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 666-679) (1990)

As part of an inter-facility comparison of secondary emissions from plasma-arc and laser cutting techniques, standard cutting tests have been done by plasma arc underwater and in air and laser beam in air. Twenty mm and 40 mm thick grade 304 stainless-steel plates were cut by plasma-torch in three different facilities: Heriot Watt University of Edinburgh, Institute fuer Werkstoffkunde of Hannover, and CEA/CEN Cadarache. Ten mm and 20 mm thick grade 304 stainless-steel plates were cut by laser beam in four different facilities: CEA/CEN Fontenay, CEA/CEN Saclay, Institute fuer Werkstoffkunde of Hannover, and ENEA/FRASCATI. The results obtained in the standard experiments are similar; the differences that appear can be explained by the various scales of the facilities (semi-industrial and laboratory scale) and by some particularity in the cutting parameters (additional secondary gas flow of oxygen in plasma cutting at Hannover, for example). Supplementary experiments show the importance of some cutting parameters.

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Spreading and Filtering of Radioactive By-Products from Underwater Segmenting

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 649-658) (1990)

Atmospheric and underwater effluents generated during underwater plasma arc cutting operations have been determined for stainless steel, mild steel and aluminum. Different filter systems for air and water filtration have been tested. The effluent generation is strongly connected to the parameters used. When cutting stainless steel or aluminum with the grinding technique no aerosol generation could be measured

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In Situ Arc-Saw Cutting of Heat Exchanger Tubes and of Pipes from the Inside

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989

International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 249-257) (1990)

This study provides a demonstration of the reliability of the electric arc-saw cutting process, as applied to the cutting of low diameter and thin tubes from the inside. This process is not applicable to the cutting of thick manifolds from the inside, because of dimensional restrictions on the sizing of the cutting head and the size of its supply cord (limited to 600 A). The arc-saw cutting process has been studied for application on three different types of cutting tools: (1) transversal cutting parameters for steam generator tubes - the wearing of the molybdenum electrode allows only two successive cuts; a flexible tool and a representative bench for SG tubular plate simulation have been realized; (2) longitudinal cutting parameters for steam generator tubes - the wearing of the molybdenum electrode is negligible; and (3) internal cuts of stainless-steel thick tubes. In (3), a formula has been elaborated from the experimental data that relates the cutting speed to the maximum intensity available, and to the geometrical parameters. According to this formula, it appears that a tube with an outside diameter of 240x6 mm tube may need more than a 1600 A supply to be cut in 15 minutes industrial time. Therefore, the process is inappropriate for industrial applications.

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Solid and Gaseous Secondary Emissions from Underwater Plasma Arc Cutting

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 239-248) (1990)

Solid and gaseous emissions from underwater plasma-arc cutting of non-active stainless steel have been studied. The influence of water depth up to 9.55 m was investigated. Argon/nitrogen plasma gas was used in prefiltered and deionized water. The distribution of secondary solid wastes was measured, sedimented dross being the major ore, with greater than 90% weight of total solids collected. Aerosol particles comprised 0.025% weight or less, decreasing with water depth. Attached slag increased with depth at constant plasma conditions. Measurements of elemental metal contents of aerosols and fine suspended particles showed mass enhancement by chemical reaction and enrichment in manganese, a more volatile constituent of stainless steel. Aerosol size distributions measured with an inertial impaction/diffusion spectrometer gave mean sizes of 0.16 to 0.23 microns, there being no systematic variation with water depth. Gaseous emissions were mainly plasma gases, H2 and NO. Concentrations and evolution rates varied with depth; H2 due probably to differences in plasma power, and NO due to absorption. The latter phenomenon made the water acidic.

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Inventory of Glove Boxes Dismantling Operations in the Fuel Fabrication Complex of Cadarache from 1986 to 1988

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 379-385) (1990)

Several plutonium processing lines belonging to the Fuel Fabrication Complex of Cadarache had to be dismantled after long service, in the interest of plant modernization. The importance of the plutonium quantities (several tons) that have been processed in these obsolete lines, the volume of

the glove boxes which have been dismantled (more than 100 cu m), and the variety of their functions made it worth setting up an inventory of these operations and evaluating the waste management problems involved in the decommissioning of such a facility. Depending on the type, size and plutonium retention of the glove boxes, different procedures for dismantling, plutonium recovery, waste size reduction and decontamination have been tried. As a final result, a 400 sq m area, corresponding to 4 laboratories (working cells) was made available for new equipment after complete cleaning.

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Gentilly-1 Reactor Dismantling Proposal

INIS-mf-12832; CONF-840613; Proceedings of the 24th Annual International Conference of the Canadian Nuclear Association and the Fifth Annual Conference of the Canadian Nuclear Society, I.J. Itzkovitch (ed.), Saskatoon, Saskatchewan, Canada, June 3-6, 1984, 132 pp.; (pp. 104-111) (1984)

Studies have been undertaken to establish the feasibility and costs involved in the decommissioning of the Gentilly-1 Nuclear Power Station. This paper outlines a method of dismantling the reactor. It demonstrates that the dismantling of the Gentilly-1 reactor is feasible, and also serves to highlight the inherent decommissionability of all CANDU reactors.

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Getting on with Dismantling at Czechoslovakia's Bohunice

Nuclear Engineering International 35(434):28-33 (September 1990)

As a result of investigations following an accident in 1977, authorities decided to close Czechoslovakia's first pre-commercial nuclear reactor, A-1 Jaslovske Bohunice, five years after it reached full power. In the accident, one fuel channel was damaged during refuelling operations and a fuel assembly was partially melted. The condition of the plant after the accident was complicated because of problems stemming from: (1) damage to the spent fuel element cladding; (2) extensive contamination of the primary circuit by alpha-nuclides after the fuel channel was damaged in the accident; and (3) contamination of some parts of the secondary circuit, caused by leaking steam generators. Activities after the decision to shut down and decommission the plant were concentrated in three main areas: (a) protecting personnel and the environment, (b) managing spent fuel and processing media, and (c) preparing for plant system decommissioning. A special research and development program was established to address these problems. There are three possible options for the next stage of decommissioning: (i) immediate decommissioning to the third stage (green field), (ii) deferred dismantling, and (iii) entombment. Because of many unsolved problems, such as handling highly contaminated equipment, remote dismantling and cutting of the reactor and the hot cell, and because of the lack of a suitable final disposal option for such an amount and type of material, immediate dismantling was deemed impossible. Although entombment seemed advantageous for technical and economic reasons, deferred dismantling was chosen. Reasons for choosing deferred dismantling were environmental safety and public concern. A general schedule for the remainder of the decommissioning program is given, along with cost estimates for the project.

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Status and Trends of Underwater Plasma Arc Cutting

CONF-8911319; Status Report 1989 of the Central Bureau for Management and Coordination of Projects Concerning the Decommissioning of Nuclear Facilities, Proceedings of a Conference, Hanover, Federal Republic of Germany, November 15-16, 1989, 350 pp.; (pp. 13-38) (April 1990)

Cutting operations necessary to disassemble metallic components of the primary coolant circuit of nuclear power plants are carried out under water. For this purpose the following techniques and tools can be applied: autogeneous flame cutting for ferritic steels, oxygen-arc cutting, arc water-jet cutting, the arc saw, plasma-arc cutting, and the plasma saw. Depending on the special materials, such as ferritic steel, CrNi steel, plated steel, and aluminium alloys, these techniques and tools can be combined with each other.

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Investigation of the Dissipation of Cutting Byproducts During Underwater Dismantling of Steel Parts from Nuclear Installations in View of Selection and Optimization of Filtering Systems to Separate Cutting Byproducts

EUR-13356; 96 pp. (1991)

Due to high radioactivity levels, the primary circuits of boiling water reactors and pressurized water reactors must be dismantled under water. Several different mechanical and thermal tools are appropriate for this work. Selection of a tool for a given task entails consideration of both the design of the tool and the handling of the generated secondary waste. The aim of this research was to collect all cutting by-products (in air and water) generated during underwater plasma-arc cutting and during underwater grinding. These techniques were applied to various filter systems and their efficiencies were measured. Proposals are made for air and water filter systems appropriate for the cutting of radioactive materials.

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Decommissioning Concept for the High Temperature Reactor THTR-300

Kerntechnik 56(6):362-366 (December 1991)

The decommissioning of THTR-300 will be performed in four stages. The plant will be kept in shutdown operation (stage 1) pending issuance of the decommissioning license. Plant systems for performing, monitoring or ensuring residual-heat removal and shutdown will not be in operation during stage 1. Core unloading (stage 2) and the establishment of safe enclosure (stage 3) follow shutdown. These stages are followed by 30 years of safe enclosure (stage 4). Safe enclosure reduces the activity inventory, so that radiation exposure is reduced and technical implementation is facilitated for plant dismantlement. The dismantling concept comprises four dismantling phases, only one of which is characterized by dismantling of activated and/or contaminated systems and structures.

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Underwater Dismantling of Metallic Components Using Arc Water Jet Cutting and Abrasion

CONF-8911319; Status Report 1989 of the Central Bureau for Management and Coordination of Projects Concerning the Decommissioning of Nuclear Facilities, Proceedings of a Conference, Hanover, Federal Republic of Germany, November 15-16, 1989, 350 pp.; (pp. 39-64) (April 1990)

Arc water-jet cutting is a thermal cutting method which can be used under water to dismantle contaminated metallic components. A pilot plant with optimum control of the arc water-jet path and cutting pond is described. Special attention is given to the design of a suitable flame cutter.

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Explosive Fracturing of Concrete Structures and Pipings - Generalization of Results and Applicability to Real Facilities

CONF-8911319; Status Report 1989 of the Central Bureau for Management and Coordination of Projects Concerning the Decommissioning of Nuclear Facilities, Proceedings of a Conference, Hanover, Federal Republic of Germany, November 15-16, 1989, 350 pp.; (pp. 291-327) (April 1990)

Because of its size and equipment, the HDR reactor is suitable for demonstrating the explosive fracturing of the biological shield, and the separation of piping elements having a diameter of up to 600 mm. The analyses concentrate on safety assessment, course of procedure, and characteristics of procedure. The dismantling planning for the close-up area and the whole building complex can be supported by computational models.

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Explosive Cutting Methods to Dismantle Concrete Structures

CONF-8911319; Status Report 1989 of the Central Bureau for Management and Coordination of Projects Concerning the Decommissioning of Nuclear Facilities, Proceedings of a Conference, Hanover, Federal Republic of Germany, November 15-16, 1989, 350 pp.; (pp. 135-150) (April 1990)

Linear shaped charges are used to dismantle the internal shell of a two-shell biological shield into a size suitable for containers. Tests show that the amount of explosives required for linear shaped charges is about 2 kg per ton of concrete material. This technique does not dismantle the shield into smoothly cut blocks.

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Comparison of Decontamination and Melting with Direct Disposal

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 765-771) (October 1989)

This report deals with the currently preferred methods of radioactive waste disposal in the Federal Republic of Germany. It is an update and extension of the author's publication, EUR-11149 (1987). Several factors have increased interest in direct melting of radioactive waste since the prior publication: (1) sharply reduced "de minimis" levels for waste disposal, (2) increased waste documentation requirements, and (3) delays in start-up of the final disposal mine (KONRAD). In recent years, direct melting was considered by many to be merely a form of volume reduction. Today, recycling is the preferred method of volume reduction. As the amount of scrap metal waste continues to grow, direct melting must be considered as a means of final disposal.

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Explosive Dismantling of Reactor Pressure Vessels Using the Brittle Fracturing Method

CONF-8911319; Status Report 1989 of the Central Bureau for Management and Coordination of Projects Concerning the Decommissioning of Nuclear Facilities, Proceedings of a Conference, Hanover, Federal Republic of Germany, November 15-16, 1989, 350 pp.; (pp. 107-133) (April 1990)

The dismantling of reactor pressure vessels using the explosive brittle-fracturing method was tested on a mock-up. Pre-notching in the ductile state facilitates the dismantling along given rupture lines. For three variants of embrittlement, the coolant requirements, cooling time, and evaporation rate of liquid nitrogen were theoretically considered.

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Large-Scale Application of Segmenting and Decontamination Techniques

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 787-797) (1990)

In cooperation with the Commission of the European Community, operators of the nuclear power plant KRB-A began investigations in 1985 into decommissioning techniques, to select effective segmenting and decontamination methods for large-scale applications. Several techniques have been tested and applied to approximately 300 mg of various components out of the turbine house, with special regard to efficiency, costs, dose, and amount of secondary-waste production. In the framework of this research program, a procedure for regeneration of phosphoric acid was successfully introduced. Several techniques for detecting low residual activity are also briefly described.

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Development of a System to Demonstrate the Safe Underwater Dismantling of Metallic Components

CONF-8911319; Status Report 1989 of the Central Bureau for Management and Coordination of Projects Concerning the Decommissioning of Nuclear Facilities, Proceedings of a Conference, Hanover, Federal Republic of Germany, November 15-16, 1989, 350 pp.; (pp. 65-83) (April 1990)

A heptaxial tool-carrier system makes it possible to dismantle plant components by means of underwater plasma-arc cutting. Plasma torches are applied to remotely exchanging, wearing elements under water. Occurring emissions are recorded.

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Explosive Fracturing of Concrete Structures and Pipings - Experiments in the HDR

CONF-8911319; Status Report 1989 of the Central Bureau for Management and Coordination of Projects Concerning the Decommissioning of Nuclear Facilities, Proceedings of a Conference, Hanover, Federal Republic of Germany, November

15-16, 1989, 350 pp.; (pp. 257-289) (April 1990)

Explosive experiments were carried out on concrete bodies inside the HDR containment, which were coupled to the central column (rotunda) below the reactor pressure vessel. The test program provided three ring explosions. The applicability of sleeve-type separation charges was proved using short pieces from HDR pipe parts. The pipe nozzles were connected by flanges to the inner bearing-containment structure (rotunda). Special consideration was given to the use of the linear shaped charge and missile protection. Characteristic values of shock and blast wave stresses were determined.

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Electrochemical Technique for the Segmenting of Activated Steel Components

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 258-263) (1990)

Electrochemical machining (ECM) is well known in non-nuclear metal working, i.e., for special manufacturing tasks. In the nuclear power plant KRB Unit A, electrochemical decontamination has been introduced into the decommissioning process. It was necessary to examine ECM techniques for the potential of cutting thick walls of activated steel. Three different methods (static, step by step, and dynamic cathode movement) have been tested on non-irradiated samples of the reactor pressure wall (22NiMoCr37 with stainless cladding). The best test results were achieved by a stepwise moving cathode. On the test facility, a 143 mm thick sample was cut through in 750 minutes. The dissolved material out of the 8 mm gap was converted to approximately the double amount of waste in form of dry metal salt.

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The Cutting Process, Its Harmful Effects, the Biological Behavior of Aerosols and Possible Protective Actions

CONF-8803283; Decommissioning of Fuel Cycle Nuclear Facilities, Proceedings of a Meeting, Paris, France, March 15, 1988. Societe Francaise d'Energie Nucleaire, Paris, France, 301 pp.; (pp. 232-259) (1988)

Most of the cutting methods applied in the nuclear decommissioning industry are either thermal or mechanical. During the cutting process, most worker contaminations occur by inhalation. Therefore, for health protection purposes, the physico-chemical properties of the aerosols must be known. The physical characteristics of the gases and aerosols limit the choice of applicable cutting techniques. Investigations into new cutting methods and development criteria, including health protection, are described in this paper.

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Dismantling of the Rooms 82 to 100 at Marcoule

CONF-8803283; Decommissioning of Fuel Cycle Nuclear Facilities, Proceedings of a

Meeting, Paris, France, March 15, 1988. Societe Francaise d'Energie Nucleaire, Paris, France, 301 pp.; (pp. 92-107) (1988)

The dismantling of rooms 82 to 100 is currently the most important decommissioning operation at Marcoule. Compagnie Generale des Matieres Nucleaires, Etablissement de Marcoule (COGEMA), was responsible for studying and organizing the operation. On-site work was performed by Societe des Techniques en Milieu Ionisant (STMI). The construction of a complete nuclear waste processing system was necessary to protect against plutonium contamination. The efficiency of the work was improved by the development and use of specialized, large cutting tools.

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Dismantling and Decontamination of Piver Prototype Vitrification Plant

EUR-13495; 54 pp. (1991)

The PIVER prototype was targeted for dismantling in order to install a new pilot facility for the French continuous vitrification process. Most of the work involved the vitrification cell containing process equipment, which had to be cleared out and thoroughly decontaminated. This required disassembling, cutting up, conditioning and removing all the equipment installed in the cell. Remote manipulation, handling and cutting devices were used and some prior modifications were implemented in the cell environment. The dismantling procedure was conducted under a detailed program defining the methodology for each operation. After equipment items and active zones were identified, the waste materials were removed, and several liquid decontamination operations were implemented. Removed activity, levels of irradiation in the cell, and doses integrated by personnel were monitored to control progress and to adapt procedures to the conditions encountered. At the end of December 1989, the PIVER cleanup program was 87% complete and the total activity removed was 5712 Ci. The objective now is to obtain suitable working conditions in order to allow operators to enter the cell to remove items that are inaccessible or which cannot be dismantled by remote manipulators, and to complete the decontamination procedure.

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Underwater Plasma Arc Cutting - Final Report

EUR-13191; 42 pp. (1991)

This report describes work done in France to develop underwater plasma-arc cutting techniques, to characterize aerosols from cutting operations on radioactive and non-radioactive work pieces, and to develop suitable ventilation and filtration techniques. The work was carried out in the framework of a contract between the Commissariat a l'Energie Atomique (CEA) Center d'Etudes Nucleaires (CEN) in Cadarache and the Commission of European Communities (CEC). Furthermore, the work was carried out in close cooperation with CEA-CEN in Saclay. There, the research was mainly on secondary emissions and radioactive analysis. The contract started in May 1986 and was completed in December 1988 by a supplementary agreement. This report was compiled from several progress reports submitted during the work period. It contains the main findings of the research and includes the results of comparative tests using plasma-arc cutting.

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The Experience - 1st Case - The Decommissioning of Hot Cells: Elan 2B Workroom at La Hague

CONF-8803283; Decommissioning of Fuel Cycle Nuclear Facilities, Proceedings of a Meeting, Paris, France, March 15, 1988. Societe Francaise d'Energie Nucleaire, Paris, France, 301 pp.; (pp. 47-66) (1988)

Technicatome performs, under a contract to Commissariat a l'Energie Atomique (CEA), the decommissioning of the cells of the Elan 2B Workroom at La Hague. It is carried out as part of shutdown operations of the 3rd level of the facility, producing Cs-137 and Sr-90 sealed sources. The nature of the radiation levels found and the radiation dose from some cells led to the development and control of several special automated operations, including cutting and cladding of the nuclear wastes. The importance of complementary means for operating in a radioactive environment is stressed and discussed.

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Dismantling and Disassembling at the Waste Processing Unit at La Hague

CONF-8803283; Decommissioning of Fuel Cycle Nuclear Facilities, Proceedings of a Meeting, Paris, France, March 15, 1988. Societe Francaise d'Energie Nucleaire, Paris, France, 301 pp.; (pp. 67-91) (1988)

The steps taken during dismantling of the hot-sector centrifugal extractor device are described. The goal of the operation is replacement of the device, and the work is performed in a high-level radiation environment. The configuration of the system and its placement are presented. The amount of work (in hours) was dictated by the maximum radiation dose requirement of 20 mrem per day. The operations relating to the equipment include disassembling, cleaning, and assembling the new test-bench system.

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Prefiltration of Gaseous Effluents in Plant Dismantling

EUR-13253; 161 pp. (1991)

Dismantling techniques (especially thermal cutting tools) create large amounts of airborne dust. When radioactive materials are dismantled, the resultant dust is often contaminated. Aerosols are the most mobile of all secondary solid emissions, and are capable of contaminating both the cutting room and the ventilation ducts leading to the high efficiency particulate air (HEPA) filters. A prefiltration device coupled with a captation device at the aerosol generating source reduces the dissemination of the contamination, increases the life of the HEPA filters, and thus reduces the amount of residual solid waste. The objective of this project was to select one or more cleaning devices based upon the following factors: (1) physico-chemical characteristics of the relevant gases and aerosols, (2) available cleaning devices, and (3) the facility to be dismantled.

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Dismantling of RAPSODIE Reactor

OECD/NEA Co-Operative Program on Decommissioning, 10th Meeting of the Technical Advisory Group, Karlsruhe, Federal Republic of Germany, April 22-26, 1991; (12 pp.) (1992)

The RAPSODIE prototype reactor at Cadarache is one of the first FBR type reactors. The principle steps in its Stage 2 dismantling are: (1) isolation and confinement of the reactor vessel, after the

removal of 496 steel/nickel elements used as reflectors and neutronic protection; (2) dismantling of the sodium-cooling primary loops after Na removal and decontamination; (3) dismantling and decontamination of the auxiliaries; and (4) destruction of the residual contaminated sodium. At the time of publication of this report, the removal of the steel/nickel elements had been accomplished, and the elements put in interim storage at a disposal site in Cadarache. The sodium-cooling primary system had been decontaminated and dismantled. The auxiliary circuit had been completely dismantled and the unnecessary parts of the electrical system removed. At the beginning of 1991, the reactor will be put into safe storage (SAFSTOR) within the reactor building. Studies for the destruction of the residual contaminated Na are in progress and work is scheduled to begin on the equipment for this process in early 1992. This report is accompanied by a schedule chart and several drawings.

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Survey of the EDF First Dismantling Operations: The Case of Chinon A2

CONF-8803283; Decommissioning of Fuel Cycle Nuclear Facilities, Proceedings of a Meeting, Paris, France, March 15, 1988. Societe Francaise d'Energie Nucleaire, Paris, France, 301 pp.; (pp. 181-208) (1988)

The steps followed during dismantling operations at the Chinon A-2 power plant and the experience acquired during the first dismantling steps are summarized. The parameters to be taken into account are (1) the assembly of the irradiated or contaminated equipment or materials, (2) the radiological aspects characterizing the peripheral circuit components, (3) the duration of operations, and (4) the Electricite de France (EDF) regulations relating to the chosen solutions. The strategy followed is summarized. The experience acquired in methods, tests, decontamination, and removal of oils is analyzed. Measures preventing radioactive wastes from reentering the public environment are presented.

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F. Cornu, Commissariat a l'Energie Atomique, Etablissement de la Vallee du Rhone, Bagnols-sur-Ceze, France

Dismantling of the Pilot Facility AT1

OECD/NEA Co-Operative Program on Decommissioning, 10th Meeting of the Technical Advisory Group, Karlsruhe, Federal Republic of Germany, April 22-26, 1991; (6 pp.) (April 1991)

The AT1 fuel reprocessing pilot plant, located in La Hague, France, has been dismantled. The main dismantling steps were: (1) dismantling of unshielded calls; (2) dismantling of accessible hot cells (necessary for installation of the remote-controlled machine ATENA); (3) dismantling, with the ATENA machine, of the 3 main shielded blind cells; (4) dismantling of cells housing various effluents and fission products; and (5) general cleaning of the building. This report gives a general overview of the dismantling project, and includes a decommissioning schedule, a table of hazardous wastes generated, and a table of integrated doses received during operations.

197

C. Lorin, Commissariat a l'Energie Atomique, Bagnol-sur-Ceze, France

Use of Remote Device Coupled with a Carrier for the Dismantling of Hot Cells in France

CONF-911135 (Vol. 2); Nuclear Engineering, Proceedings of the First JSME/ASME Joint International Conference, November 4-7, 1991, Tokyo, Japan, Vol. 2, 593 pp.; (pp. 71-76) (November 1991)

This paper describes the dismantling of AT1 hot cells at La Hague Nuclear Center. Dismantling was accomplished using a carrier named "ATENA", which holds in its tips a remote telemanipulator coupled with a cutting tool. ATENA's mission is to place the telemanipulator inside the hot cell, near the material to be cut. From this position the telemanipulator can dismantle all equipment within its reach.

198
J.L. Decitre, Commissariat a l'Energie Atomique, Etablissement de la Vallee du Rhone, Bagnols-sur-Ceze, France

Dismantling of the G2 Reactor

OECD/NEA Co-Operative Program on Decommissioning, 10th Meeting of the Technical Advisory Group, Karlsruhe, Federal Republic of Germany, April 22-26, 1991; (11 pp.) (April 1991)

The G-2 Reactor, located at Marcoule, France, is being decommissioned. A nuclear steel melting facility, INFANTE (Installation de Fusion des Aciers Nucleaires pour le Traitement en vue d'Exemption), is being developed as part of the decommissioning program. INFANTE will transform the contaminated steel pipes of the CO2 and auxiliary circuits of the G-2 Reactor into cast ingots with residual specific contaminations low enough for unrestricted release. This report discusses progress made toward completion of the decommissioning project.

199
F. Bregani and A. Garofalo, Ente Nazionale per l'Energia Elettrica, Centro Termica e Nucleare, Milan, Italy; Commission of the European Communities, Luxembourg, Luxembourg

Dismantling and Decontamination of the Tube Bundle of a Feedwater Preheater of the Garigliano BWR

EUR-13255; 60 pp. (1991)

This report deals with dismantling and decontamination of the tube bundle of a feedwater preheater of Garigliano-BWR. Decontamination of reactor components is commonly undertaken in decommissioning work. It is useful both for reducing radiation exposures and for the unrestricted release of materials. With the goal of unrestricted release of material, the decontamination of tube bundles is of special interest because of their large areas of contaminated surface and relatively low weight. At the time of this study, no technique was available to decontaminate tube bundles to the unrestricted release level. In this context, an innovative decontamination technique, using aggressive chemicals together with ultrasound in a tank, was developed by several laboratories working together. The technique was assessed with in-scale testings at the Garigliano-BWR. The decontamination procedure consisted of two phases: (1) ultrasound applied in water at 60(E+0C), and (2) ultrasound applied in a solution of HF/HNO3 acids at 60-70(E+0C). The demonstration of the this new decontamination technique under real conditions was made by performing ten full-scale demonstration tests. The ten tests were performed on an assembly of 100 straight tubes, each one meter long. A total of 1000 meters of tube were decontaminated.

200
B. Migliorati, G. Tarroni, M. Di Fino, P. Picini, and G. Manassero, Fiat Research Center, Turin, Italy; European Nuclear Energy Agency, Bologna, Italy; European Nuclear Energy Agency, Centro Ricerche Energia, Frascati, Italy; European Nuclear Energy Agency, Rome, Italy

Investigation of Laser Cutting Applications in Decommissioning

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 181-190) (1990)

The aim of this work, performed on an experimental basis in a frame of strict collaboration between industry and public research laboratories, was to better evaluate laser beam application possibilities in dismantling nuclear power plants. The main topics of the research are: (1) study and definition of the relevant basic parameters ruling the aerosol generation rate and behavior in terms of physical and chemical characteristics; (2) study of the feasibility of local abatement of the aerosol produced and of the pressure drop in high-efficiency particulate air filters; (3) study of the long distance transmission

of laser beam power with evaluation of the power loss and of the beam characteristic modifications; and (4) study of laser beam technique application in dismantling the Garigliano power plant steam drum in order to better evidence the feasibility of the use of this technique and the problems still to be solved.

201
T. Asano and K. Sato, Power Reactor and Nuclear Fuel Development Corporation, Tokyo, Japan

Method of Dismantling and Withdrawing Equipment Containing Radioactive Oil Waste

Japanese Patent 3-21896/A; 3 pp. (June 20, 1989; June 30, 1991)

Upon dismantling and removing equipment containing radioactive oil wastes and solvent wastes, an oil coagulant comprised of polynorbornane is charged into the equipment to solidify the oil and solvent wastes in the equipment. This procedure prevents the radioactive oil wastes from leaking out of the dismantled equipment, which would result in the scattering of radioactive contamination. The procedure shortens operation time and reduces the exposure dose.

202
S. Beppu, G. Takano, O. Matsumoto, M. Sugihara, and K. Miya, Mitsubishi Heavy Industries Limited, Takasago Research and Development Center, Takasago, Japan; Nuclear Power Engineering Center, Tokyo, Japan; University of Tokyo, Tokyo, Japan

Local Drying Underwater Cutting of Reactor Core Internals by CO Laser

CONF-911135 (Vol. 2); Nuclear Engineering, Proceedings of the First JSME/ASME Joint International Conference, November 4-7, 1991, Tokyo, Japan, Vol. 2, 593 pp.; (pp. 77-80) (November 1991)

Since the CO laser operates at a shorter wavelength than the CO2 laser, the former has superior ability to cut materials. Its applicability to the cutting of reactor core internals in a nuclear power plant has been studied. In order to use this technology on actual structures, it is necessary to develop underwater cutting techniques to minimize radiation exposure. However, since the laser beam is absorbed by water, a path must be cleared along the laser's line of projection. The authors have developed a nozzle that forms a local dry zone surrounding the laser's pathway, and have demonstrated that CO laser cutting can be successfully performed underwater, as well as in air.

203
R. Fukuzawa, N. Kondo, Y. Kamiyama, K. Hawasato, and T. Hiraga, Toda Construction Company Limited, Tokyo, Japan

Method for Dismantling Shields

Japanese Patent 2-309299/A; 3 pp. (May 24, 1989)

The purpose of the present invention is to enable operators to easily and quickly dismantle shieldings contaminated by radioactivity, without danger of radiation exposure. First, several introduction pipes are embedded into the shielding walls of shielding members which contain a reactor core. Both ends of the introduction pipes are in communication with the outside. A wire saw is inserted into the introduction pipes to cut the shieldings upon dismantling. Shieldings can then be dismantled easily and quickly, with no radiation exposure to operators. With the present invention, operating efficiency is improved because the wire saw can be set easily and a large area can be cut at once. Further, since remote control is possible, cutting can be conducted in water and in complicated areas of the reactor. Biting upon starting the wire saw in the introduction pipe is reduced to facilitate startup for the rotation.

204
T. Hasegawa and T. Watanabe, Shimizu Construction Company Limited, Tokyo, Japan

Example of Dismantling Nuclear Reactors

Konkurito Kogaku 29(7):59-63 (July 1991)

Concrete structures for nuclear reactor facilities are designed by taking into account a seismatic capabilities and other factors. The main shields surrounding nuclear reactors are made of concrete and steel, in which the concrete section is thick, the large diameter reinforcement is arranged densely, steel lining is applied to the inner surface, and pipings are buried. These shields are difficult to dismantle because of their construction and because of residual radioactivity. Methods for dismantling these concrete structures are: (1) cut the shield into small pieces and remove only the radioactivated parts; (2) remove the whole reactor body to another location; and (3) lower the reactor and bury it. In all cases, safety must be assured for the public and workers.

205

A. Kutsumizu, Obayashi Corporation, Tokyo, Japan

Research and Development of Laser Cutting Technology and Robots Used for Dismantling Nuclear Power Facilities

Report; 4 pp. (1992)

This corporate brochure describes the experimental dismantling of a biological shield wall using robotic laser cutting and compares this method with other methods of nuclear facility dismantling. Several color photographs, conceptual drawings, and detailed figures accompany the text.

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K. Murayama and S. Ushida, Toshiba Engineering and Construction Company Limited, Tokyo, Japan

Method of Dismantling Radioactivity-Contaminated Fluid Pump

Japanese Patent 3-181897/A; 6 pp. (August 7, 1991)

The present invention concerns a method of dismantling a radioactivity-contaminated fluid pump such as a coolant recycling pump in a BWR-type reactor. First, sealing is applied from the circumference of the axial opening of a pump casing to the outer circumference of the lower portion of the pump cover by a flexible cylinder impermeable to fluids contaminated with radioactivity. Next, an inner portion is hoisted together with the pump cover and separated from the pump casing. Subsequently, the cylindrical body connecting the pump casing and the pump cover is shrunk to seal the pump cover, while the casing is separated. This can prevent leakage or scattering of radioactivity-contaminated materials. Since a sealed chamber and exhaust device for local containment of the operation is no longer necessary, cost can be reduced. Further, since a special whole mask and a protection cloth are no longer necessary, operation efficiency can be improved.

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Y. Shinohara, H. Usui, and Y. Fujii, Japan Atomic Energy Research Institute, Tokai Research Establishment, Tokai, Ibaraki, Japan

Development of Telerobotic Manipulators for Reactor Dismantling Work

Nippon Robotto Gakkai-Shi 9(3):323-334 (June 1991)

This paper describes the amphibious electrical manipulators JARM-10, JART-25, JART-100 and JARM-25, which were developed in the program of reactor-decommissioning technology development carried out by the Japan Atomic Energy Research Institute. These are multi-functional, telerobotic, light-duty and heavy-duty manipulators which can be used in hostile environments (e.g., high radiation, underwater, and electrical noise areas) to dismantle reactors. Each manipulator can be operated in three modes: (1) bilateral master-slave, (2) teach-and-playback, and (3) programmed-control mode. By combining these modes appropriately, it is possible to perform complex remote-handling tasks. The usefulness of the telerobotic systems for dismantling nuclear reactors has been demonstrated by successful application of the JARM-25 to remote underwater dismantlement of highly radioactive reactor internals.

208
Y. Shiraishi, T. Konno, K. Nakamura, M. Takahashi, T. Monma, and T. Hoshi, Kajima Construction Company Limited, Tokyo, Japan; Japan Atomic Energy Research Institute, Department of Japan Power Demonstration Reactor, Tokai, Ibaraki, Japan

Slow Demolition of Thick Wall Using Hydrostatic Tube - Example of Dismantling RC Structures in Radioactive Facilities

CONF-911135 (Vol. 2); Nuclear Engineering, Proceedings of the First JSME/ASME Joint International Conference, November 4-7, 1991, Tokyo, Japan, Vol. 2, 593 pp.; (pp. 103-108) (November 1991)

A demolition method using a hydrostatic tube developed by Kajima Corporation was recently used in the dismantling of a thick reinforced concrete (RC) radiation-barrier wall in a nuclear power plant. The method utilizes a diamond disk cutter for cutting reinforced bars and a diamond core drill for drilling the hydrostatic loading holes. For the pressurization fracture, a hydrostatic tube is used to generate cracks in the thick walls. Concrete breakers are then used for secondary break-up. This method greatly simplifies concrete breaking and contributes considerably to the prevention of dust propagation. The RC demolition conditions, basic characteristics of the hydrostatic tube, and an outline of the equipment, work methods and work results based on work execution examples are reported in this paper.

209
S. Tokioka, H. Inagaki, S. Sakai, I. Kasahara, and I. Shinya, Kumagai Gumi Company Limited, Tokyo, Japan

Development of a Shot-Blasting Robot for Removal of the Wall Concrete Surface

CONF-911135 (Vol. 2); Nuclear Engineering, Proceedings of the First JSME/ASME Joint International Conference, November 4-7, 1991, Tokyo, Japan, Vol. 2, 593 pp.; (pp. 563-566) (November 1991)

This paper reports research and development of a shot-blasting robot, for which the following targets are set up and their performances confirmed through basic experiments: (1) uniform removal of concrete surface by an impeller type shot-blasting system, (2) recycling of projecting material (steel shot), and (3) separation of removal material. On the basis of these tests, the application of the shot-blasting robot to decontamination of nuclear power facilities is projected.

210
M. Harada, K. Nakamura, I. Yokota, K. Nishi, M. Yokota, and F. Sato, Kajima Construction Company Limited, Institute of Construction Technology, Tokyo, Japan; Japan Atomic Energy Research Institute, Department of Japan Power Demonstration Reactor, Tokai, Ibaraki, Japan

Study on Technology of Reactor Dismantling by Abrasive Water Jet Cutting System

CONF-911135 (Vol. 2); Nuclear Engineering, Proceedings of the First JSME/ASME Joint International Conference, November 4-7, 1991, Tokyo, Japan, Vol. 2, 593 pp.; (pp. 93-96) (November 1991)

It is the policy of the Japanese government that nuclear reactors be dismantled after decommissioning, so that the reactor sites can be used for other purposes. In one reactor-dismantling technology-development project being conducted by the Japan Atomic Energy Research Institute, Kajima has been performing research and development on an abrasive-water-jet cutting system. This system is to be applied to the cutting of biological shields. This work cannot be performed by humans because of the high level of radioactivity in the shields. A mock-up test for dismantling the biological shield of the Japan Power Demonstration Reactor (JPDR) has been performed to demonstrate that the abrasive-water-jet cutting system is fast, safe, and reliable under actual working conditions. The mock-up test provided valuable experience and various kinds of reference data useful for dismantlement of the JPDR. The system will be put into practical use in the dismantling of the JPDR from April to September 1991. The abrasive-water-jet cutting system is expected to

prove very useful in the dismantlement of atomic power plants after decommissioning.

211
M. Tachibana, T. Hoshi, and I. Miki, Japan Atomic Energy Research Institute, Department of Japan Power Demonstration Reactor, Tokai, Ibaraki, Japan

Underwater Cutting of JPDR Reactor Pressure Vessel and Core Internals

CONF-911135 (Vol. 2); Nuclear Engineering, Proceedings of the First JSME/ASME Joint International Conference, November 4-7, 1991, Tokyo, Japan, Vol. 2, 593 pp.; (pp. 81-84) (November 1991)

The most important feature of reactor decommissioning is the removal of the reactor pressure vessel (RPV) and core internals. These components are highly contaminated and require innovative technologies for their dismantlement and removal. It is necessary to develop techniques with high cutting performance and remote-operation capability. An underwater arc-saw cutting technique and an underwater plasma-arc cutting technique were used to dismantle the Japan Power Demonstration Reactor RPV and core internals. Actual disassembly of core internals using the plasma-arc cutting system was performed between February and September 1989, and the removal of the RPV by arc-saw cutting followed from April to June 1990. In this dismantling operation, it was proved that the cutting capabilities of the underwater arc-saw and the underwater plasma-arc are adequate for their intended purposes.

212
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Development of Telerobotic Systems for Reactor Decommissioning: (III) - Demonstration System

Journal of Nuclear Science and Technology 28(8):767-776 (1991)

This paper describes a telerobotic system for reactor decommissioning demonstrated in dismantling of the radioactive reactor internals of an experimental boiling water power reactor, the Japan Power Demonstration Reactor (JPDR). The telerobotic system consists of a telerobotic manipulator equipped with a multi-functional amphibious slave manipulator with a load capacity of 25 daN, a chain-driven transport system, and a computer-assisted monitoring and control system. Preceding the use of the telerobotic system in the actual dismantling operation, a mockup test was performed. In the mockup, the telerobotic system was used to dismantle actual-size, simulated reactor internals through underwater plasma-arc cutting. The test was carried out in order to study the performance of the telerobotic system in a realistic environment. The system was then successfully applied to dismantling the actual reactor internals in accordance with the JPDR decommissioning program.

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M. Yokota, T. Hasegawa, and M. Saito, Japan Atomic Energy Research Institute, Department of Japan Power Demonstration Reactor, Tokai, Ibaraki, Japan; Shimizu Construction Company Limited, Tokyo, Japan

Dismantling of Biological Shield by Cutting Machine

CONF-911135 (Vol. 2); Nuclear Engineering, Proceedings of the First JSME/ASME Joint International Conference, November 4-7, 1991, Tokyo, Japan, Vol. 2, 593 pp.; (pp. 97-102) (November 1991)

A sawing and coring technique has been developed to dismantle a biological shield in the Japan Power Demonstration Reactor (JPDR) decommissioning program. Preliminary cutting tests were conducted that used a prototype machine equipped with sawing and coring units, to obtain data for characteristics of cutting and to confirm capabilities of this technique for reinforced concrete. Many data, including cutting rates under various conditions and characteristics of by-products, were obtained in the tests. Based on the results of the cutting test, the dismantling system was designed for safe and efficient

dismantlement of the JPDR biological shield. The actual dismantling work was performed from 1990 to 1991 and was completed satisfactorily.

214
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Dismantling of Activated Equipment in the Proton Channel of the PSI-Accelerator Facility

CONF-910507; Jahrestagung Kerntechnik '91 (Annual Meeting on Nuclear Technology '91), Proceedings of a German Nuclear Society Annual Meeting, Bonn, Federal Republic of Germany, May 14-16, 1991; (pp. 471-474) (1991)

The accelerator facility at the Paul Scherrer Institut (PSI) consists of two 72 MeV injector cyclotrons and a ring cyclotron for 590 MeV protons. The accelerator facility feeds two pion production targets, M and E. Starting in 1991, the intensity of the proton beam will be increased in stages from 100 uA to 1-2 mA. To cope with this higher intensity, both target stations had to be replaced. Target M was rebuilt in 1985. The dismantling of Target E and its associated equipment was recently completed. About 500 tons of activated equipment have been removed from the proton channel. This includes several focusing and bending magnets, the main pion-production target, the p-beam dump, vacuum devices, electrical instrumentation and cables, cooling water installations, and concrete and iron shielding blocks. The total activity inventory was about 4 x 10(E+14) Bq at three months after shutdown, with 85 percent of the activity concentrated in the beam dump complex. About 300 tons of the activated material has been reused immediately after decontamination for the new proton channel equipment. The other 200 tons of activated material were integrated into the biological shield of the new proton channel, after being dismantled in a hot cell and conditioned with concrete mortar in PSI-type containers. To achieve reliable and realistic planning data, the decommissioning work was divided into small and practicable job packages, which are described in the operational handbook for the dismantling. The work was carried out between January and August 1990 and required about 50 man-months of manpower. Individual doses to the dismantling staff remained far below the limits for radiation workers set by the Swiss Radiation Protection Ordinance. The recycling of the activated material from the old proton channel made intermediate storage unnecessary until the plant's final decommissioning and achieved a significant reduction in the volume of waste at final disposal.

215
G.B. Poluehktova and O.V. Koval'chuk

Methods of Decontamination and NPP Equipment Dismantling

Atomnaya Tekhnika za Rubezhom 8:9-13 (August 1990)

Methods of decontamination (chemical, electrochemical and nonchemical or mechanical ones) and dismantling of nuclear power plant equipment are considered. Chemical methods of decontamination are subdivided into "rigid" and "soft" ones with reagents of high and low concentration. Electrochemical decontamination is based on anodic dissolution of metal surface layers containing alpha-, beta-, and gamma-contaminants. Mechanical methods are based on physical removal of radioactive contaminants from the surface, using different mechanical means. Plant dismantling includes cutting (segmentation) and destruction of concrete structures or removal of the surface layer of these structures.

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Report of the Advisory Committee on Nuclear Waste: Pathfinder Atomic Power Plant Dismantlement

NUREG-1423 (Vol. 1); (pp. 65-66) (October 18, 1989)

This letter from the Advisory Committee on Nuclear Waste (ACNW) to the chairman of the Nuclear Regulatory Commission (NRC)

summarizes the committee's initial recommendations concerning criteria for the dismantlement of the Pathfinder Atomic Power Plant. The ACNW suggests that dismantling should be based on a systems approach, so that associated regulatory criteria can help minimize the volume of wastes generated and facilitate their handling, transport, and disposal. The criteria should be as nonprescriptive as possible, once acceptable levels of residual contamination are clearly defined and justified. Overly restrictive limits (e.g., "no detectable activity") should be avoided. Potential for long-term contamination of groundwater should be considered when setting residual radionuclide limits. The possibility of eventual unrestricted use by members of the public implies that exposures well in excess of an occupational time of 2000 hours per year should be considered. Previous decommissioning experience, such as at the Shippingport Atomic Power Station, should be utilized as much as possible. Adequate but not overburdening quality assurance requirements should be established.

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T.L. White, R.G. Grubb, L.P. Pugh, D. Foster Jr., and W.D. Box, Oak Ridge National Laboratory, Oak Ridge, TN

Removal of Contaminated Concrete Surfaces by Microwave Heating: Phase 1 Results

CONF-920307; Waste Management '92, R.G. Post (ed.), Proceedings of a Conference, Tucson, AZ, March 1-5, 1992; 10 pp. (1992)

Oak Ridge National Laboratory (ORNL) is developing a microwave heating process to remove radiologically contaminated surface layers from concrete. The microwave energy is directed at the concrete surface and heats the concrete and free water present in the concrete matrix. Continued heating produces steam-pressure-induced mechanical stresses that cause the concrete surface to burst. The concrete particles from this steam explosion are small enough to be removed by a vacuum system, yet less than 1% of the debris is small enough to pose an airborne contamination hazard. The first phase of this program has demonstrated reliable removal of noncontaminated concrete surfaces at frequencies of 2.45 Gigahertz (GHz) and 10.6 GHz. Continuous concrete removal rates of 1.07 cu cm with 5.2 kW of 2.45 GHz power and 2.11 cu cm with 3.6 kW of 10.6 GHz power have been demonstrated. Figures-of-merit for microwave removal of concrete have been calculated to be 0.21 cu cm/s/kW at 2.45 GHz and 0.59 cu cm/s/kW at 10.6 GHz. The amount of concrete removed in a single pass can be controlled by choosing the frequency and power of the microwave system.

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Diamond Wire Cutting of Heat Exchangers

CONF-911135 (Vol. 2); Nuclear Engineering, Proceedings of the First JSME/ASME Joint International Conference, November 4-7, 1991, Tokyo, Japan, Vol. 2, 593 pp.; (pp. 89-92) (November 1991)

With the change-out of equipment at nuclear power plants comes large quantities of low-level contaminated metallic waste. Of special concern are large heat exchangers, preheaters and steam generators. These bulky items consume large amounts of burial space. The need for volume reduction and recycling of these metals has created new demands for cutting heat exchangers into sizes useful for decontamination, melting or compaction. This paper reviews the cutting solution provided by a diamond wire system, with particular regard for cutting of a Ringhals Preheater Bundle at Studsvik Nuclear in 1989. The background of diamond wire sawing is discussed and basic components of wire sawing are explained. Other examples of wire cutting of decommissioned components are given.

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Integrated Five Station Nondestructive Assay System for the Support of Decontamination

and Decommissioning of a Former Plutonium Mixed Oxide Fuel Fabrication Facility

EUR-12890; CONF-891197; Non-Destructive Assay of Radioactive Waste, C. Eid and P. Bernard (eds.), Proceedings of a Topical Meeting, Cadarache, France, November 20-22, 1989, 327 pp.; (pp. 124-133) (1990)

The goal of safe, efficient and economic decontamination and decommissioning of plutonium facilities can be greatly enhanced through the intelligent use of an integrated system of nondestructive assay equipment. A system has been designed and fabricated utilizing five separate NDA stations integrated through a single data acquisition and management personal computer-based controller. The initial station utilizes a passive neutron measurement to determine item Pu inventory to the 0.1 gm level prior to insertion into the decontamination cell. A large active neutron station integrated into the cell is used to measure decontamination effectiveness at the 10 nci/gm level. Cell Pu buildup at critical points is monitored with passive neutron detectors. An active neutron station having better than 1 mg Pu assay sensitivity is used to quantify final compacted waste pucks outside the cell. Bulk Pu in various forms and isotopic enrichment is quantified in a combined passive neutron coincidence and high resolution gamma ray spectrometer station outside the cell. Item control and Pu inventory are managed with bar code labeling and a station integrating algorithm. Overall economy is achieved by multiple station use of the same expensive hardware such as the neutron generator.

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Development of Measuring and Control Systems for Underwater Cutting of Radioactive Components

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 201-207) (October 1989)

Underwater dismantling of nuclear power plants must be performed by remote control, with simultaneous optical control by underwater cameras. Some types of optically controlled underwater operations (e.g., abrasive-wheel cutting) are problematic because of the wide range of interferences to which the camera is subjected. This paper describes a new image-processing system that has been developed for use with a modified underwater television camera for optical cutting-process control. A satisfactory prototype system has been built which is capable of performing image analysis as well as the control of a handling system with an inductive sensor.

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Development of Telerobotic Systems for Reactor Decommissioning (II) - Prototype Heavy-Duty System

Journal of Nuclear Science and Technology 28(7):670-677 (1991)

This paper describes the prototype heavy-duty telerobotic system constructed as a cold test facility for the development of robotic, remote-handling-system technology in reactor decommissioning. The system contains a multi-functional, electrical manipulator system, a manipulator transporter system equipped with a tripedal support mechanism, a monitoring system equipped with a three-dimensional television monitor, and a computer control system for overall system operation. The manipulator system consists of two master manipulators and two corresponding amphibious slave manipulators with load capacities of 100 and 25 daN, respectively. Valuable engineering experiences for developing more advanced heavy-duty telerobotic system have been gained through designing, constructing and testing the system.

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Technical Verification Test for Reactor Pressure Vessel Cutting by Using G&G Method ("Arc-Gouging & Gas Cutting" Method)

CONF-911135 (Vol. 2); Nuclear Engineering, Proceedings of the First JSME/ASME Joint International Conference, November 4-7, 1991, Tokyo, Japan, Vol. 2, 593 pp.; (pp. 85-88) (November 1991)

In an actual application of a dismantling operation to nuclear reactor decommissioning, the "arc-gouging/gas-cutting" method was selected to demonstrate cutting techniques of reactor pressure vessels. Using a combination torch of arc gouging and gas cutting, test models simulating reactor pressure vessels were cut successfully underwater by remote control. In remote control tests, an underwater industrial television camera proved useful for monitoring the cutting process. At the same time, the quantity and characteristics of the secondary products of underwater cutting were investigated.

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Development of Telerobotic Systems for Reactor Decommissioning: (I) - Prototype Light-Duty System

Journal of Nuclear Science and Technology 28(6):547-554 (June 1991)

This paper describes the prototype light-duty telerobotic system constructed at a cold-test facility, as part of a program for developing the technology of robotic handling systems for decommissioning nuclear reactors. The system consists of a multi-functional, electric manipulator system; a transporter system of telescopic-boom type; a monitoring system, comprising several television monitors; and a computer-assisted control system for overall system operation. The slave manipulator has a load capacity of 10 daN and can be used both in air and in water. Various tests, such as a basic performance test and a remote operability test, have been performed to point out the possibilities for further technological improvement of the system performance. Valuable experience for developing subsequent systems has been acquired through designing, constructing and testing the system.

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Removal of Concrete Layers from Biological Shields by Microwaves

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 291-300) (1990)

A comprehensive literature review has been carried out to provide information for an experimental program and equipment design. Mathematical modelling of the microwave and power fields in a concrete block, both steel reinforced and unreinforced, subjected to a microwave attack at two frequencies, has been carried out and estimates of the likely temperature rise with time obtained. A method of launching microwaves into concrete has been established from theoretical considerations and from the findings of the literature review. Equipment for laboratory trials has been designed and assembled using an 896 Mhz, 25 Kw microwave generator. Reinforced concrete blocks, 0.6 m in dimension and representing the concrete in a Magnox reactor biological shield, have been attacked at different power levels and the surface removed to the depth of the reinforcing steel (100 mm). Outline

proposals for the design of a remotely operated prototype microwave machine for stripping the surface of large concrete test panels have been prepared.

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Immobilization of Contamination by the Coating of Polymers on Large-Size Waste Products

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 712-720) (1990)

Basic research in the field of epoxies and polyurethanes has produced several polyurethane formulations which are suitable for the application of quickly hardening thick coats. The mechanical and physico-chemical characteristics of these polymeric systems have been studied, in particular the diffusion of radio-elements such as H-3, Co-60, and Cs-137. Progress has been made with respect to resistance to temperature and diffusion of radio-elements in aqueous medium. Several "bi-component" industrial devices have been tested to verify their aptitude for spraying thick coats. The feasibility study was completed by applications on an industrial scale for the dismantling of AT1 cells at the Nuclear Centre of the Hague.

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In Situ Treatment of Concrete Surfaces by Organic Impregnation and Polymerization

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 128-138) (1990)

The impregnation by resins of concrete structures is a process known as PIC (Polymer Impregnated Concrete). This process improves the physical-chemical features of concrete matrixes in order to extend their durability in the presence of severe environmental conditions. The main objective of this research contract has been the verification of a proper, "in situ" organic impregnation of existing concrete surfaces. The research includes polymer impregnation, by means of a prototype machine expressly designed and implemented for the task, and the verification of an increase of mechanical resistance, leach resistance, and durability in the treated material. In a nuclear facility, this goal is very important in relation to the long term integrity of concrete structures during the facility's operating lifetime and, in particular, after its final shutdown.

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Assessment of the Applicability of a Protective Polymeric Coating for Decontamination of Certain Surfaces

Problemi na Nuklearnata Meditsina, Radiobiologiyata i Radiatsionnata Khigiena 11:113-118 (1990)

A polymeric film coating is proposed for decontamination of metal and glass surfaces contaminated with cesium and ruthenium radioisotopes. Its applicability has been estimated according to the following indices: (1) decontamination efficiency in multiple radioactive contamination; (2) effect of the coating on the recontamination of the surface, and (3) possibility for reduction of the decontamination volume.

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Environmental Assessment: Transportation, Receipt, and Storage of Fort St. Vrain Spent Fuel at the Irradiated Fuel Storage Facility at the Idaho Chemical Processing Plant, Idaho National Engineering Laboratory

DOE/EA-0441; 96 pp. (February 1991)

This environmental assessment (EA) addresses the proposed transportation, receipt, and storage of up to 1482 blocks of spent nuclear fuel from the Fort St. Vrain (FSV) reactor, located in Platteville, Colorado, to the Idaho National Engineering Laboratory (INEL). The purpose of this EA is to analyze the impacts which may result from this proposed action. Decommissioning of the FSV reactor necessitates the storage of irradiated reactor fuel until final disposition can be accomplished. In accordance with existing agreements between DOE and Public Service Company of Colorado (PSC), the spent fuel would be transported to the INEL by PSC in compliance with applicable transportation requirements and using shipping casks certified by the Nuclear Regulatory Commission (NRC). The spent fuel blocks would be removed from the shipping casks and transferred to the storage area of the Irradiated Fuel Storage Facility (IFSF), which was specifically designed for interim storage of this fuel.

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Separation by Vapour Phase Transport of Stainless Steel Constituents

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 504-514) (1990)

A process for separating the constituents of radioactive steels is proposed for treating materials produced during the dismantling of reactor pressure vessels. This process is based on the transport of the constituent elements of the steels by an iodide vapor phase in a thermal gradient inside a gas-tight device. Tests were carried out at a 2 g scale in quartz ampoules to determine the effectiveness of the separation as a function of temperature range, pressure and temperature gradient. Results of these tests indicate that cobalt can be separated from the other elements (after about 150 elementary transports), with a productivity of about 1 kg of treated steel per square meter per day. This process is applicable to both metallic and non-metallic wastes.

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Separation of Contaminated Concrete

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 721-730) (1990)

In concrete, mainly the porous cement stone and not the dense aggregates (sand and gravel), will be contaminated by radioactive fluids. By separation of these components, a considerable reduction of radioactive material can be achieved. In this research project, concrete separation techniques were based upon milling in combination with cooling (liquid nitrogen) or heating (750 deg C). Concretes of various qualities with three different maximum grain sizes were tested. It was possible to separate the fine porous material from the coarse aggregate, resulting in a volume reduction of about 60 to 70%. Heat treatment significantly enhanced the separation process.

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Atomique, Centre de Marcoule, Bagnols-sur-Ceze, France; Commissariat a l'Energie Atomique, Centre d'Etudes Nucleaires de Grenoble, Grenoble, France; Commissariat a l'Energie Atomique, Centre d'Etudes Nucleaires de Cadarache, Saint-Paul-lez-Durance, France

Conditioning for Disposal of Radioactive Graphite Bricks from Reactor Decommissioning

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 738-750) (1990)

The decommissioning of gas-graphite reactors in the European Community (e.g., French UNGGs, British Magnox reactors and AGRs, and reactors in Spain and in Italy) will produce large amounts of graphite bricks. Evaluations of the radioactivity inventory of graphite moderators made in France and the United Kingdom show that this graphite cannot be accepted by the existing shallow land-disposal sites without particular conditioning. The aim of the study is to examine the behavior of graphite waste and to develop a conditioning technique which makes this waste acceptable for shallow land disposal sites.

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Development of a Large Container Cast of Low-Level Radioactive Steel

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, b. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 437-448) (1990)

The development and testing of a large prototype container type, KONRAD VI, is the subject of this paper. KONRAD VI was cast using very low-level radioactive carbon steel from the refurbishing of nuclear reactors. The transportation and disposal of low-level radioactive solid waste from the decommissioning of nuclear installations in such large containers may result in less cutting work and therefore less radiation exposure of the decommissioning workforce. The use of steel waste from decommissioning for manufacturing large transport and/or disposal containers is a promising method for recycling decommissioning waste, for saving storage volume and for conserving new resources.

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Radiological Impact of Very Slightly Radioactive Copper and Aluminium Recovered from Dismantled Nuclear Facilities

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 755-764) (1990)

This article deals with the recycling of copper and aluminium derived from dismantled nuclear facilities. The study is based on an evaluation of the quantities of materials likely to be very slightly contaminated by radioactivity. Descriptions are given of scenarios involving exposure of individuals, and derived limits are deduced for exemption of these metals from regulatory control in protection against ionizing radiation.

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Melting of Contaminated Steel Scrap from Decommissioning

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 473-481) (1990)

Practical work on the melting of materials was completed early in 1988 and no further work is planned. The goal was to establish the use of melting processes as a means of aiding disposal of slightly radioactive steel from nuclear power stations. The behavior of cobalt, cesium, and europium was studied under a range of steelmaking conditions. It was concluded that the use of steel scrap containing low levels of radioactivity would not be viable and the work will not be continued by British Steel.

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Prefiltering Devices for Gaseous Effluents from Dismantling Operations

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 639-648) (1990)

Dismantling processes produce radioactive aerosols which contaminate the cell in which the cutting operation occurs and the ventilation ducts leading to the high-efficiency particulate air (HEPA) filters. Cutting processes (in particular thermal processes) cause rapid plugging of HEPA filters because of the high concentrations of ultrafine particles produced. To increase the life of HEPA filters and to reduce the amount of residual solid wastes, it is necessary to develop an efficient and cleanable prefiltering device. The objective of this work was to select one or more cleaning devices, using the known physical and chemical characteristics of relevant gases and aerosols, the range of the available cleaning devices, and the nature of the facility to be dismantled. Data was collected on secondary emissions produced by various cutting techniques of metallic structures and complementary experimental studies were performed.

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First Results of the Melting of Radioactive Waste in the EIRAM Plant

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 494-496) (1990)

The EIRAM melting plant for radioactive metals was constructed in connection with the decommissioning and dismantling of the Niederaichbach nuclear power plant. According to the licensing certificate, contaminated parts and metallic parts from the Niederaichbach power plant with low radioactivity (up to 200 Bq/g) may be melted down. The core of the plant is an induction furnace with a capacity of 600 kV-A. About 150 tons of material with a total activity of 20 million Bq were melted in the period from March to August 1989.

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Decommissioning Waste Arising in the European Community and Western Europe

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B.

Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 413-422) (1990)

Some of the first commercial nuclear power stations in Europe are reaching the end of their useful lives. This paper considers the volumes and timing of decommissioning wastes that will arise over the coming decades. Using national decommissioning policy statements (or stated assumptions), the volume of structural radioactive waste from all Western European commercial power stations is derived and presented graphically. This has been done for each country, the European Community, and for the whole of Western Europe.

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Conditioning and Disposal of Decommissioning Wastes

Kerntechnik 56(6):379-382 (1991)

Nuclear installations are generally planned to be decommissioned at the end of their service life. Unlike conventional facilities, e.g., industrial plants, the radionuclide inventory of these installations requires specific procedures to be observed during decommissioning and dismantling. Taking a 1300 MW pressurized water reactor and a 1300 MW boiling water reactor as examples, on the basis of the present state of planning, a survey is given on the types and expected amounts of radioactive wastes from their decommissioning and dismantling, the conditioning techniques to be applied, as well as the planned disposal of these wastes in deep geologic formations.

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Announcement of a Recommendation by the Strahlenschutzkommission (SSK): Radiation Protection Principles to be Applied in Measurements for Decontrol of Metal Scrap from the Decommissioning of Uranium Mining Plant and Equipment

Bundesanzeiger 43(151):5461-5462 (August 15, 1991)

Decommissioning of uranium mining sites and installations by the Wismut AG will produce large quantities of contaminated metal scrap destined for recycling in a steel-smelting plant. The SSK recommends a maximum permissible radioactivity level of 0.5 Bq/sq cm for decontrol (in accordance with Annex IX, column 4 of the radiation protection ordinance for natural uranium), after chemical and mechanical decontamination. The scrap is to be fractured (under radiologically safe conditions prior to decontrol) into sizes appropriate for use in the smelting plant.

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Deutsches Institut fuer Normung e.V., Normenausschuss Kerntechnik, Berlin, Federal Republic of Germany

Activity Measurement Methods for the Release of Radioactive Residual Materials and Decommissioning Components of Nuclear Facilities - Principles for Beta and Gamma Radiation Measurements

DIN-25457 (Pt. 1, Draft); 26 pp. (August 1991)

This radiological standard is to be applied to the release of residually radioactive materials and plant components resulting from the maintenance, retrofitting, or dismantling of nuclear facilities, and which are specifically intended for unconditional release, recycling or utilization in non-nuclear applications.

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Activity Measurement Methods for the Release of Radioactive Residual Materials and

Decommissioning Components of Nuclear Facilities - Scrap Metal from Nuclear Power Stations

DIN-25457 (Pt. 4, Draft); 15 pp. (August 1991)

This standard is applicable to the release of contaminated or activated scrap metal (metallic materials) arising from maintenance, retrofitting or dismantling of nuclear power plants, specifically those which are not intended for unconditional release, recycling or utilization in non-nuclear applications. The standard may also be applied to the release of contaminated or activated components or parts made of steel, iron and other metals and originating in plants other than nuclear power plants, provided that they have a comparable radiological inventory.

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Further Studies on Melting of Radioactive Metallic Wastes from the Dismantling of Nuclear Installations

EUR-13133; INIS-mf-14015; BMFT 02-5-7277-7; 66 pp. (1991)

Melting of radioactive waste metal from the dismantling/refurbishing of nuclear installations is an acceptable means of recycling nuclear waste. The recycled material can be used for the casting of qualified products such as type A- and type B-waste containers. Results at the melting facility TAURUS were used to build the industrial scale melting facility CARLA at Siempelkamp. Radiation exposure to workers was in the range of the admissible limit for non-exposed people. Environmental radiation exposure is far below limits set by the German Radiation Protection Law. Activity distribution within the product is homogeneous, and can be precisely measured before the product is reused. When waste copper was melted the specific limits for unrestricted reuse were achieved; for brass the limit for conditioned reuse in the industrial field was reached. During the research program, 2000 Mg of waste steel was melted at industrial scale. Products such as shielding blocks and waste containers were produced.

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Research on the Harmless Reuse of Non-Iron Metals

BMU-1990-264; 295 pp. (March 1990)

Non-ferrous metal scrap is produced during repair and decommissioning of nuclear facilities. The scrap, which can be reused without harmful effects, is primarily aluminum, copper, copper alloys, and lead. The purpose of the investigation is to examine the applicability of the recycling concepts used to convert decommissioning metal scrap to harmless metal scrap. It is concluded that controlled recycling within the nuclear industry leads to a considerable reduction of the exposure to the general public.

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Exemption Limits for Contaminated Materials to be Recycled and for Low Level Radioactive Waste from Nuclear Power Stations and Uranium Mining and Milling Areas in South-Eastern Germany

CONF-920307; Waste Management '92, R.G. Post (ed.), Proceedings of a Conference, Tucson, AZ, March 1-5, 1992; (11 pp.) (1992)

Germany's Federal Radiation Protection Commission (SSK), which advises the Federal Minister for Environment, Nature Protection and Reactor Safety, for more than five years has been discussing the question of exemption limits for very

low-level radioactive wastes and for recyclable, very low-level contaminated materials. The SSK's first recommendation was published in 1988 and gave radiological protection principles for the recycling and reuse of the low-level radioactive steel and iron that comes from the maintenance, refurbishment, and decommissioning of nuclear power stations. In 1991, the SSK made several other recommendations that could be applied to the decommissioning and redevelopment of the abandoned installations and sites remaining in the areas of South-Eastern Germany where uranium mining and milling took place during the past fifty years. The SSK distinguished between (1) cases where the circumstances and extent of the radiation exposure to the population can be determined by the conditions of the release of low-level contaminated materials and (2) cases where there are pre-existing conditions. For example, a pre-existing condition exists in the case of uranium mining and milling sites; areas and buildings are contaminated and a maximum permissible level of contamination must be set, above which measures must be taken to decrease the resulting exposure to the population. The SSK recommended that if, as in (1), the circumstances and extent of the radiation exposure to the public can be determined by the release conditions, the permissible dose to the population should not exceed 10 uSv/a; and (2), if there are pre-existing conditions, the maximum permissible dose to the population should not exceed 1 mSv/a. The release limits for the low-level contaminated materials vary between 0.1 and 1 Bq/g for specific activity and 0.05 and 0.5 Bq/g for surface activity. The SSK performed environmental studies to find out which release limits to apply to the unconditional release of the low-level contaminated materials, and it recommended that the annual dose resulting from the release of these materials should not exceed 10 uSv. Calculations of release limits were made for a variety of radionuclides; depending on the radiotoxicity of the radionuclide concerned, the results of these calculations generally agree with the current recommended release limits of 0.5 to 500 Bq/g.

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Recycling of Metallic Materials from the Dismantling of Nuclear Plants

Kerntechnik 56(6):376-378 (1991)

Metallic scrap from the dismantling of nuclear power plants can successfully be recycled by melting. After separation of the slag and of filter dust, the recovered metal can be reused for the construction of shielding plates and casks for the transport of radioactive material. The development of the melting process is described. Special attention is given to the distribution of the original specific activity in the recovered metal, the slag and the filter dust. The licenses which had to be obtained from the authorities are also discussed.

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Melting of Activated/Contaminated Metallic Components Arising from the Decommissioning of Nuclear Facilities

CONF-8911319; Status Report 1989 of the Central Bureau for Management and Coordination of Projects Concerning the Decommissioning of Nuclear Facilities, Proceedings of a Conference, Hanover, Federal Republic of Germany, November 15-16, 1989, 350 pp.; (pp. 85-105) (April 1990)

In reprocessing metallic components arising from the backfitting and decommissioning of nuclear plants, melting of radioactive scrap is done in a medium-frequency furnace. The facility is designed so that materials having specific activities exceeding 200 Bq/g can be put in the cold furnace without mixing-in, and heated up without operating the starting-up unit. Redundant ventilation systems ensure safe operation.

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Device for Decisive Measurements of Waste from Dismantling of KKN

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 349-355) (1990)

During the dismantling of nuclear facilities, large quantities of potentially releasable materials with very low radioactivity levels have to be screened. For this purpose Nuklear-Ingenieur Service (NIS) developed a device sensitive to gamma radiation for decisive measurements and as a decision-making aid. The detectors are arranged on the outer surface of a tunnel with a cross section of 1.2 m by 1.2 m. This configuration permits measurement of activities on complex surfaces and hidden activities with different, but known, nuclide compositions. The minimum detectable level for shielded activities (2 cm steel) is lower than 500 Bq for Co-60 at any location within the measuring chamber. By mid-1989, more than 100 Mg of various materials originating from the dismantling of the Kernkraftwerk Niederaichbach (KKN) reactor had been screened for unrestricted release.

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Measurement of Alpha Radiators in Nuclear Wastes by Active and Passive Methods: Devices for Measuring Nuclear Wastes from Dismantling Operations

CONF-8803283; Decommissioning of Fuel Cycle Nuclear Facilities, Proceedings of a Meeting, Paris, France, March 15, 1988. Societe Francaise d'Energie Nucleaire, Paris, France, 301 pp.; (pp. 270-279) (1988)

Two systems adapted to the analysis of nuclear wastes from dismantling operations are described. They allow accurate measurements, easy transportation and operation, and the analysis of small and large equipment components. The techniques commonly applied and the detection limits are summarized. The study shows that the parameters characterizing nuclear wastes, environment, measurement rates, and human and financial factors all must be considered when choosing a measurement technique.

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Low-Level Radioactive Wastes

CONF-8803283; Decommissioning of Fuel Cycle Nuclear Facilities, Proceedings of a Meeting, Paris, France, March 15, 1988. Societe Francaise d'Energie Nucleaire, Paris, France, 301 pp.; (pp. 216-231) (1988)

Both radioactive and non-radioactive wastes are produced during dismantling of nuclear facilities. The distinction between these kinds of wastes is difficult, and in each dismantling operation special care must be taken when separating wastes. Each case must be separately studied for volume and surface activity. The regulations, international recommendations, and theoretical and experimental investigations in this field are presented. Regulation principles and examples of radioactivity limits, based on international recommendations, are provided.

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Experimental Plant for Treating Contaminated Sodium

OECD/NEA Co-Operative Program on Decommissioning, 10th Meeting of the Technical Advisory Group, Karlsruhe, Federal Republic of Germany, April 22-26, 1991; (5 pp.) (1992)

This paper describes an experimental, transportable plant to treat large quantities (tens of tons) of chemically pure sodium from the primary and secondary circuits of a reactor after decommissioning. The plant is a continuous treatment system that produces a by-product of the transformation of sodium that can be easily managed as radioactive waste in conventional containers (drums).

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Anticipated Assessment of the Amount of Radioactive Wastes Arising from Pool LMBFR Dismantling

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 403-412) (1990)

This report is part of a series of studies on nuclear installation decommissioning relating to fast breeder reactors of the European type. It deals with assessment of the amount of radioactive wastes arising from decommissioning. Activities in the wastes are produced through neutronic captures in the materials. Radioactive wastes arising from dismantling the Super Phenix 1 reactor structure and components are described. The following assumptions are made: (1) the reactor ran at full power for 30 years, followed by a 2-year decay time after ultimate reactor shutdown; (2) the more active structures and components are situated on the core axis (core cover plug, diagrid, diagrid-support, etc.); and (3) radially, beyond the core, are the lateral neutron shielding assemblies, which reduce primary pump and intermediate heat exchanger activation. The following isotopes are the main contributors to component activation: Co-59, Fe-54, and Ni-62. Stellite coatings on the spherical seats of the subassembly props and stellite coatings on the diagrid/diagrid-support seats have high maximum local volumetric activities of about 10(E+12) and 10(E+9) Bq/cu cm, respectively. In contrast, 85% of the 3000 tons of steel analyzed has an activity lower than 100 Bq/g. Above the roof slab and outside the safety tank, structures and components are not active.

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Present Status of Decommissioning Materials Reuse Research at JAERI

CONF-911135 (Vol. 2); Nuclear Engineering, Proceedings of the First JSME/ASME Joint International Conference, November 4-7, 1991, Tokyo, Japan, Vol. 2, 593 pp.; (pp. 47-52) (November 1991)

Rational treatment and disposal of large volumes of dismantling wastes resulting from reactor dismantling are essential to a successful decommissioning operation. With this in mind, the Japan Atomic Energy Research Institute (JAERI) has been developing recycling technology for metal waste, and has begun an investigation of recycling other dismantling wastes. Melting tests using non-contaminated metals have been conducted and the basic characteristics of the experimental facility are now understood. A waste recycling scenario, the necessary processing facilities, and the amount of waste arising from decommissioning a nuclear power plant are reviewed in the investigation study on the rational recycling system.

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Evaluation of Processing and Disposal System for Decommissioning Waste

CONF-911135 (Vol. 2); Nuclear Engineering, Proceedings of the First JSME/ASME Joint International Conference, November 4-7, 1991, Tokyo, Japan, Vol. 2, 593 pp.; (pp. 37-42) (November 1991)

Waste generated in the decommissioning of a commercial nuclear reactor has distinctive characteristics, such as large volume, a wide range of radioactivity, and a mixture of shapes and materials. It is necessary to develop, through model simulations, an appropriate processing and disposal system for this waste. COPAD (Evaluation Code for Processing and Disposal of Decommissioning Waste) was written to simulate such a processing and disposal system, and is able to evaluate waste volume, manpower, processing facility outline, cost, and other factors. Using COPAD, a case study has been carried out for a processing and disposal system for decommissioning waste. The study is based on the standard Japanese decommissioning process for a 1100 MW(e) boiling water reactor. An effective decommissioning waste processing and disposal method should include a system for decreasing the quantity of radioactive waste, and a system for simplified disposal of very-low-level waste.

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Site Inventory of Residual Radioactivity in Japan

EPA/520/1-90-013; CONF-8909236; Residual Radioactivity and Recycling Criteria, A.B. Wolbarst, H. Terada, and A.C.B. Richardson (eds.), Proceedings of a Workshop, St. Michaels, MD, September 27-28, 1989, 311 pp.; (pp. 44-56) (September 1989)

The types and numbers of facilities in Japan that may require residual radioactivity criteria for decommissioning have been investigated. The quantities of decommissioning wastes were estimated. The characteristics of the residual radioactivity at the facilities are discussed, based on Japanese decommissioning experience. There is no experience in decommissioning a commercial nuclear facility which would produce large amounts of radioactive wastes, but decommissionings of small-scale experimental facilities are reported. According to these experiences, the most practical way to reduce residual activity is to prevent components and structures from being contaminated and to remove contamination where present. Thus it is important to include contamination controls and the simplification of decommissioning when designing the facility. It is also essential to keep detailed documentation of contamination incidents as well as maintenance and remodelling records. It is necessary to consider both the method of recycling or reuse and the characteristics of the residual radioactivity in establishing residual radioactivity criteria.

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Low-Level Radioactivity Measurement Methods for Reusing or Recycling

EPA/520/1-90-013; CONF-8909236; Residual Radioactivity and Recycling Criteria, A.B. Wolbarst, H. Terada, and A.C.B. Richardson (eds.), Proceedings of a Workshop, St. Michaels, MD, September 27-28, 1989, 311 pp.; (pp. 82-89) (September 1989)

In reusing nuclear facilities and land or in recycling materials, radioactivity surveys and measurements are indispensable to make the program effective and to assure radiological safety. This paper discusses the procedures and techniques of radioactivity measurement needed to confirm the contamination levels for reuse or recycling. These procedures can be divided into three phases: planning, decontamination, and reuse/recycling. Radioactivity measurements should be made in each phase: (1) pre-investigating the contaminated spots or materials; (2) checking the contamination levels and classifying the material; and (3) verifying the contamination levels and confirming

radiological safety. Some methods and instruments appropriate for each phase are proposed, and the measurements (including minimum detectable limits) are discussed. New kinds of automated systems developed at JAERI for verifying low-level radioactive wastes are presented. One of these has a minimum detectable limit of 10 mBq/g for Co-60 and Cs-137. This paper illustrates the procedures and measurement techniques with three examples: (a) the reuse of research reactor facilities, (b) the reuse of a radiochemical laboratory, and (c) the dismantling of a power reactor. This paper also describes the effectiveness of the survey and measurement techniques and an automated measuring system for 200-liter drums.

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A Research Program on the Recycling of Decommissioning Materials at JAERI

EPA/520/1-90-013, CONF-8909236; Residual Radioactivity and Recycling Criteria, A.B. Wolbarst, H. Terada, and A.C.B. Richardson (eds.), Proceedings of a Workshop, St. Michaels, MD, September 27-28, 1989, 311 pp.; (pp. 257-265) (September 1989)

Research on reuse of wastes from reactor decommissioning has been done at Japan Atomic Energy Research Institute (JAERI) since 1987. This paper describes a fundamental research program on reuse of radioactive metal wastes, and discusses future plans for the development of reuse techniques as a realistic method of waste disposal. The melting testing program for radioactive metal from the decommissioning of the Japan Power Demonstration Reactor (JPDR) reveals the material balance and the radioactivity balance during melting. Development of reuse techniques is at the stage of designing research programs intended to demonstrate realistic reuse of decommissioning materials.

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Melting of Low-Level Contaminated Steels

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 497-503) (1989)

The melting facility at Studsvik, Sweden began operating in October 1987. By the end of 1988, more than 400 tons of low-level metallic scrap had been melted. The contaminated scrap comes from nuclear power plants in Sweden and the Federal Republic of Germany, or is produced at the various laboratories in Studsvik. The scrap arrives either as miscellaneous items such as pipes, beams, valves, etc., or as large individual pieces of equipment such as pre-heaters and moisture separators from commercial boiling water reactors. These latter pieces of equipment must be segmented before introduction to the melting furnace. The experiences gained so far show that melting is a safe, environmentally acceptable, and commercially viable method of treating contaminated metallic low-level scrap.

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Boxes for the Transport and Disposal of Low Level and Decommissioning Intermediate Level Radioactive Wastes

International Journal of Radioactive Materials Transport 2(1-3):161-168 (1991)

United Kingdom Nirex Limited is developing specifications for standard containers for the packaging of low- and intermediate-level radioactive wastes for disposal in a deep underground repository. The methodology used for selection of the dimensions and payloads of boxes for low-level wastes and decommissioning intermediate-level wastes are described, and design

features for handling the boxes are also briefly discussed. The results of this study are preliminary, and may change in the light of the evolving system design for waste packaging, storage, transport and disposal.

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Methodology for Assessing Suitable Systems for Management of Reactor Decommissioning Wastes

EUR-12701; 114 pp. (1990)

This report demonstrates a methodology for quantitatively comparing the options open to decision-makers at various stages of the decommissioning process. The methodology takes into account radiological protection and other relevant factors. In order to compare different decommissioning options, various impacts associated with decommissioning operations and decommissioning waste disposal were assessed. These included costs as well as radiological, environmental and socio-political impacts. The post-disposal radiological impact was calculated for four generic concepts: (1) near surface, (2) deep geological, (3) coastal tunnel and (4) deep ocean bed.

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Detection of Radioactivity in Steel Scrap

DSH319X/JH; 3 pp. (November 28, 1991)

Radioactive materials are sometimes delivered to steelworks along with scrap. If this material were melted, it could create a safety hazard for the steelworkers and might create steel and slag which required disposal as radioactive wastes; and it might cause the steelworks to be closed for decontamination. It is therefore reasonable that steel manufacturing plants should take precautions against accepting radioactive materials in loads of scrap. British Steel has developed a radiation detector for use on steel scrap. It detects gamma radiation and works automatically during the normal weighing and inspection of each vehicle load of scrap. The detector detected 1 mCi (37 MBq) of cobalt-60 and 5 mCi (185 MBq) of cesium-137 in scrap, although the sources were encased in lead shielding. These sources were so small that they would represent relatively little hazard if they had been melted with the scrap; larger sources are easier to detect. The prototype system was installed at United Engineering Steels' Aldewark plant in June 1989. This detector has inspected more than 100,000 loads, and 7 loads containing low levels of radioactivity have been detected. A second system at British Steel Stainless Sheffield has detected low-level radioactivity in 2 loads since June 1991. By the end of 1992, detectors will be in use at all the main steelworks of British Steel and United Engineering Steels. Two photos of the detector at work on the British Steel Sheffield Site accompany this paper.

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Large Packages for Reactor Decommissioning Waste

EUR-13345; 140 pp. (1991)

This study was carried out jointly by the Atomic Energy Establishment at Winfrith (now called the Winfrith Technology Centre), Windscale Laboratory, and Ove Arup and Partners. The work involved the investigation of the design of large transport containers for intermediate-level reactor decommissioning waste, and is aimed at European requirements (i.e., water-cooled and gas-cooled reactors). It proposes a design methodology for such containers covering the whole lifetime of a waste-disposal package. The design methodology presented takes into account various relevant constraints. Both large,

self-shielded and returnable-shielded concepts were developed. The work was generic, rather than specific; the results obtained and the lessons learned remain to be applied in practice.

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The Development and Testing of a Container for the Transport of Decommissioning Wastes

CONF-8805340; Transportation for the Nuclear Industry, Proceedings of the First International Conference, Stratford-upon-Avon, United Kingdom, May 23-25, 1988; (18 pp.) (February 1988)

The waste produced during the decommissioning of the Windscale Advanced Gas-Cooled Reactor contains 1900 tons of radioactive material. This material is composed of 1100 tons of low-level waste suitable for disposal in a nearby shallow land burial site, and 800 tons of intermediate-level waste, for which shielded transport containers are required. This paper describes the design, development and testing of an economic transport container which complies with the requirements of the regulatory authorities.

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Development of Sampling and Assay Methods for Windscale Advanced Gas Cooled Reactor Radwaste

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 344-348) (1990)

Reviews have been made of the impurity concentrations and of the long-lived radioactivities in material to be consigned to low- and intermediate-level waste disposal facilities. Sampling methods were developed and available optical X-ray and neutron activation analysis routes were used to assess radioactive waste activity at the Windscale Advanced Gas Cooled Reactor (WAGR). A calculation code, WESTD, for inventory checking has also been developed. This paper reviews the experience of sampling, assay and inventory checking at WAGR. Simple schemes are proposed for assay during WAGR dismantling which can be applied elsewhere.

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Disposal Capacity and Projected Waste Volumes Within the Low-Level Radioactive Waste Compacts

EPA/520/1-90-013; CONF-8909236; Residual Radioactivity and Recycling Criteria, A.B. Wolbarst, H. Terada, and A.C.B. Richardson (eds.), Proceedings of a Workshop, St. Michaels, MD, September 27-28, 1989, 311 pp.; (pp. 90-121) (September 1989)

Waste volume and activity projection analyses have been performed for the Southwestern and Central States Low Level Radioactive Waste (LLRW) Compact. The Southwestern Compact study is based on historical data taken from U.S. Ecology radioactive waste shipment records originating from California, Arizona, North Dakota, and South Dakota from 1985 to 1987. Future LLRW is expected to be buried at the proposed Southwestern Compact Ward Valley Site near Needles, California. Six nuclear power plants are projected for shutdown during the 30-year lifetime of the Ward Valley facility. The Midwest Compact region consists of the states of Kentucky and Illinois, with 80 percent of the waste volume and 99 percent of the activity coming from 14 nuclear power reactors in Illinois. Approximately 185,000 cu ft/yr of LLRW will be sent to the Midwest Compact's disposal facility, beginning with its operation in 1993. Twenty-first century reactor dismantlement in the Midwest Compact region is expected to significantly increase the volume of waste generated. A detailed discussion of the data and projections from fuel cycle-generated waste,

medical, academic, government, and non-medical industry LLRW in both compacts is presented. The effects of nuclear power plant decontamination, volume reduction technology, U.S. Nuclear Regulatory Commission/Environmental Protection Agency below regulatory concern (BRC) decisions, and mixed waste production are discussed. The projected waste volumes and activity projections are compared with present disposal capacity.

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Demonstration of a Methodology for Assessing Suitable Systems for Management of Reactor Decommissioning Wastes

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 395-402) (1990)

A methodology has been developed for aiding decisions relating to the decommissioning of nuclear facilities. The method uses multi-attribute utility analysis to break complex decisions down into a series of quantitative judgements as to the relative importance of different economic, radiological, environmental, social and political factors. As many of these judgements are subjective, a number of different weighting schemes have been used to reflect the views of different "preference groups" or sections of society holding particular opinions. The methodology has been demonstrated in the context of three specific waste streams, using broadly representative data to show how choices between different decommissioning strategies might be made in a systematic way. The methodology is suitable both for broad policy decisions on general approaches to decommissioning and for decisions on particular aspects of specific decommissioning projects. It also allows the most important factors in the decision to be identified so that research effort may be concentrated in the appropriate areas.

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Bechtel National, Inc., Oak Ridge, TN

Final Report: Scrap Metal Program Phase I - Decontamination Demonstration Project

DOE/DE-AC05-86OR21669; 129 pp. (January 1988)

Bechtel National, Inc. (BNI) conducted the Phase I demonstration of scrap metal decontamination for the U.S. Department of Energy (DOE). Phase I consisted of the development and demonstration of processes to decontaminate 80,000 tons of scrap in Phase II. BNI selected fifty tons of scrap from the four DOE scrapyards in Paducah, Kentucky; Fernald, Ohio; Portsmouth, Ohio; and Oak Ridge, Tennessee. BNI intended to perform decontamination of this scrap by a variety of "single-pass" processes that would generate minimum volumes of waste. Surface decontamination through ultra-high pressure water (up to 35,000 psi) and liquid abrasive blasting (solid particles in water at approximately 100 psi) were chosen as the most effective and economical methods. Results of these surface decontamination methods showed that the effectiveness of the processes was far below that anticipated: less than 20% of the scrap was cleaned to U.S. Nuclear Regulatory Commission Regulatory Guide 1.86 release criteria, and decontamination rates were less than 1 sq ft/min. Chemical treatment of some of the scrap was then used to determine if improved decontamination could be obtained. Chemical decontamination was never considered attractive for Phase II because of the large chemical waste volumes that would be generated in treating 80,000 tons of scrap metal. Furthermore, in Phase II quantities the scrap would require extensive modifications in size and shape to prepare it for production-rate surface decontamination. As an alternative approach to the surface decontamination methods, BNI performed smelting of the scrap metal using inductoslag treatments. Using equipment and technology provided by ETE Consulting Engineers of Oak Ridge, Tennessee, several small high-frequency induction furnaces were used experimentally to remove contaminants as slag compounds. Results of the smelting experiments showed that effective decontamination was achieved for both copper and steel, whether the contamination was on the surface or internal.

Inductoslag smelting treatments of both copper and steel reduced the radioactive contaminants in the scrap to extremely low concentrations: less than 1 part per million of U-238, less than 1 part per billion (ppb) of U-235, less than 0.005 ppb of Pu-239, less than 0.5 ppb of Np-237, and less than 5 ppb of Tc-99. Inductoslag treatment of internally contaminated nickel achieved contaminant concentrations similar to those in the treated copper and steel, except for the concentration of Tc-99 (700 ppb). Inductoslag treatment of internally contaminated aluminum achieved similar concentrations of Pu-239 and Np-237, but did not lower the uranium or technetium concentrations to acceptable levels. It is concluded that further development of these treatments for nickel and aluminum will result in acceptable decontamination, and the use of the inductoslag smelting will be a viable method of decontamination in Phase II. No hazardous or mixed wastes were generated in Phase I, except for very small quantities of acidic solutions used to further decontaminate scrap steel that was not cleaned in the surface decontamination processes. Radioactive wastes generated by Phase I processes consisted primarily of approximately 5 cu ft of sludges from the water processing of scrap (with a surface area of 3830 sq ft), and less than 80 lb (0.5 cu ft) of metallic slag compounds from the smelting of 1500 lb of scrap metal. As the final project report, this document includes a section on planning Phase II of the DOE scrap metal program.

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Measurement and Sorting Techniques for Unrestricted Recycling of Metal from the Nuclear Industry

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 356-364) (1990)

This report describes a low-level radioactivity controller (LLC), with a large detection surface area, used at a decommissioning site. The LLC sorts parts weighing up to 500 kg as they move past the detectors. The device calculates the specific activity and the mean activity per unit area, while logging the measurement parameters and the number of parts scanned.

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Development of Assay System for Very Low Level Decommissioning Waste

CONF-911135 (Vol. 2); Nuclear Engineering, Proceedings of the First JSME/ASME Joint International Conference, November 4-7, 1991, Tokyo, Japan, Vol. 2, 593 pp.; (pp. 53-57) (November 1991)

An assay system for very-low-level radioactive waste generated during decommissioning is under development. The system will have much improved detection, performance, and treatment capacity. The 3 cubic-meter measurement container trolley has a lead shield and contains one of three types of detectors (NaI, Ge, or plastic). Measurements have been carried out on generally uniform metallic and concrete samples of up to 10 tons. The results indicate that the detection limit for the system when measuring quasi-homogeneous waste is well below 4000 Bq per ton with 300-second measurements. Three gamma-ray self-absorption compensation methods that use information such as scattering gamma-ray ratio and multiple gamma-ray intensity ratio are employed for radioactivity estimation. The improvement in measurement accuracy was achieved by using these methods rather than the conventional average-density compensation method.

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Estimates of Low-Level Waste Volumes and Classifications at 2-Unit 100 MWe Reference Plants for Decommissioning Scenarios

Proceedings of the 53rd Annual American Power Conference, Chicago, IL, April 29-May 1, 1991. Illinois Institute of Technology, Chicago, IL, Vol. 53 (Pt. 2); (pp. 1313-1321) (1991)

A number of nuclear utilities and industry organizations in the United States have evaluated the requirements for reactor decommissioning. These broad-scope studies have addressed the major issues of technology, methodology, safety and costs of decommissioning and have produced substantial volumes of data to describe, in detail, the issues and impacts which result. Commonwealth Edison Company (CECo) requested a limited, focused review of the impact which decommissioning for large, multi-unit nuclear power stations will have on low-level waste burial volumes for various decommissioning options. The objectives of the study were to provide CECo a reasonable basis for discussing low-level waste burial volumes for the most likely decommissioning options and to show how various decontamination and volume reduction technologies can be applied to provide additional reduction of the volumes that would be buried at low-level waste burial grounds.

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Key Parameters for the Safe and Economical Recycling of Contaminated Stainless Steel

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 772-776) (October 1989)

The decontamination and recycling of 8 tons of piping removed from a Belgian nuclear power station has been used by Westinghouse as a test case to evaluate the key technical and economic aspects of the recycling of large quantities of stainless steel. Selection of the decontamination process, methods used to measure the residual radioactivity after decontamination, and the amount of waste generated by both decontamination and melting are discussed. Economic data extrapolated to large quantities of waste are given to justify the selection of recycling over long-term storage.

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Decommissioning Waste Characteristics

EPA/520/1-90-013; CONF-8909236; Residual Radioactivity and Recycling Criteria, A.B. Wolbarst, H. Terada, and A.C.B. Richardson (eds.), Proceedings of a Workshop, St. Michaels, MD, September 27-28, 1989, 311 pp.; (pp. 28-43) (September 1989)

This paper describes the expected general characteristics of wastes produced from the decommissioning of nuclear facilities. For boiling water reactors and pressurized water reactors, the paper summarizes information extracted from studies performed by Pacific National Laboratories under contract to the U.S. Nuclear Regulatory Commission. These types of nuclear facilities will generate the largest volumes and activities of decommissioning wastes. The paper compares these studies with current waste generation information and briefly address decommissioning waste projections for other industries.

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Immobilisation of Active Concrete Debris Using Soluble Sodium Silicates

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier

Applied Science, Barking, United Kingdom, 858 pp.; (pp. 721-730) (October 1989)

Demolition of biological shields creates large amounts of active concrete debris; sodium silicate solutions are capable of immobilizing such debris in a pellet form. This study investigates debris immobilization via a silicate solution/debris slurry. The physical and chemical characteristics of demolition debris was studied, and laboratory scale trials show that only the finer (less than 5 mm) debris fractions set satisfactorily when mixed with a sodium-silicate solution. Debris from ordinary portland cement sets more quickly than debris containing a 30% pulverized fuel-ash cement replacement. The particle size is an important factor in the setting process, but chemical interactions are also significant. A ratio of 1.2:1 debris:sodium-silicate solution (SiO_2/Na_2O = 3.30) produced an optimum mix. A brief study of the logistics of full-scale application of the debris immobilization process is given.

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Effects of Residual Radioactivity in Recycled Materials on Scientific and Industrial Equipments

EPA/520/1-90-013; CONF-8909236; Residual Radioactivity and Recycling Criteria, A.B. Wolbarst, H. Terada, and A.C.B. Richardson (eds.), Proceedings of a Workshop, St. Michaels, MD, September 27-28, 1989, 311 pp.; (pp. 266-280) (September 1989)

Health effects, as well as scientific and industrial effects, should be assessed in establishing residual-radioactivity criteria for recycled materials. In this study, a comprehensive literature survey was carried out on the effects of residual radioactivity on scientific and industrial equipment. To develop a method for assessing the scientific and industrial impacts of recycling materials, an investigation also was conducted on measures to reduce these effects, based on the trends in rates of production of the equipment and on the progress of the technologies. The kinds of equipment most likely to be affected by residual radioactivity are large-scale integrated circuits (LSI), photographic films, and low-background radiation counters. Procedures for assessment of the effects of residual radioactivity on such equipment are suggested. Recycling of contaminated materials is expected to bring both gains and losses. An optimum residual-radioactivity level is proposed as an index for the assessment of the effects. The optimum residual-radioactivity level is defined as the level at which the difference between economic benefits and costs from recycling contaminated materials is maximum. The relationship between the optimum residual-radioactivity level and a level derived to produce no significant radiological hazard is discussed.

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Development of International Exemption Principles for Recycle and Reuse

EPA/520/1-90-013; CONF-8909236; Residual Radioactivity and Recycling Criteria, A.B. Wolbarst, H. Terada, and A.C.B. Richardson (eds.), Proceedings of a Workshop, St. Michaels, MD, September 27-28, 1989, 311 pp.; (pp. 281-289) (September 1989)

For the past several years, the International Atomic Energy Agency (IAEA) has been investigating the possibility of exempting certain radiation sources and practices from regulatory control. Initials efforts were conducted under the general heading of "de minimis." Interest in this topic arises from international recognition that a significant fraction of the wastes from industry, research, medicine, and the nuclear fuel cycle are contaminated to such low levels that applying regulatory controls may be unwarranted. The IAEA evaluation has been conducted by Advisory Groups considering two interrelated topics: establishing principles for exemption, and applying the principles to various areas of waste management. The IAEA Advisory Groups developed the criteria from modeled assessments of the potential radiation exposure pathways and scenarios for individuals and population groups

following the unrestricted release of radioactive materials. Although the scenarios and models used by the IAEA are necessarily generic, consultants to the Advisory Groups attempted to identify the most important radiation exposure pathways based on available literature. This approach is intended to provide the basic framework for the numerical derivation of generic exempt quantities that would be conservative in most situations. In their evaluations to date, the IAEA Advisory Groups considered: (1) disposal of exempt wastes in a sanitary landfill; (2) disposal of exempt wastes by incineration; (3) recycling of contaminated steel, aluminum, or concrete; and (4) reuse of concrete buildings, tools, or equipment. This paper discusses the current status of the IAEA's efforts on the subject of exemption and presents the generic results expressed as overall exemption limits for municipal wastes and materials for recycle and reuse.

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DOE Scrap Metal Recovery Project - Phase I Report (Volume 1)

Report; 65 pp. (July 30, 1987)

The Oak Ridge operations office of the United States Department of Energy (DOE) is administering a program to eliminate approximately 80,000 tons of contaminated scrap metal that have accumulated at various DOE facilities. DOE proposes to eliminate the scrap metal inventory by means of a two-phase approach. Phase I is a demonstration program that will establish a group of DOE qualified companies that are capable of processing the scrap at one or more of the sites. In Phase I, selected companies will be required to (1) decontaminate approximately 25 tons of scrap to demonstrate capability and (2) submit plans applicable to future elimination of the scrap inventories at one or more of the sites. Phase II consists of processing the contaminated scrap metal inventories, with the objective of releasing as much of the metal for unrestricted use as is economically feasible.

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Large Shielded Industrial Packages for the Transport of Intermediate Level Waste

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 455-467) (December 1989)

A study of the factors which affect the design of large shielded containers for the transport of intermediate-level waste from the decommissioning of nuclear power stations has been performed, culminating in the development of concepts for self-shielded and returnable, shielded industrial packages. The latter design is relatively insensitive to changes in disposal costs and is more adaptable to regulatory changes. Designs weighing 65 tons are described. A novel proposal is to use sprayed fiber-reinforced concrete for the walls of the inner disposable container.

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Melting of Radioactive Metal Scrap from Nuclear Installations

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 482-493) (1990)

Between 1984 and 1989, the process of melting radioactive scrap was established in Germany. To date, more than 2000 tons of low-level contaminated scrap (less than 74 Bq/g) have been melted and recycled. About 95% of the radioactivity present in the recycled scrap was either Co-60 or Cs-137, although cesium activity should be lower in plants with minimal damage to fuel elements. Cesium was found in slag and filter dust, whereas cobalt remained in the melt. A separate and modern facility was constructed due to the results from the previous tests. The maximum activity level to be handled will be 500 Bq/g. Here the "onion-casting" technique for processing radioactive metal scrap will be tested. A first casting was done using non-contaminated material.

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Behaviour of Difficult to Measure Radionuclides in the Melting of Steel

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 516-525) (1990)

A direct alpha-measurement technique was developed to measure alpha radionuclides in steel samples. Only this type of direct measurement is effective on steel containing alpha emitters, as a decision measurement to assure that the steel decontaminated by the melt process can be released for unrestricted reuse. In general, the melt experiments confirmed the expected behavior of the radionuclides selected for the experiments. Fe-55 and Ni-63 distribute homogeneously in the metal ingot, as was expected from the behavior of Co-60. Co-60 may be used as an indicator nuclide for Fe-55 and Ni-63, which are both difficult to measure. C-14 shows a comparable behavior and is homogeneously distributed in carbon steel. As expected, strontium is released to the slag in the melt process. The principle is also valid for actinides. The behavior of actinides in the melt process depends to some extent on the chemical form (elemental uranium, UO2), the added tracer quantity, and the quantity of slag-forming material added in the melt process.

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W.W. Scott and M.L. McKernan, Roy F. Weston, Inc., Germantown, MD

Decontamination and Decommissioning Methods and Management of the Resultant Waste Products

CONF-910270; Waste Management '91: Working Towards a Cleaner Environment - High-Level Waste, Low-Level Waste, Mixed Waste and Environmental Restoration, R.G. Post (ed.), Proceedings of a Conference, Tucson, AZ, February 24-28, 1991; (14 pp.) (February 1991)

The nuclear industry has been active in developing cost effective techniques for decontamination and decommissioning of nuclear sites and facilities for more than 40 years. Important to the planning and implementation of physical decommissioning procedures is knowledge of past and current successful practices. A brief overview is given of selected U.S. Department of Energy decontamination and decommissioning projects. Types of waste generated, curie content, radiation levels, shipping containers, specific methods for managing waste, and release levels are discussed. A specific problem is identified for managing radioactive wastes, and a practical method for reduction of radioactive waste volume is described.

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U.S. Nuclear Regulatory Commission, Office of Nuclear Regulatory Research, Washington, DC

Report on Waste Burial Charges - Escalation of Decommissioning Waste Disposal Costs at Low-Level Waste Burial Facilities

NUREG-1307 (Rev. 2); 39 pp. (May 1991)

This report, which is scheduled to be revised annually, contains the development of a formula for escalating decommissioning cost estimates that is acceptable to the NRC, and contains values for the escalation of radioactive waste burial costs, by site and by year. The licensees may use the formula, the coefficients, and the burial escalation from the report in their escalation analyses, or they may use an escalation rate at least equal to the escalation approach presented here. Revision 2 of the report corrects several errors in the calculations and disposal costs for the reference PWR and the reference BWR.

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Tunney's Pasture Decommissioning Project

OECD/NEA Co-Operative Program on Decommissioning, 10th Meeting of the Technical Advisory Group, Karlsruhe, Federal Republic of Germany, April 22-26, 1991; (5 pp.) (April 1991)

Since October 1990, most of the work at Tunney's Pasture in Ottawa, Canada has involved planning and preparatory activities in anticipation of the Canadian licensing authority's permission to proceed with decommissioning activities. The work has progressed in the following areas: (1) mobilization of resources (i.e., staff and tradespersons); (2) procurement of mechanical equipment (e.g., drum compactor for reduction of waste volume); (3) staff training; (4) isolation of equipment no longer required for decommissioning activities; (5) installation of temporary systems (i.e., filters for ventilation, electrical power supply, compressed air, lighting, etc.); and (6) constructing a handling and packaging area for radioactive wastes. The total cost of the project is estimated at 13.1 million Canadian dollars.

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W. Harbecke, Kernkraftwerk Lingen GmbH, Lingen, Federal Republic of Germany

The Decommissioned Lingen Nuclear Power Station (KWL)

ATW, Atomwirtschaft, Atomtechnik 36(12):565-567 (December 1991)

The decision to decommission the Lingen Nuclear Power Station (KWL) was made in 1981. The safe enclosure phase began in 1988. The licensing procedure on the decommissioning activities was not subdivided into partial steps. Consequently, the decommissioning permit included these main items: (1) shutdown of KWL; (2) establishing and maintaining the safe enclosure status; (3) putting a number of plant components to different uses and dismantling other components.

283
R.C. Pant, Bhabha Atomic Research Centre, Bombay, India

Decommissioning of Research Reactor ZERLINA

IAEA-SR-179; CONF-920577; Ageing, Decommissioning, and/or Major Refurbishment of Research Reactors, Proceedings of an IAEA Seminar for Asia and the Pacific, Bangkok, Thailand, May 18-22, 1992; (12 pp.) (1992)

ZERLINA, or Zero Energy Reactory for Lattice Investigations and New Assemblies, was India's third research reactor, commissioned in 1961. The reactor was located at the Bhabha Atomic Research Centre, Bombay. Normally, ZERLINA was operated at a nominal power level of 100 w(t), with a corresponding maximum neutron flux of 1 x 10(E+7) n/sq cm/sec. After 22 years of successful operation, the reactor had served its purpose and the space it occupied was required for other activities. ZERLINA's decommissioning began in March 1983. The work took about two months. This paper describes the decommissioning plan and briefly discusses the major decommissioning steps.

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Experience of Research Reactor Decommissioning in Japan

IAEA-SR-179/9C; CONF-920577; Ageing, Decommissioning, and/or Major Refurbishment of Research Reactors, Proceedings of an IAEA Seminar for Asia and the Pacific, Bangkok, Thailand, May 18-22, 1992; (31 pp.) (May 1992)

This report reviews the experience gained by Japanese engineers from decommissioning seven research reactors in Japan, compares the individual decommissioning projects, and reevaluates them based on today's knowledge. The need for careful and detailed planning is perhaps the most important lesson that was learned. Four of the facilities were critical assemblies, designed to determine appropriate size of the reactor core needed and other reactor characteristics. Of these four, one (the Aqueous Homogenous Critical Facility or AHCF) was an aqueous-homogeneous, enriched-uranium, heavy water-moderated, tank-type assembly. The other three were light water moderated assemblies. The three reactors decommissioned were the Japan Research Reactor No. 1 (JRR-1), a water boiler reactor; the Hitachi Training Reactor (HTR), a pool type reactor; and the Japan Research Reactor No. 3 (JRR-3), a heavy water moderated reactor. The timetable and details of each of the seven decommissioning projects are described.

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M. Laraia, International Atomic Energy Agency, Vienna, Austria

IAEA Activities on Decommissioning of Research Reactors and Other Small Nuclear Facilities

IAEA-SR-179; CONF-920577; Ageing, Decommissioning, and/or Major Refurbishment of Research Reactors, Proceedings of an IAEA Seminar for Asia and the Pacific, Bangkok, Thailand, May 18-22, 1992; (15 pp.) (1992)

Decontamination and decommissioning (D&D) activities were introduced in the IAEA's program in 1973. Currently, all IAEA D&D activities are consolidated within the Waste Management program. Since 1980, the IAEA has published 14 technological review reports and four safety and regulatory guidance reports on D&D; it is recognized that these existing publications generally satisfy the current needs of IAEA Member States. As decommissioning activities become more frequent, the emphasis of the IAEA D&D program has shifted to other areas of interest, including regulations, standards, guides, and direct assistance to Member States. A highlight of the program is the preparation of a Safety Standard on Decommissioning, accompanied by two Safety Guides. In response to needs of specific Member States, work has begun on the preparation of reports on the planning and management aspects, including economic evaluations, of decommissioning research reactors, radiochemical laboratories, hot cells, and other small nuclear facilities. The transfer of D&D experience has been provided through an interregional training course on the decontamination of research reactors, held in France in June 1991. Increased emphasis has also been placed on technical assistance to Member States in the safe confinement, rehabilitation, and long-term storage of uranium mill tailings, and in the environmental restoration of mining and milling sites.

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Dismantling and Shutdown of a Nuclear Fuel Cycle Facility: The Belgian Context

CONF-8803283; Decommissioning of Fuel Cycle Nuclear Facilities, Proceedings of a Meeting, Paris, France, March 15, 1988. Societe Francaise d'Energie Nucleaire, Paris, France, 301 pp.; (pp. 209-215) (1988)

The problems encountered during the dismantling of Eurochemic plants and problems in the production of nuclear fuel assemblies at the Mol-Dessel site are discussed. Regulations and technical aspects relating to the shutdown are analyzed. The steps concerning the computation of the nuclear wastes and the actions required for reprocessing, cladding, storing temporarily, and removing all the nuclear wastes are summarized. The cases of the nuclear fuel fabrication plants and of the Belgoprocess are overviewed.

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A Utility View of Decommissioning a Gas-Cooled Reactor

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 777-781) (1990)

The South of Scotland Electricity Board has begun preparations for the decommissioning of Hunterston A Power Station, which has two Magnox Gas-cooled Reactors and was commissioned in 1964. Decommissioning will take place in three stages: (1) removal of fuel, (2) removal of the external plant, and (3) dismantling of the reactor. This paper is concerned with non-technical aspects, beginning with the initial planning and the preparation of the necessary papers required by the regulatory authorities. Attention is drawn to the large commitment of specialized resources needed at this stage. Personnel matters and local liaison are also discussed, and the desirability of early work in these areas is highlighted. The time of stage-2 work is considered and several alternatives are noted. Some implications of site redevelopment are also discussed. It is concluded that the non-technical aspects of decommissioning require early consideration and the provision of significant resources, but they should not cause undue delays or cost increases in the work.

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D.C. Pocock, H. van Exel, R. Oberpichler, D. Beukelmann, R. Huth, and B. Rose, Taylor Woodrow Construction Limited, Southall, United Kingdom; Stangenberg, Schnellenbach und Partner Gemeinschaft Beratender Ingenieure GmbH, Bochum, Federal Republic of Germany; Technischer Ueberwachungs-Verein Bayern eV, Muenchen, Federal Republic of Germany

Deterioration Assessment of Nuclear Power Station Buildings and Long-Term Stability and the Leak Tightness of Reactor Containments

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 51-67) (1990)

Current suggestions are that complete dismantling and removal of reactors and associated buildings and a return of sites to green field conditions may be delayed for up to about 100 years after plants cease generation. Throughout their remaining operating life and the delay period, structures are expected to perform their intended functions efficiently. Since power stations have been designed for comparatively shorter working lives, assessment of the long-term performance of these structures is required.

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Testing of New Techniques in Decommissioning of a Fuel (U,Th) Fabrication Plant, Special Consideration to Free Release Measurement of Low Uranium Activities

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 386-394) (1990)

For the decommissioning of a fuel fabrication plant like NUKEM-A, the identification of uranium isotopes and thorium in large residue masses and volumes, with contents down to natural levels, is an important task. A contamination map of NUKEM-A was prepared and compared with the natural contents of uranium isotopes and thorium in conventional building materials. Liquid

scintillation equipment was tested for detection of low uranium activities. A computer program was created to calculate calibration factors allowing the measuring techniques to be judged mathematically, as used by a barrel scanner combined with height resolution gamma spectrometry.

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L. Teunckens, Belgoprocess NV, Nuclear Services Department, Dessel, Belgium

Decommissioning Project - The "Purple Shed"

OECD/NEA Co-Operative Program on Decommissioning, 10th Meeting of the Technical Advisory Group, Karlsruhe, Federal Republic of Germany, April 22-26, 1991; (2 pp.) (April 1991)

The "Purple Shed" was a wooden storage building located at the former waste treatment plant of the Belgian Nuclear Research Center in Mol, Belgium. The shed was constructed in 1970 and was used for the storage and processing of Ra- and Ac-contaminated waste. In 1988 the shed was emptied and all the waste transferred to containers. Before dismantlement the shed was repaired with wooden plates to avoid the spread of contamination during decommissioning. In 1990 the shed was dismantled. Dismantling was executed in two phases: (1) dismantling of the stack, the filtration unit, and the cleaning of the inner parts of the shed; and (2) demolition of the wooden shed itself. During dismantling the shed was connected to a mobile ventilation unit. A tent was constructed inside the shed to allow the cutting of pipes and other parts inside the building. Preliminary data on waste produced during decommissioning are available.

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F. Motte, Centre d'Etude de l'Energie Nucleaire, Mol, Belgium

The Decommissioning of the BR3 Reactor

OECD/NEA Co-Operative Program on Decommissioning, 10th Meeting of the Technical Advisory Group, Karlsruhe, Federal Republic of Germany, April 22-26, 1991; (29 pp.) (April 22-26, 1991)

This report describes the decommissioning of the BR3 pressurized water reactor. The project is divided into three phases: (1) decontamination of the reactor primary loop and dismantlement of the thermal shield; (2) dismantlement of other reactor internals; and (3) dismantlement of the reactor primary loop.

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F. Motte, H. Operschall, and M. Bourdelet, Centre d'Etude de l'Energie Nucleaire, Mol, Belgium; Siemens AG, Erlangen, Federal Republic of Germany; Societe Franco-Americaine de Constructions Atomiques, Paris-la-Defense, France

The Decommissioning of the BR3 Pressurized Water Reactor Plant

CONF-911135 (Vol. 2); Nuclear Engineering, Proceedings of the First JSME/ASME Joint International Conference, November 4-7, 1991, Tokyo, Japan, Vol. 2, 593 pp.; (pp. 7-14) (November 1991)

The decommissioning of the BR3 reactor, the first PWR reactor built in Western Europe, has begun. This project is partially financed by the Commission of the European Communities, in the framework of its third five-year (1989-1993) program of research and technological development on the decommissioning of nuclear facilities. Phase 1 of this project, covering 1991 and 1992, involves the chemical decontamination of the plant primary loop, the design and construction of equipment for the dismantling of the highly radioactive reactor internals, and the testing of this equipment during segmentation of the reactor vessel thermal shield. The segmenting equipment has been tested in cold conditions on a full-size mock-up of the thermal shield. Preliminary results of the primary loop decontamination and of the cold testing of the segmenting equipment are given. Complete results will be given after the cutting of the thermal shield.

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Atomic Energy Control Board, Advisory Committee on Nuclear Safety, Ottawa, Ontario, Canada

General Principles Underlying the Decommissioning of Nuclear Facilities

INFO-0273; 22 pp. (March 1988)

Previous statements on the use of the term "decommissioning" by the International Atomic Energy Agency, the Atomic Energy Control Board, and the Advisory Committee on Nuclear Safety are reviewed, culminating in a particular definition for its use in this paper. Three decommissioning phases are identified and discussed, leading to eight general principles governing decommissioning, including one related to financing.

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I.J. Itzkovitch (ed.), Eldorado Nuclear Limited, Port Hope, Ontario, Canada

Proceedings of the Canadian Nuclear Society Fifth Annual Conference

INIS-mf-12832; CONF-840613; Proceedings of the 24th Annual International Conference of the Canadian Nuclear Association and the Fifth Annual Conference of the Canadian Nuclear Society, I.J. Itzkovitch (ed.), Saskatoon, Saskatchewan, Canada, June 3-6, 1984, 132 pp. (1984)

The twenty papers presented at this conference covered the areas of (1) modeling and analysis, emphasizing thermal hydraulics in CANDU primary heat transport systems; (2) nuclear technologies in general, particularly relating to the operation and performance of CANDU reactors; and (3) tailings and reactor waste disposal.

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N. Jayawardene and S. Naqvi, Ontario Hydro, Toronto, Ontario, Canada

Ontario Hydro Proposes Canning and Burying CANDU Reactors

Nuclear Engineering International 35(434):22-24 (September 1990)

Decommissioning plans typically assume a "deferred dismantling" approach composed of three stages: (1) shutting down and thorough decontamination, (2) storage and surveillance, and (3) dismantling and disposal. This method of decommissioning conforms to mainstream thinking, which involves piece-by-piece dismantling of the reactor units and associated plants, cutting and packaging of all components, and transporting and disposing of the radioactive waste in an off-site disposal facility. In 1986, Ontario Hydro presented an alternative decommissioning concept which involves "canning" the reactor in its biological shield tank, removing it and other major components as a single piece, and burying the entire package in the underlying bedrock. The merits of this concept are: (a) little or no transport of radioactive materials off-site, (b) reduced need for developing sophisticated remote-cutting and -handling equipment procedures, (c) reduced radiation doses to crews, and (d) no need for developing large, off-site disposal vaults for decommissioning wastes. The authors argue that it would be both technologically sound and socially prudent to locate future nuclear stations on sites that have suitable characteristics for "in situ" decommissioning and disposal of reactors.

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S. Zhao, Beijing Institute of Nuclear Engineering, Beijing, China

The Brief Introduction to Decommissioning of Nuclear Reactor Projects

Nuclear Power Engineering 12(4):45-48 (August 1991)

The basic concept and the procedure for the decommissioning of a nuclear reactor and the three stages of decommissioning defined by IAEA are introduced in this article. The main work of decommissioning a nuclear reactor proceeds as follows: (1) the documentary and technological preparation; (2) the site preparation of the decommissioning project; (3) the dismantling of the equipment, piping system, and components; (4) the decontamination of the piping system before and after decommissioning; and (5) the storage and disposal of the operational and decommissioning waste.

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Federal Ministry of Fuels and Energy, Praha, Czech and Slovak Federal Republic

Information of Present Status of NPP A-1 Bohunice

OECD/NEA Co-Operative Program on Decommissioning, 10th Meeting of the Technical Advisory Group, Karlsruhe, Federal Republic of Germany, April 22-26, 1991; (6 pp.) (1992)

A relatively comprehensive description on the main features, history, and decommissioning of the Bohunice A-1 nuclear power plant are given in the Nuclear Engineering International journal article attached to this brief 1992 report to the tenth Technical Advisory Group meeting. The two-page report lists new facts that have come to light since the article appeared and updates the decommissioning time schedule that resulted from the changes.

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A. Cregut and A.R. Gregory, Commissariat a l'Energie Atomique, Centre de Marcoule, Bagnols-sur-Ceze, France; National Power, Leatherhead, United Kingdom

Decommissioning of Nuclear Installations in Member States: Achievements and Projects

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 5-12) (1990)

Since the last International Conference arranged by the European Commission was held in Luxembourg five years ago, some important and exciting developments in the field of decommissioning of nuclear facilities have been achieved. Knowledge and capability have been accumulated from joint research and development programs which have been coupled with practical experience gained from actual dismantlement of prototype reactors and other plants. Member countries are now in a strong position to address the task of undertaking the decommissioning of the first round of commercial nuclear power stations which, having operated successfully for 20 years or more, are now being taken out of service. It is now time to review the capability to meet this goal technically and financially, while taking into account waste management, regulatory requirements and public relations.

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K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski, Commission of the European Communities, Directorate General for Science, Research and Development, Brussels, Belgium

Decommissioning of Nuclear Installations

CONF-891077; Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp. (1990)

The European Community is conducting research on the decommissioning of nuclear installations, with the prime objective of developing effective techniques and procedures to ensure the protection of man and his environment against the potential hazards of nuclear installations that have been finally shut down. This book contains the results of the 1984-1988 five-year program of research on the decommissioning of nuclear power plants, which were presented at the International Conference on the Decommissioning of Nuclear Installations, held at the Palais des Congres, Brussels, Belgium, October 24-27, 1989. The program extended to all types of installations of the nuclear fuel cycle and produced numerous scientific and technical achievements, some of which have already been tested on an industrial scale. In particular, great progress has been achieved in the reduction of metal waste arising from decommissioning, due to advances in aggressive decontamination procedures and techniques for melting and recycling low-level radioactive waste metal. These results will be of specific interest to those in the nuclear, reliability, safety, mechanical and structural engineering industries. These proceedings include all 82 papers

presented at the conference. Individual papers of particular interest have been indexed and abstracted separately.

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Status of Work on Decommissioning the THTR 300

ATW, Atomwirtschaft, Atomtechnik 36(12):577-579 (December 1991)

The Thorium-Hochtemperatur Prototype Reactor-300 (THTR-300) was approved for commercial operation on June 1, 1987, and was shut down for a scheduled annual revision on September 29, 1988. After lengthy negotiations about restarting the plant, the reactor was permanently shut down on September 1, 1989. Decommissioning is to be performed in four phases, with the goal of safe containment by 1994. The plant will be maintained in the safe containment phase for thirty years, followed by dismantlement. As of December, 1991, the reactor was in the outage mode, awaiting issuance of a permit for core unloading.

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Kernforschungszentrum Karlsruhe GmbH, Karlsruhe, Federal Republic of Germany

Decommissioning of Nuclear Facilities and Power Reactors in Germany - Status, 1991

OECD/NEA Co-Operative Program on Decommissioning, 10th Meeting of the Technical Advisory Group, Karlsruhe, Federal Republic of Germany, April 22-26, 1991; (28 pp.) (1991)

This paper is a series of visual aids designed to accompany an overall summary presentation of the decommissioning projects operated by KfK (Kernsforschungzentrum Karlsruhe, or Karlsruhe Nuclear Research Center) in Germany during 1990. A total of 17 projects are listed by type of facility, the thermal and electrical output of each, and the stage of decommissioning at each. A more detailed, individual presentation is given on six of these nuclear facility decommissioning projects: (1) the HDR BWR-type, superheated steam reactor - in the planning stage; (2) the MZFR multipurpose, PWR-type, D2O-cooled and -moderated reactor - dismantlement started; (3) the KNK compact, sodium-cooled, fast breeder-type power station - decommissioning planning started; (4) the KKN pressure tube-type, D2O-moderated, CO2-cooled reactor system - remote-controlled dismantling in process; (5) the WAK PUREX-process reprocessing plant, shut down in late 1990 - decommissioning planning begun; and (6) the FR-2 research reactor, D2O-cooled and - moderated - in Stage II decommissioning. Accompanying the sections on individual projects is a section describing KfK's main activities, particularly Activity 17, Handling Technology.

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Six Years of Experience with Decommissioning and Dismantling VAK

ATW, Atomwirtschaft, Atomtechnik 36(12):571-573 (December 1991)

After twenty-five years of successful operation, VAK was shut down permanently on November 25, 1985. Decommissioning will be carried out in three phases by the year 2000. In the first phase, the components of the turbine hall, which is not part of the controlled area, will be dismantled and scrapped. In phase two, the radioactive materials in the plant will be contained and reduced in volume. The third and final phase includes the complete disposal of the plant.

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D. Raum and F. Schmid, Technischer Ueberwachungs-Verein Bayern eV, Muenchen, Federal Republic of Germany

Experience Accumulated in Expert

Consultancy about Decommissioning Nuclear Power Plants

ATW, Atomwirtschaft, Atomtechnik 36(12):551-555 (December 1991)

Consultancy by the Technical Inspectorate depends on a commission by the public authorities. The expert consultant is called in to examine whether the required state-of-the-art provisions have been made to protect against damage arising from the decommissioning of the plant. The rules of procedure under the Atomic Energy Act define the type and scope of the documentation to be filed in the licensing procedure. In the evaluation of these documents, no difference is made between decommissioning and erecting a plant. The disassembly manual contains all important safety data.

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M.C. Schuchardt, Kernforschungszentrum Karlsruhe GmbH, Karlsruhe, Federal Republic of Germany; Bundesministerium fuer Forschung und Technologie, Projekttraeger Universitaetsforschung zum Nuklearen Brennstoffkreislauf/Stillegung von Nuklearanlagen, Bonn, Federal Republic of Germany

Collection of Papers Presented for the Status Report 1989 of the Central Bureau for Management and Coordination of Projects Concerning the Decommissioning of Nuclear Facilities

CONF-8911319; Proceedings of a Conference, Hanover, Federal Republic of Germany, November 15-16, 1989, 350 pp. (April 1990)

This paper deals with the development of techniques and methods for dismantling reactor and nuclear power plant components. It focuses on plasma-arc cutting under water, arc water-jet cutting, and high-pressure abrasive-jet cutting. The results of dismantling experiments carried out in the Karlstein HDR reactor by means of explosive fracturing are reported. Other topics concern the final disposal of radioactive waste in the Konrad ore mine.

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Status of Decommissioning Work at the Gundremmingen Unit A Power Station

Kerntechnik 56(6):367-371 (1991)

In early 1980, it was decided to decommission the Gundremmingen Unit A Power Station. The experiences from dismantling, disassembling, decontamination, and activity measurement, resulting from the treatment of about 4000 tons of material released from the controlled area, are described. The recycling of carbon steel for use in the nuclear industry, e.g., for production of waste containers, is an important technique for reducing the waste volume, and has been performed with 1500 tons of steel scrap. An overview of scheduled decommissioning activities is given.

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Kernforschungszentrum Karlsruhe GmbH, Karlsruhe, Federal Republic of Germany

Karlsruhe Nuclear Research Center

OECD/NEA Co-Operative Program on Decommissioning, 10th Meeting of the Technical Advisory Group, Karlsruhe, Federal Republic of Germany, April 22-26, 1991; (27 pp.) (1992)

This report describes in some detail the activities of the Karlsruhe Nuclear Research Center, host of the 10th Technical Advisory Group Meeting. The Center is organized as a private company (GmbH) under German law, whose shareholders are the federal government (90 percent) and the State of Baden-Wurttemberg (10 percent). Activities of the Center include the construction of experimental facilities and demonstration plants and the execution of experimental and operating programs, often jointly with industries and public institutions. Since the early 1980s, the Center's research activities in nuclear fission have been reduced steadily, from an original proportion of 80 percent to about 30 percent in 1990, as nuclear technology

increasingly changed to commercial use and passed into the hands of private industry. Current work in nuclear technology is focused on safety and waste management, two fields in which the government is responsible for making appropriate provisions.

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Karlsruhe Reprocessing Plant (WAK)

OECD/NEA Co-Operative Program on Decommissioning, 10th Meeting of the Technical Advisory Group, Karlsruhe, Federal Republic of Germany, April 22-26, 1991; (18 pp.) (1992)

The Karlsruhe Reprocessing Plant (WAK) is an experimental facility whose technical design and size were chosen to allow the operating experience accumulated with it to be transferred to an industrial-scale reprocessing plant. WAK's construction and operation has produced experience from which those planning, building, running, and decommissioning the industrial-scale plant, the Wackersdorf Reprocessing Plant (WAW), will benefit. As WAK is an experimental plant, only about half of its time is available for reprocessing operations. The planned down-time is used for the execution of technical development projects. WAK will provide qualified personnel for decommissioning the plant as it is scheduled, after the completion of its operating program. The decommissioning date depends on the timetable and construction of the commercial WAW plant. Along with this descriptive report, a schedule for this decommissioning was presented at the tenth Technical Advisory Group meeting, in a master schedule for the decommissioning of other nuclear facilities in Germany submitted by the Kernsforshungszentrum Karlsruhe.

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W. Demant, Kernforschungszentrum Karlsruhe GmbH, Erection and Decommissioning of Nuclear Facilities Division, Karlsruhe, Federal Republic of Germany

The Decommissioning of the Nuclear Power Plant MZFR at the Kernforschungszentrum Karlsruhe

OECD/NEA Co-Operative Program on Decommissioning, 10th Meeting of the Technical Advisory Group, Karlsruhe, Federal Republic of Germany, April 22-26, 1991; (16 pp.) (April 1991)

This report describes decommissioning activities carried out at the nuclear power plant MZFR in Karlsruhe, Federal Republic of Germany, for the period October 1990 through April 1991. The second decommissioning license was granted on April 2, 1990, and covers the following activities: (1) decommissioning of auxiliary systems no longer needed; (2) simplification of auxiliary systems still in use; (3) drying of all systems using a mobile drying plant; and (4) exclusion of the turbine hall, cooling towers and water conditioning plant from the area covered by the license, and dismantling of the components located in these buildings. The third decommissioning license was applied for in January, 1991, and covers the following activities: (a) dismantling of the auxiliary reactor systems in the auxiliary area and inside the reactor building; (b) dismantling of the systems inside the fuel pool building; and (c) simplification of the power supply. The third license is expected to be granted in 1992. All decommissioning activities will be completed by the year 2001.

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Decommissioning of the MZFR Nuclear Power Plant at the Karlsruhe Nuclear Research Center

CONF-911135 (Vol. 2); Nuclear Engineering, Proceedings of the First JSME/ASME Joint International Conference, November 4-7, 1991, Tokyo, Japan, Vol. 2, 593 pp.; (pp. 15-19) (November 1991)

The MZFR multipurpose research reactor was permanently shut down on May 3, 1984. Planned

decommissioning of MZFR provides for disposal in five steps. The first two steps consist of preparatory dismantling work and simplification of the systems to be dismantled. The third and fourth steps involve dismantling both the reactor auxiliary systems in the auxiliary building and the reactor systems in the reactor building. In the fifth step, remote dismantling of the reactor pressure vessel and demolition of the building will take place. Decommissioning work is scheduled to be completed by the year 2001.

310
V. Rudinger and K. Grabenstatter, Kernforschungszentrum Karlsruhe GmbH, Projektbereich Anlagen, Karlsruhe, Federal Republic of Germany

Progress Report for the Neideraichbach Nuclear Power Plant (KKN)

OECD/NEA Co-Operative Program on Decommissioning, 10th Meeting of the Technical Advisory Group, Karlsruhe, Federal Republic of Germany, April 22-26, 1991; (4 pp.) (April 1991)

This report documents progress made toward decommissioning of the Neideraichbach Nuclear Power Plant (KKN) in Karlsruhe, Federal Republic of Germany, for the period November 1990 to April 1991. The most important project completed during the period was the remote-controlled dismantlement of the pressure tube reactor. Due to broader-than-expected welds and cooling and lubrication problems, this part of the project took longer to complete than expected. Dismantling of the activated structures of the reactor building are scheduled to begin in the middle of 1992.

311
S. Finzi, Societe Francaise d'Energie Nucleaire, Paris, France

The Shutdown of Nuclear Plants and Its Perspectives

CONF-8803283; Decommissioning of Fuel Cycle Nuclear Facilities, Proceedings of a Meeting, Paris, France, March 15, 1988. Societe Francaise d'Energie Nucleaire, Paris, France, 301 pp.; (pp. 293-301) (1988)

The projects of the Committee relating to the shutdown of nuclear facilities are presented. The purposes and results of the first two projects, carried out respectively from 1979 to 1983 and from 1984 to 1988, are reviewed. The third project (1989-1993) includes, as did the first ones, the following steps: (1) research and development actions; (2) the definition of the construction, operation and shutdown of the nuclear facility; and (3) tests of new dismantling techniques. The prospects for the dismantling of nuclear facilities from 1992 to 2000 are examined in an European context.

312
M. Laraia, European Nuclear Energy Agency, Rome, Italy

Decommissioning Nuclear Reactors in Italy: the Unrestricted Release Issue

Energia Nucleare 8(1):65-72 (January-April 1991)

A number of small-sized Italian research reactors became obsolete in the early 1980's. From 1983 to 1987, three small-sized research reactors, ROSPO, RITMO and RANA, were dismantled at the ENEA (Italian Commission for Nuclear and Alternative Energy Sources) Casaccia Centre, and the site was released for unrestricted use. Meanwhile, two more research reactors, RB-1 and RB-2, were dismantled at the Montecuccolino Laboratories (Bologna). In this paper, an Italian study on unconditional recycling or disposing of thousands of tons of solid materials resulting from the decommissioning of a massive nuclear power station is presented. The results show that the adopted levels for unconditional release of solid materials meet International Atomic Energy Authority dose targets. Special consideration is given to the ENEL (the Italian National Electricity Board), Garigliano boiling water reactor, whose operating license was modified with the aim of achieving a 30-to-50 year passive safe-storage condition.

313
European Nuclear Energy Agency, Rome, Italy

Garigliano NPP - Decommissioning Schedule

OECD/NEA Co-Operative Program on Decommissioning, 10th Meeting of the Technical Advisory Group, Karlsruhe, Federal Republic of Germany, April 22-26, 1991; (2 pp.) (April 1991)

This paper is a two-page schedule of 29 individual projects at the Garigliano nuclear power plant decommissioning in Italy from 1991 to 1996. Several activities were scheduled to begin or end in 1991 and 1992. Final completion of the decommissioning work is scheduled for mid-1996.

314
M. Akiyama, Atomic Energy Society of Japan, Tokyo, Japan

Research and Development on Decommissioning of Nuclear Facilities in Japan

CONF-910817; Structural Mechanics in Reactor Technology, H. Shibata (ed.), Transactions of the 11th International Conference, Tokyo, Japan, August 18-23, 1991. Atomic Energy Society of Japan, Tokyo, Japan, 6297 pp.; (pp. 45-56) (1991)

The Japan Power Demonstration Reactor (JPDR) first began nuclear power generation in 1963. Since then, the development, construction, and operation of nuclear power plants in Japan has expanded. Most Japanese commercial reactors are light water reactors. Thirty-nine nuclear power plants are currently being operated, and nuclear power generation accounts for about 25% of the total yearly power generation in Japan. However, it is forecast that plans for decommissioning commercial nuclear power plants will be developed soon after the mid-1990s. After termination of operations, plants should be decommissioned in a manner that promotes the understanding of nuclear power generation within local communities. Public and worker safety must be ensured, decommissioning technology must be developed, and the systems and regulations for the funding and disposal of waste must be established. This paper addresses the status of the preparation activities for future Japanese decommissioning, and focuses on the policies and technological developments being promoted.

315
T. Tokuine, Kansai Electric Power Company, Inc., Osaka, Japan

Decommissioning of Nuclear Power Plant

Karyoku Genshiryoku Hatsuden 42(2):184-196 (February 1991)

Research and development in Japan and throughout the world shows that Japan can adequately cope with decommissioning requirements by using existing or improved techniques. In order to reduce the occupational radiation dose, decrease radioactive waste and improve the efficiency of the decommissioning process, governmental authorities and nuclear plant owners have been doing further studies in a systematic and efficient way. This paper describes the results of a system engineering study that focuses on dismantling procedures.

316
K. Tomii, M. Yokota, and T. Hoshi, Japan Atomic Energy Research Institute, Department of Japan Power Demonstration Reactor, Tokai, Ibaraki, Japan

Advances in the Decommissioning of the JPDR (Japan Power Demonstration Reactor)

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 818-827) (1990)

Since 1986, the actual dismantling of the Japan Power Demonstration Reactor (JPDR) has been carried out using dismantling techniques developed at the Japan Atomic Energy Research Institute

(JAERI). Except the utility system in the reactor enclosure all the equipment and the piping around the reactor have already been removed. Since 1988, highly activated reactor internals have been dismantled using underwater plasma arc cutting devices developed at JAERI. This paper describes the progress of the JPDR dismantling and outlines the dismantling experience obtained.

317
N. Usui

Japan Pushes Nuclear Decommissioning Work

Engineering News-Record 225(11):78-79 (September 13, 1990)

Decommissioning of outdated nuclear reactors has become a major challenge for scientists and nuclear utilities around the world. Some countries simply contain reactors within concrete walls, and others tightly mothball them. Japan, with 38 commercial reactors and extremely limited land space, is attempting to dismantle everything and recycle the vacant space by building new units. The fast-approaching retirement date for many of Japan's nuclear reactors has the Japan Atomic Energy Research Institute accelerating its nuclear decommissioning technology demonstration program. Two new methods to disassemble and store two small, retired nuclear test reactors are discussed. One method utilizes an arc saw (which never comes into direct contact with the vessel surface) to dismember the reactor vessel. In a job that preceded the use of the arc saw, the entire reactor block of a small unit was removed by hoisting it, moving it 1100 feet, and then lowering it into a concrete-lined underground chamber for permanent storage. Because of their size, larger commercial reactors cannot yet be decommissioned by these innovative means.

318
T. Hoshi, Japan Atomic Energy Research Institute, Department of Japan Power Demonstration Reactor, Tokai, Ibaraki, Japan

The JPDR Decommissioning Program

OECD/NEA Co-Operative Program on Decommissioning, 10th Meeting of the Technical Advisory Group, Karlsruhe, Federal Republic of Germany, April 22-26, 1991; (13 pp.) (April 1991)

This report accompanies a progress report on the Japan Power Demonstration Reactor decommissioning. The report consists of two pages of text and eleven pages of visual aids. The report contains a brief section on the overall progress of the project, followed by a short description of the demolition of the biological shield concrete, and very brief sections on cutting techniques and remote operations, radioactive waste management, health and safety, and regulatory aspects. The figures and photographs accompany the section on biological shield demolition.

319
T. Hoshi, H. Yasunaka, M. Yokota, and K. Tomii, Japan Atomic Energy Research Institute, Department of Japan Power Demonstration Reactor, Tokai, Ibaraki, Japan

Status and Safety of the Decommissioning of the JPDR

CONF-911135 (Vol. 2); Nuclear Engineering, Proceedings of the First JSME/ASME Joint International Conference, November 4-7, 1991, Tokyo, Japan, Vol. 2, 593 pp.; (pp. 1-6) (November 1991)

Dismantling of the Japan Power Demonstration Reactor (JPDR) has been in progress since 1986. The ultimate goal for JPDR is Stage 3 (green field) status. All equipment and pipes surrounding the reactor pressure vessel were initially removed in order to expand the working space in the reactor containment building. Then, dismantling operations were begun on the highly activated reactor components, using remote cutting techniques. Total manpower expenditure and total radiation exposure to workers through December 1990 was 39,000 man-days and 0.26 man-Sv, respectively. Manpower expenditure is close to that planned, while radiation exposure is less than half that planned. Lower radiation exposure to workers is the result of appropriate planning and the use of remotely operated systems.

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Japan Atomic Energy Research Institute, Department of Japan Power Demonstration Reactor, Tokai, Ibaraki, Japan

Progress of JPDR Decommissioning Program - Seventh Progress Report (April-September 1990)

OECD/NEA Co-Operative Program on Decommissioning, 10th Meeting of the Technical Advisory Group, Karlsruhe, Federal Republic of Germany, April 22-26, 1991; (23 pp.) (April 1991)

The Japan Power Demonstration Reactor (JPDR) decommissioning program was begun in 1981 by the Japan Atomic Energy Research Institute. This seventh progress report for the program describes the JPDR dismantling progress and the development of related reactor decommissioning technology. During the period of this report, most of the reactor pressure vessel was successfully dismantled using the underwater saw cutting system. Preparatory work was started for dismantling the biological shield concrete and for the removal of components in the turbine building. There were no significant difficulties in the dismantling activities. Decontamination of the dismantled components was performed using the electropolishing decontamination system. Dismantled components were classified and packed in various types of containers according to their make-up, size, and radioactivity. Development of the computer code system for management of reactor decommissioning and research and development in recycling low-level radioactive metal wastes continued. International cooperation on decommissioning nuclear facilities continued with several countries. Chapter 3 of this report explains the evaluation of concrete contamination in the JPDR buildings.

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Japan Atomic Energy Research Institute, Tokai Research Establishment, Tokai, Ibaraki, Japan

Quarterly Report of JPDR Decommissioning Program, 4th Quarter, FY 1990

Report; 27 pp. (1991)

This report summarizes the progress of the Japan Power Demonstration Reactor (JPDR) decommissioning program for fiscal year 1990. Major items of dismantling work performed during the year were: (1) removal of the reactor pressure vessel, (2) removal of components in the reactor pressure vessel, (3) dismantlement of the concrete biological shield, (4) removal of components in the turbine building, (5) decontamination testing of contaminated concrete surfaces in the control building, (6) decontamination of dismantled components, and (7) recycling of the decommissioning wastes. Approximately 43% (by weight) of all components and equipment in the facility had been removed by the end of fiscal year 1990. Research and development activities and planned decommissioning projects for fiscal year 1991 are discussed.

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Japan Atomic Energy Research Institute, Tokai Research Establishment, Tokai, Ibaraki, Japan

Quarterly Report of JPDR Decommissioning Program, 3rd Quarter, FY 1990

Report; 22 pp. (1991)

This report summarizes the progress of the Japan Power Demonstration Reactor (JPDR) decommissioning program during the third quarter (October through December) of fiscal year 1990. Major items of dismantling work performed during this quarter were: (1) removal of the reactor pressure vessel, (2) dismantling of the concrete biological shield, (3) removal of components in the turbine building, (4) decontamination of the dismantled components, and (5) recycling of the decommissioned wastes. Approximately 28% (by weight) of all components and equipment had been removed by the end of the quarter. Radiation control, management of radioactive wastes, and planned activities for fiscal year 1990 are discussed.

323
P.J. Andrews, I.H. Gibson, S.F. Hall, and S. Ludlam, AEA Technology, Winfrith, United Kingdom; AEA Safety and Reliability,

Cumbria, United Kingdom; Rolls-Royce Limited, Derby, United Kingdom

SIR Reactor Safety and Decommissioning

Nuclear Energy 30(2):117-122 (April 1991)

This paper describes, in broad terms, the safety principles of the Safe Integral Pressurized Water Reactor (SIPWR). It discusses the design safety provisions and emphasizes those inherent and passive features which allow 72 hours of safe response to any design-based accident (without operator action and without safety-grade AC electrical supplies). Four options for decommissioning the SIPWR reactor plant are discussed. Dose burdens and cost estimates are minimal relative to other PWR systems.

324
F.J. Bindon

The Decommissioning of the Windscale Pile Chimneys

Nuclear Engineer 32(3):87-91 (May-June 1991)

The two pile chimneys at the Windscale Site have been part of the landscape since 1957. The piles were originally built to produce weapon-grade plutonium. Subsequent nuclear accidents led to the deposition of radioactive material in the chimneys, mainly in the filters near the top of the stacks. The decision to decommission the top sections of both chimneys was made in 1985, mainly because of rising maintenance costs. The decommissioning work performed by British Nuclear Fuels Limited is described in this article. Future plans to complete the task are also noted.

325
S. Buck and A.P. Colquhoun, British Nuclear Fuels plc, Sellafield, United Kingdom; Commission of the European Communities, Luxembourg, Luxembourg

Decommissioning of a Mixed Oxide Fuel Fabrication Facility

EUR-13057; 30 pp. (1990)

Decommissioning of the coprecipitation plant, which made plutonium/uranium oxide fuel, is a lead project in the British Nuclear Fuels Limited (BNFL) Sellafield decommissioning program. The objective of the overall program is to gain data and experience in a wide range of decommissioning operations. In this project the goal is to pilot the decommissioning of a plant heavily contaminated with plutonium and other actinides. The operations have been used to test improvements in temporary containment, contamination control and decontamination methods, and also to develop in situ plutonium assay, plutonium recovery and size-reduction methods. The project is yielding data on manpower requirements, personnel radiation uptake and waste arisings. This data will help in the planning of future decommissioning projects.

326
S. Campbell, Scottish Nuclear Limited, Glasgow, United Kingdom

The Second Irradiated Fuel Dismantling Cell at Hunterston "B"

Nuclear Engineer 32(4):108-110 (July-August 1991)

The design, construction and commissioning of a second irradiated-fuel dismantling cell for Hunterston "B" power station is described. The design was driven by three fundamental criteria: (1) secure handling of stringers or individual fuel elements; (2) containment of radiation from broken or burst fuel pins; and (3) speedy, reliable control-system failure back-up. Close cooperation between all parties allowed the South of Scotland Electricity Board to write a safety case in line with nuclear safety standards.

327
F. Passant, Nuclear Electric plc, Barnwood, United Kingdom

A New Decommissioning Strategy for the United Kingdom

Nuclear Engineering International 36(447):35-36 (October 1991)

In 1990, Nuclear Electric (NE) concluded that potential cost savings merited examination of alternative decommissioning strategies for gas-cooled power stations in the United Kingdom. The company carried out a detailed review, in which it first looked at its existing decommissioning strategy to see where savings could be made. The NE reference decommissioning strategy has three stages: Stage 1, which consists of removing the fuel; Stage 2, where the plant outside the biological shield is dismantled and the reactors sealed; and Stage 3, where, after about 90 years of care and maintenance, the site is cleared to "green field" status. NE found that cost savings could be made by speeding up the defuelling process in Stage 1 and deferring Stages 2 and 3. This optimization of the reference decommissioning strategy had only limited scope for reducing decommissioning costs. It was therefore decided to examine all possible approaches to decommissioning. Two approaches emerged as being worthy of inclusion in the review alongside the early decommissioning strategies, since they offered radiological safety advantages and potential cost savings. The first is an alternative to Stage-2 dismantling, and is the containment of the active plant in such a way that the plant can be left, with very little maintenance, for about 100 years before dismantling. This approach is referred to as "safestore" and, as with Stage 2, could be carried out early or deferred. The second possible approach is "in situ" decommissioning. This involves engineering a stable mound over the buildings and, in effect, burying them. This could be carried out as an alternative to Stage 3 or as an alternative to Stages 2 and 3. After considering environmental, technical, and cost factors, it was decided that safestore (followed in 135 years by dismantling) is an attractive strategy for NE power station decommissioning. NE is now proposing to adopt the deferred safestore strategy for decommissioning its thirteen gas-cooled stations. Such proposals have been submitted for consideration by United Kingdom government departments and regulators.

328
J.R. Wakefield, AEA Technology, Risley, United Kingdom

Decommissioning and Decommissioning Wastes

NRL-R-3107(W); 23 pp. (July 1988)

Decommissioning of nuclear installations has become important in recent years. This paper discusses decommissioning stages, the decommissioning strategies that are being pursued around the world, and the resultant waste arising from the decommissioning. The paper also describes, in more detail, the United Kingdom's lead reactor-decommissioning project, namely the decommissioning to Stage 3 of the Windscale Advanced Gas-cooled Reactor.

329
A.E. Sheil, British Nuclear Fuels plc, Sellafield, United Kingdom

BNFL's Decommissioning and Decommissioning Development Programmes at Sellafield

CONF-910413; Nuclear Fuel Reprocessing and Waste Management, Proceedings of the Third International Conference, Sendai, Japan, April 14-18, 1991. Japan Atomic Industrial Forum, Tokyo, Japan, 1186 pp.; (pp. 960-964) (1991)

British Nuclear Fuels Limited is facing a major decommissioning challenge at its largest site, located in Sellafield, Cumbria. The site has plants dating back to the late 1940's that are associated with all aspects of the nuclear fuel cycle. A decommissioning unit is planning and implementing decommissioning on the site. This paper describes the problems encountered, the decommissioning approach being taken, some of the major projects that are planned, and gives an outline of the structure of the supporting decommissioning development program.

330
AEA Technology, Windscale, United Kingdom

Decommissioning B204 Primary Separation Plant - Progress Report: October 1990 - April 1991

OECD/NEA Co-Operative Program on Decommissioning, 10th Meeting of the Technical Advisory Group, Karlsruhe, Federal Republic of Germany, April 22-26, 1991; (6 pp.) (1992)

This progress report gives an overview of the decommissioning requirements and the status of the decommissioning program for the former Primary Separation Plant at Sellafield. It indicates the scope and scale of the project and the integrated, phased decommissioning strategy for reducing dose uptake and overall costs. A description of the B204 Primary Separation Plant decommissioning was included in a report to the ninth Technical Advisory Group meeting in October 1990. Details of the plant and its operating history were given in the proposal paper, reference CPD/PC/91/2 Paper B4. A schematic design of the plant and its relevant building nomenclature are shown in a figure in this report. Although the radiological conditions in the MAN cell make full-contact removal of the equipment feasible, a contact-deployment, remote-operation method has been chosen (1) to reduce the dose uptake, which is consistent with the ALARP (as-low-as-reasonably-practicable) principle, and (2) to provide operating experience with remote handling equipment that can be transferred to other projects.

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S.F Challinor and A.P. Colquhoun, British Nuclear Fuels plc, Sellafield, United Kingdom

Decommissioning of B204 Reprocessing Plant

CONF-911135 (Vol. 2); Nuclear Engineering, Proceedings of the First JSME/ASME Joint International Conference, November 4-7, 1991, Tokyo, Japan, Vol. 2, 593 pp.; (pp. 125-130) (November 1991)

The Decommissioning Program at Sellafield comprises four facilities grouped into 22 projects. Four are undergoing practical dismantling, while the other 18 are at various stages of the planning, design and engineering process. This paper gives an overview of the decommissioning requirements and a description of the proposals for the first phase of the former Primary Separation Plant B204, at Sellafield. The size and complexity of the project will inevitably lead to a wide range of technical and radiological problems associated with decommissioning. The aim of the project is to remove the process plant, vessels, pipework, and steelwork and to decontaminate the residual building structure to meet low-level waste criteria. The project is being divided into nine distinct phases and has a projected total cost of 67 million British pounds sterling.

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T. Boorman, AEA Technology, Windscale, United Kingdom

Progress Report on the Windscale Advanced Gas-Cooled Reactor Decommissioning Project, UK

OECD/NEA Co-Operative Program on Decommissioning, 10th Meeting of the Technical Advisory Group, Karlsruhe, Federal Republic of Germany, April 22-26, 1991; (6 pp.) (1992)

The Windscale Advance Gas-Cooled Reactor (WAGR) Decommissioning Project has continued on the program set in January 1988. Since the ninth TAG meeting report, the main operations have been the removal of standpipes and the lifting of the top dome of the reactor pressure vessel. These operations are described in this report. The development of equipment and techniques for the remote working phase has reached an advanced stage and the manufacture of the Remote Dismantling Machine has been completed.

333
V.M. Tarasov

Main Approaches to Solving the Problem of Nuclear Facility Decommissioning in the United Kingdom

Energeticheskoe Stroitel'stvo 9:57-61 (September 1990)

Development of solutions to the problems of decommissioning first-generation Magnox reactors started in Great Britain in 1982. The Berkeley and

Bradwell NPPs were chosen to test methods for dismantling and waste disposal. The advanced gas-cooled WAGR reactor was chosen to demonstrate the capability of carrying out such full-scale work. Total cost of decommissioning is estimated at 50 million British pounds sterling.

334
G. Clement and G. Coste, Commissariat a l'Energie Atomique, Centre d'Etudes Nucleaires de Fontenay-aux-Roses, Fontenay-aux-Roses, France

CEA's RD 500 Has the Power for Decommissioning

Atomnaya Tekhnika za Rubezhom 1:21-23 (January 1991)

This article describes the new RD-500 manipulator, designed to conduct remote handling during nuclear facility dismantling.

335
G.B. Poluehktova, O.V. Koval'chuk, and A.K. Kruglov

NPP Decommissioning

Atomnaya Tekhnika za Rubezhom 8:3-8 (August 1990)

Consideration is given to general problems of nuclear power plant (NPP) decommissioning, peculiarities of the three main versions of NPPs, calculated data on amount of formed radioactive wastes, and expenses for decommissioning of power units with standard pressurized water reactors and boiling water reactors. Pilot designs of decommissioning for the WAGR (Great Britain) and JPDR (Japan) reactors, the Shippingport (USA) and Neideraichbach (Germany) NPPs are characterized in brief.

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B.A. Pyatunin, V.V. Vainshtein, Y.F. Yurchenko, A.K. Kruglov, and P.V. Sakharov, Research and Development Institute of Power Engineering, Moscow, USSR; Research and Development Institute of Mounting Technology, Moscow, USSR

Trial Decommissioning of Nuclear Reactors

Soviet Atomic Energy 69(3):739-744 (March 1991)

The major problem in dismantling nuclear facilities following operation is the technical complexity of the disassembling the highly radioactive assemblies and structural elements of the nuclear reactors. In the mid-1960's, a demonstration reactor was dismantled in the territory of VDNKh [sp] USSR. The site was completely released to access, and the steel pavilion itself is now used as an exhibition building. In dismantling highly radioactive structural materials, the task of greatest complexity is that of cutting it into transportable pieces. This paper provides greater detail on the performance of electrocontact cutting, which is widely employed in the Soviet Union.

337
B.S. Shirev

General Approaches to Selection of Final State of Decommissioned NPP Power Units

Elektricheskie Stantsii 8:22-24 (August 1990)

Consideration is given to the problem of NPP power unit decommissioning, including a complex of measures realized after the end of power unit operation as a power generating object. The first stage is the isolation in nuclear safe state. The second stage is partial dismantling of radioactive equipment with successive power unit conversion. The final stage is complete dismantling of equipment, buildings and constructions.

338
Babcock and Wilcox Company, Apollo, PA

Apollo Pennsylvania Nuclear Fuel Facility D&D Project

DOE/EW-40017-T1; 19 pp. (February 3, 1992)

The Apollo Pennsylvania Nuclear Fuel Facility Decontamination and Decommissioning (D&D) Project involves the site characterization,

remediation, decontamination, and deconstruction of a former commercial nuclear fuel manufacturing site. The Apollo Site is located in an industrial complex in the Borough of Apollo, Pennsylvania. To organize, manage, and control decommissioning activities, the Apollo Nuclear Fuel Facility D&D Project Site has been broken down into three areas: the main building, the parking lot, and an off-site area. The former fuel manufacturing operations were performed in the main building (i.e., the east bay) and three attached buildings: the west bay, the box shop, and the annex. These buildings are on property owned by Babcock & Wilcox and are located on the east side of the site. They consist of approximately one acre of roofed area bounded on the north, south, and west by a metals-processing facility located on the off-site property. These buildings are two-story structures and house the former nuclear fuel-manufacturing operations, laboratories, and other support operations. This report discusses progress in the characterization, remediation, decontamination and deconstruction activities.

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E.O. Adomov, V.I. Mikhan, Y.M. Cherkashov, V.V. Vainshtein, and Y.F. Yurchenko, Research and Development Institute of Power Engineering, Moscow, USSR; Research and Development Institute of Mounting Technology, Moscow, USSR

Renovation of Nuclear Power Plants

CONF-911135 (Vol. 2); Nuclear Engineering, Proceedings of the First JSME/ASME Joint International Conference, November 4-7, 1991, Tokyo, Japan, Vol. 2, 593 pp.; (pp. 59-63) (November 1991)

When the need for decommissioning nuclear power plants arose in recent years, it called for solving a whole array of scientific, technological, economic and social problems. Many programs have been established involving shutdown and dismantling of facilities, utilization of materials and equipment, radioactive waste disposal, and plant life extension. This report discusses problems involved in decommissioning nuclear power plants, experience gained in radioactive equipment dismantling, and progress made in these areas.

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American Society of Mechanical Engineers, New York, NY; Japan Society of Mechanical Engineers, Tokyo, Japan

Joint International Conference on Nuclear Engineering - Volume 2: Decommissioning

CONF-911135 (Vol. 2); Proceedings of the First JSME/ASME Joint International Conference, November 4-7, 1991, Tokyo, Japan, Vol. 2, 593 pp. (November 1991)

The Power and Energy System Division of the Japan Society of Mechanical Engineers (JSME) and the Nuclear Engineering Division of the American Society of Mechanical Engineers (ASME) completed the first in a series of Joint International Conferences on Nuclear Engineering in Tokyo in November 1991. The purpose of these conferences is to establish a closer relationship between JSME and ASME and to enhance technology exchange with other nations. These conferences will be held bi-annually, with the location alternating between the United States and Japan. Volume 1 of the conference proceedings is concerned primarily with structural engineering of nuclear facilities. Volume 2 contains work on nuclear facility decommissioning, management of decommissioning waste, and innovative techniques in the field of structural cutting and disassembly.

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H.W. Ay, Siemens AG, Unternehmensbereich Kraftswerkunion, Offenbach am Main, Federal Republic of Germany

Life Extension of Nuclear Power Plants: A Temporary Alternative to Demolition

Kerntechnik 56(6):388-391 (1991)

Commercial nuclear power plants currently in operation are being extensively backfitted to comply with changing safety standards. Proven maintenance concepts keep the plants in good working order and operating economically. If plant operating strategies are extended to include validated plant life extension programs, nuclear power plants that were originally designed for a service life of 40 years can remain on line for a

considerably longer period, and can be operated just as economically as new plants. This article describes the surrounding circumstances and the present status of backfitting and life-extension programs.

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F.J. Bindon

Decommissioning of the Windscale Pile Chimneys

Nuclear Engineer 32(3):87-91 (1991)

In 1985/1986, the decision was made to decommission the top sections of two chimneys at the Windscale Pile. This paper describes the work associated with the chimney decommissioning to date.

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British Nuclear Fuels plc, Sellafield, United Kingdom

Co-Precipitation Plant Decommissioning: Progress Report to TAG Meeting 22 April 1991 for November 1990 to March 1991

OECD/NEA Co-Operative Program on Decommissioning, 10th Meeting of the Technical Advisory Group, Karlsruhe, Federal Republic of Germany, April 22-26, 1991; (4 pp.) (April 1991)

Progress made on the decommissioning of the Co-Precipitation Plant was reported to the Technical Advisory Group on April 22, 1991. Major tasks accomplished include the following: (1) preparatory work for dismantling the buffer storage cabinets; (2) cleaning of the powder offtake room; and (3) in situ size reduction and removal of buffer storage cabinets. The end of 1990 completion date was not achieved due to the following reasons: (a) inability to maintain decommissioning operations because of conflict with production operations; (b) spillage of radioactive material during production operations resulting in a lengthy decontamination period; and (c) maintenance work on the building extract filters resulting in a three-week delay for replacement and testing. The decommissioning project was completed in March 1991.

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Heavy Water Plants Being Dismantled

Canadian Energy News 5(36):288 (June 15, 1989)

Atomic Energy of Canada Limited is dismantling its two heavy-water plants at Cape Breton. These plants were closed in 1985. One plant still has hundreds of barrels of unsold heavy water in storage. Ontario Hydro sold 600 kg of heavy water in four days at the height of the furor over cold fusion.

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International Atomic Energy Agency, Vienna, Austria; Office of Atomic Energy for Peace, Bangkok, Thailand

International Atomic Energy Agency Seminar for Asia and the Pacific on Ageing, Decommissioning, and/or Major Refurbishment of Research Reactors

IAEA-SR-179; CONF-920577; Proceedings of an IAEA Seminar for Asia and the Pacific, Bangkok, Thailand, May 18-22, 1992 (May 1992)

This introductory material to the IAEA seminar proceedings contains the seminar's schedule, a list of participants and their addresses, and abstracts of the papers presented. Thirty-one papers were presented in eight topical sessions. The sessions dealt with: (1) Policy and Regulations for Refurbishment or Decommissioning of Research Reactors; (2) Aging Aspects: Mechanisms and Detection Methods; (3) Aging Aspects: Prevention, Mitigation and Repair; (4) Refurbishment Aspects: Regulation and Planning; (5) Refurbishment Aspects: Management and Implementation; (6) Decommissioning Aspects: Regulation and Planning; (7) Decommissioning Aspects: Management and Implementation; and (8) Special Topics. Individual papers within the scope of this bibliography (i.e., on decommissioning) are abstracted and indexed separately.

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Limitations of Cleanup Technologies

EPA/520/1-90-013; CONF-8909236; Residual Radioactivity and Recycling Criteria, A.B. Wolbarst, H. Terada, and A.C.B. Richardson (eds.), Proceedings of a Workshop, St. Michaels, MD, September 27-28, 1989, 311 pp.; (pp. 59-63) (September 1989)

This discussion includes the limitations of cleanup technologies used in the processes typical of decontamination and decommissioning of nuclear facilities. The key issue is to determine the primary objective of decontamination campaigns, namely to achieve free release of equipment or structures or to reduce exposure to workers. A thorough radionuclide characterization and contamination survey is a mandatory prerequisite to the development of a properly planned program. The topics to be addressed are: (1) the problems associated with performing effective decontamination without increasing low-level waste volume, radiation exposure, or cost; (2) redeposition of contaminants; (3) prevention of cross contamination; (4) process limitations (corrosion, temperature, pressure, application time, pH, flow rate, and waste volume), and (5) actual effectiveness versus a vendor's reported effectiveness. Many decontamination programs have failed to meet their objectives because of the inadequate preplanning to characterize the contamination and identify the process limitations.

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Overview of Decommissioned Nuclear Power Plants

Kerntechnik 56(6):354-357 (1991)

No commercial-scale nuclear power stations have yet been decommissioned according to plan. However, there is comprehensive experience from the decommissioning of smaller plants (over 50, world-wide) and from the cleanup and decommissioning operations following accidents at nuclear facilities. This decommissioning experience is transferrable to commercial-scale nuclear plants; but it is only partially transferrable between different nations. The world-wide decommissioning experiences gained in various operations are summarized here, and lists of decommissioned plants in the United States, France, and Germany, are presented.

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Trip Report Covering Liaison Committee and Technical Advisory Group Meeting of April 17-26, 1991

Memorandum from W. Murphie to J.J. Fiore, June 19, 1991; 11 pp. (June 19, 1991)

The Technical Advisory Group tour of the KKN decommissioning project in Germany included an inspection of on-going, remote, reactor-vessel cutting operations. The Japanese stated in their progress report that the sophisticated cutting device developed for reactor cutting at the Japan Power Demonstration Reactor was inefficient, and had been replaced with another device, a semi-manual core borer. Use of three core boring devices resulted in 30% to 40% cost savings. A detailed report summarizing the meeting and a list of those participating in the meeting is given.

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Nuclear Power Plant Decommissioning - A Technical Problem

TIB/B92-00135/HDM; 44 pp. (January 10, 1991)

From the technological point of view, the task of the safe containment and later dismantling of a shutdown nuclear power plant does not present unsolvable problems. Experience has shown that the task is technically and economically feasible. One cannot wholly apply the currently available experience to the tasks connected with the decommissioning of an existing, commercial nuclear power plant during the coming century. However, the experience and know-how gained so

far is a sound, safe and very valuable basis for future decommissioning tasks, in particular with regard to decontamination, smelting, radioactivity measurement, and remote dismantling.

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Decommissioning, a Ready-to-Start Technology for the Next Century

Kerntechnik 56(6):347-348 (1991)

Decommissioning has been viewed from an increasing number of different perspectives in the past twenty years. At first, responsible agencies required proof that it was even technically feasible to dismantle a nuclear power plant. Next came the development of many specialized decommissioning techniques and questions of licensing. More recently, there has been discussion of the postponement of final shutdown by partially refitting older reactors. Financial analysts have always been concerned with decommissioning costs, lawyers with the relevant laws, and engineers with new research and development tasks related to decommissioning; since plant owners and authorities worked on decommissioning concepts long before they were actually needed, techniques could be developed without political interference. A comparison of this issue of Kerntechnick with the decommissioning issue of the same journal from 1981 reflects the development of decommissioning concepts over the past decade. In the 1981 issue, there were seven articles of relatively general contents, while the 1991 issue has a dozen, shorter articles which reflect the current specialization and differentiation in the decommissionig field.

DEPARTMENT OF ENERGY (DOE) FORMERLY UTILIZED SITES REMEDIAL ACTION PROGRAM

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A Case Study: Underpinning of Structures as an Alternative to Demolition/Reconstruction for Removal of Underlying Contaminated Soils at the St. Louis Downtown Site (SLDS)

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 383-388) (September 1991)

From 1942-1958, a chemical plant in downtown St. Louis, Missouri, was used to chemically treat natural uranium feed materials to produce pure uranium trioxide and other uranium and thorium compounds for the Manhattan Engineer District and its successor, the Atomic Energy Commission. Characterization activities to determine the vertical and areal extent of radioactive contamination of the soil at the chemical works, known as the St. Louis Downtown Site (SLDS), were conducted by Bechtel National, Inc. for the U.S. Department of Energy's (DOE's) Formerly Utilized Sites Remedial Action Program. This paper is a report on locations at the SLDS where radioactivity exceeds DOE guidelines for soil under or around existing buildings. A preliminary study was made to evaluate the feasibility of underpinning the buildings as an alternative to demolition and reconstruction, where the depth of soil contamination extends below their foundation levels. Underpinning would transfer the building loads to strata below the depth of contamination. The contaminated soil could then be excavated and replaced with clean backfill, and demolition of the buildings could be avoided. The study involved 22 buildings where soil contamination extends under the building footprint or is present in the immediate vicinity. The preliminary study concludes that only Buildings 101 and K-1 are candidates for successful underpinning. The analysis behind this recommendation is described. Building 101 will require strengthening of its roof structure before the closure wall is demolished and the building is underpinned. The transfer of column loads to driven underpinning piles will use "needle beams," adapted with a unique "claw" feature designed to reduce deflections and bending moments in the beams. At Building K-1, a similar arrangement will be used for underpinning Column B-8. Jacked piles will be used to support a lateral bearing wall. The method of pretesting jacked piles and the need for lateral support of the underpinning structure are discussed.

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Engineering Evaluation/Cost Analysis for the Proposed Decontamination of Properties in the Vicinity of the Hazelwood Interim Storage Site, Hazelwood, Missouri - Environmental Assessment

DOE/EA-0489; 80 pp. (May 1991)

The U.S. Department of Energy (DOE), under its Formerly Utilized Sites Remedial Action Program (FUSRAP), is implementing a cleanup program for three groups of properties in the St. Louis, Missouri, area. None of the properties is owned by DOE, but each property contains radioactive residues from federal uranium-processing activities conducted at the St. Louis Downtown Site (SLDS) during and after World War II. This engineering evaluation/cost analysis (EE/CA) report has been prepared to support the interim cleanup measures for the contaminated properties in the Hazelwood and Berkeley, Missouri area. The near-term cleanup measures that may be necessary at the vicinity properties are evaluated in the main body of this report. Because of the range of active land uses in the Hazelwood and Berkeley areas, and because of the extent of contamination on public and private properties, the potential exists for disturbance and spreading of soil contamination. Specifically, implementation of the proposed action would allow DOE to remove, transport, and safely store contaminated soils from properties where other activities (not involving DOE) are likely to result in either spreading contamination or otherwise complicating ultimate cleanup measures.

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Engineering Evaluation/Cost Analysis for Decontamination at the St. Louis Downtown Site, St. Louis, Missouri

DOE/OR/23701-02.2; 75 pp. (May 1991)

The U.S. Department of Energy (DOE) is implementing a cleanup program for three groups of properties in the St. Louis, Missouri, area: (1) the St. Louis Downtown Site (SLDS), (2) the St. Louis Airport Site (SLAPS) and vicinity properties, and (3) the Latty Avenue Properties, including the Hazelwood Interim Storage Site (HISS). The general location of these properties is shown in Figure 1 of this report. The properties are referred to collectively as "the St. Louis Site." None of the properties are owned by DOE, but each property contains radioactive residues from federal uranium processing activities conducted at the SLDS during and after World War Two. The activities addressed in this environmental evaluation/cost analysis (EE/CA) report are being proposed as interim components of a comprehensive cleanup strategy for the St. Louis Site. As part of the Department's Formerly Utilized Sites Remedial Action Program (FUSRAP), DOE is proposing to conduct limited decontamination in support of proprietor-initiated activities at the SLDS, commonly referred to as the Mallinckrodt Chemical Works. The primary goal of FUSRAP activity at the SLDS is to eliminate potential environmental hazards associated with residual contamination resulting from the site's use for government-funded uranium processing activities.

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Intent to Prepare a Remedial Investigation/Feasibility Study-Environmental Impact Statement: Response Actions at a Site in Wayne, New Jersey

Federal Register 56(204):54563-6 (October 22, 1991)

Notice is hereby given that the Department of Energy (DOE), under its Formerly Utilized Sites Remedial Action Program (FUSRAP), intends to conduct a comprehensive environmental review and analysis of the Wayne Site in Wayne, New Jersey, to determine the nature and extent of existing contamination at the site and to evaluate alternative response actions. The Wayne Site is composed of the DOE-owned Wayne Interim Storage Site (WISS) and several contaminated, non-DOE-owned vicinity properties near WISS, including: the Wayne Township Park, Sheffield Brook (including 15 properties along the brook, a ditch, and a drainage pipe), Pompton Plains Railroad Spur, and a school bus maintenance facility located in Wayne Township and Pequannock Township, New Jersey. Removal activities have been conducted at all affected properties except for the WISS and Pompton Plains Railroad Spur. The environmental review and analysis will integrate the environmental impact values of the National Environmental Policy Act (NEPA) and requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA). The Environmental Impact Statement (EIS) values under NEPA will be incorporated into the remedial investigation/feasibility study (RI/FS) requirements of CERCLA. The resulting report will be the RI/FS-EIS. DOE also announces its intent to conduct a public scoping meeting.

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Engineering Evaluation/Cost Analysis for the Proposed Removal of Contaminated Materials at the Elza Gate Site, Oak Ridge, Tennessee

DOE/OR/23701-37.3; 94 pp. (June 1991)

This engineering evaluation/cost analysis (EE/CA) has been prepared in support of the proposed removal action for cleanup of radioactive and chemically contaminated soil at the Elza Gate Site

in Oak Ridge, Tennessee. This property became contaminated as a result of storage of ore residues, equipment, and other materials for the U.S. Atomic Energy Commission. The U.S. Department of Energy is responsible for cleanup of portions of the site under its Formerly Utilized Sites Remedial Action Program. In December 1990, an area known as Pad 1 was abrasively scoured to remove surface contamination, and in March 1991 removal of Pad 1 contamination was begun under a separate EE/CA. This EE/CA is intended to cover the remaining portions of the site for which the Department of Energy has responsibility. It has been determined that an EE/CA report is appropriate documentation for the proposed removal action. This EE/CA covers removal of contaminated soils and contaminated concrete rubble from the Elza Gate Site. The primary objectives of this EE/CA report are to identify and describe the preferred removal action, and to document the selection of response activities that will mitigate the potential for release of contaminants from the property into the environment and that will minimize the associated threats to human health or welfare and the environment. The preferred alternative is disposition on the Oak Ridge Reservation.

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Determining the "R" in ALARA: A Parametric Study to Establish Cleanup Criteria

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 769-772) (September 1991)

This paper describes the use of a tool for establishing criteria for the cleanup of low-level radioactive contamination that will result in cost-effective remedial action. The tool is an X-Y graph showing the relationship between the volume of soil to be remediated and cleanup criteria. The graph represents a hyperbolic function of the two variables. The y-axis represents the volume of soil to be remediated, but may be modified to represent cost. Cost includes labor, equipment, material, personal protective equipment, and other items. For varying cleanup criteria, the volume to be remediated and the accompanying costs are determined and plotted. Managers can use the tool to decide whether to perform a cleanup based on the funds available, recognizing that the cleanup would not meet required criteria, or to make budgetary plans to remediate to the criteria. Central to this tool is the application of the principle of "as low as reasonably achievable" (ALARA) levels of residual radiation. ALARA goals are driven by a desire to remediate a site to meet the strictest criteria practicable. At the same time, to meet economic requirements, the volume of wastes must be minimized. The result of using this tool is the development of a remedial action program that satisfies ALARA requirements, while it limits health and environmental risks to acceptable levels. Topics discussed in depth in this paper include the ALARA process, its principles, and its application to remedial action programs. The paper concludes with a case study of the Elza Gate site in Tennessee, in which the tool is applied to establishing cleanup criteria for the Department of Energy's Formerly Utilized Sites Remedial Action Program (FUSRAP).

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Discovering Where the Problem is Hiding: Techniques from The Formerly Utilized Sites Remedial Action Program (FUSRAP)

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 655-660) (September 1991)

Identifying environmental problems that are the results of past operations and practices at a federal facility is a good management practice and a logical precursor to site-wide cleanup. Current problems and associated data at a given site may date back fifty years, and relevant records and personnel who are familiar with the site's old

operations are difficult to locate. Information about past practices at federal facilities is available in records holding areas at the particular sites and at the Federal Records Centers of the National Archives and Records Administration. The physical volume of Manhattan Engineer District (MED) and Atomic Energy Commission (AEC) records is from 65 to 70 thousand cubic feet. The Formerly Utilized Sites Remedial Action Program reviewed these documents in systematic order. The FUSRAP reviews focused on the potential radiologic contamination of off-site facilities. The effectiveness of this tailored review procedure, which was necessitated by the volume of MED and AEC records, is well established. Sources of historical information in the public domain, such as libraries, assessor's offices, and others, should be considered in similar reviews. The decision to seek out and use sources of past-practice information should be made by environmental managers rather than by facility archivists or librarians. Environmental managers must constantly weigh the value of the records that may be found against the expense of finding and collecting the records. Likewise, environmental managers must realize that the records that they collect and maintain are a vital legacy to future generations. Colleges and universities also play an important role: they should make training in records management part of an environmental engineering curriculum, and they should pursue partnerships and internships in reviewing records and implementing records systems for the Department of Energy.

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Surveillance of Site A and Plot M - Report for 1990

ANL-91/2; 58 pp. (May 1991)

The results of the environmental surveillance program conducted at Site A/Plot M in the Palos Forest Preserve area for calendar year 1990 are presented. The surveillance program is the ongoing remedial action that resulted from the 1976-1978 radiological characterization of the site. That study determined that very low levels of hydrogen-3 (as tritiated water) had migrated from the burial ground and were present in two nearby hand-pumped picnic wells. The current program consists of sample collection and analysis of air, surface and subsurface water, and bottom sediment. The results of the analyses are used to determine the migration pathway of water from the burial ground (Plot M) to the hand-pumped picnic wells, establish if buried radionuclides other than hydrogen-3 have migrated, and generally characterize the radiological environment of the area. Tritiated water continues to be detected in a number of wells, boreholes, dolomite holes, and a surface stream. Analyses since 1984 have indicated the presence of low levels of strontium-90 in water from a number of boreholes next to Plot M. The results of the surveillance program continues to indicate that the radioactivity remaining at Site A/Plot M does not endanger the health or safety of the public visiting the site or those living in the vicinity.

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Surveillance of Site A and Plot M - Report for 1991

ANL-92/13; 47 pp. (May 1992)

The results of the environmental surveillance program conducted at Site/Plot M in the Palos Forest Preserve area for CY 1991 are presented. The surveillance program is the ongoing remedial action that resulted from the 1976-1978 radiological characterization of the site. That study determined that very low levels of hydrogen-3 (as tritiated water) had migrated from the burial ground and were present in two nearby hand-pumped picnic wells in Red Gate Woods. The current program consists of sample collection and analysis of air, surface and subsurface water, and bottom sediment. The results of the analyses are used to (1) determine the migration pathway of water from the burial ground (Plot M) to the picnic wells, (2) establish if buried radionuclides other than hydrogen-3 have migrated, and (3) generally characterize the radiological environment of the area. Hydrogen-3 in the Red Gate Woods picnic wells was still detected this year, but the

average and maximum concentrations were significantly less than those found earlier. Tritiated water continues to be detected in a number of wells, boreholes, dolomite holes, and a surface stream. For many years it was the only radionuclide found to have migrated in measurable quantities. Since 1984, analyses have indicated the presence of low levels of strontium-90 in water from a number of boreholes next to Plot M. The available data does not allow a firm conclusion as to whether the presence of strontium-90 represents recent migration or movement that may have occurred before Plot M was capped. The results of the surveillance program continue to indicate that the radioactivity remaining at Site A/Plot M does not appear to endanger the health or safety of the public.

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Results of the Radiological Survey at the New Betatron Building, Granite City Steel Facility, Granite City, Illinois (GSG002)

ORNL/RASA-91/8; 33 pp. (January 1992)

A team from Oak Ridge National Laboratory conducted a radiological survey for the Department of Energy (DOE) at the New Betatron Building in the South Plant facility of the Granite City Steel Division, 1417 State Street, Granite City, Illinois. Performed in 1991, the survey was to determine whether the property was contaminated with radioactive residues, principally U-238, from work done at the site for the Atomic Energy Commission (AEC) from 1958 to 1966. The survey included a surface-gamma scan of the outdoor ground surface near the building, of the floor and walls in all accessible areas inside the building, and of the roof. It also included a radionuclide analysis of outdoor soil samples and indoor samples of shield-wall fill material and debris. The analysis of the soil, shield wall material, debris, and smear samples showed no residual U-238 that could be attributed to the AEC operations at the New Betatron Building. None of the indoor or outdoor gamma exposure rate measurements were above DOE guidelines. The slight elevations in gamma levels found outdoors and on the roof over the shield wall are typical of naturally occurring radioactive substances present in coal ash and cinders in the fill material surrounding the building, and in concrete and cinders used in construction of the shield wall. The slightly elevated gamma levels measured at soil sampling locations can be attributed to the presence of naturally occurring radionuclides. In all of the samples, Ra-226 and U-238 appeared to be in equilibrium, indicating that these radionuclides were of natural origins and not derived from former AEC activities at the site.

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Maywood Interim Storage Site Annual Environmental Report for Calendar Year 1990

DOE/OR/21949-287; 171 pp. (September 1991)

The environmental monitoring program, which began in 1984, continued in 1990 at the Maywood Interim Storage Site (MISS), a U.S. Department of Energy (DOE) facility located in the Borough of Maywood and the Township of Rochelle Park, New Jersey. MISS is currently used for storage of soils contaminated with low-level radioactivity. Contamination is the result of wastes produced during processing of monazite sands to extract thorium, an activity carried out at the site by Maywood Chemical Works from 1916 to 1956. MISS is part of the Formerly Utilized Sites Remedial Action Program (FUSRAP), a DOE program to identify and decontaminate or otherwise control sites where residual radioactive materials (exceeding current guidelines) remain from the early years of the nation's atomic energy program or from commercial operations. Bechtel National, Inc. (BNI), project management contractor for FUSRAP, conducts remedial actions and environmental monitoring at this site and vicinity properties. The monitoring program at MISS measures radon concentrations in air; external gamma radiation levels; and thorium-232, total uranium, and radium-226 concentrations in surface water, groundwater, and sediment. Additionally, several nonradiological parameters (specific conductivity, pH, total organic carbon,

total organic halides, metals) are measured in surface water, groundwater, and sediment. The data from these monitoring programs, presented in this report, show that concentrations of contaminants of concern were all below applicable standards. The radiation dose was calculated for a hypothetical, maximally exposed individual to verify that the site is in compliance with the DOE radiation protection standard (100 mrem/yr) and to assess its potential effects on public health. Based on the conservative scenario described in this report, this hypothetical individual receives an annual external exposure of 1.3 mrem/yr. The collective dose to the population within an 80-kilometer (50-mile) radius of MISS that results from radioactive materials at the site is 2.5 person-rem/yr. The EPA-approved AIRDOS computer model calculated the dose to a hypothetical maximally exposed individual due to airborne radionuclides from the site to be 8.3 X 10(E-3) mrem/yr, well below the 10 mrem/yr limit. During 1990, MISS was in compliance with all applicable release regulations.

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Site Characterization for Remedial Design at National Priority List and FUSRAP Sites

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 439-442) (September 1991)

An innovative soil characterization procedure for radioactive soils was developed by the U.S. Environmental Protection Agency's Office of Radiation Programs. The new procedure has application to all phases of the soil characterization stage of the Remedial Investigation/Feasibility Study (RI/FS) process required at sites on the National Priority List (NPL), or at non-NPL sites being remediated under the Comprehensive Environmental Response, Compensation, and Liability Act, like the sites of the U.S. Department of Energy's Formerly Site Utilized Remedial Action Program (FUSRAP). The new soil characterization procedure is essentially an additional step to existing procedures: at the laboratory, a selected representative bulk sample from the site is processed into several size fractions, and a petrographic and radiochemical analysis is performed on each size fraction. This additional step in the RI/FS provides parameters essential for decisions that apply to site characterization, risk assessment, and remedial design. In this paper, the utility of the soil characterization protocol for radioactive soils is described for the remedial design of volume reduction methods at the FUSRAP sites in Wayne and Maywood, New Jersey, which are thorium-contaminated, and for NPL sites at Montclair and Glen Ridge, New Jersey, which are radium-contaminated. Also suggested are possible advantages of the new soil characterization, if it had been provided in the carlier stages of the RI/FS process at these sites.

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Middlesex Sampling Plant Annual Environmental Report for Calendar Year 1990

DOE/OR/21949-285; 181 pp. (September 1991)

The environmental monitoring program, which began in 1980, continued in 1990 at the former Middlesex Sampling Plant (MSP) Site, a U.S. Department of Energy (DOE) facility located in the Borough of Middlesex, New Jersey. The MSP Site is currently used as an interim storage area for contaminated soils and materials removed during cleanup of site and vicinity properties. Contamination is the result of use as a sampling, storage, and shipment facility for uranium, thorium, and beryllium ores from 1943 to 1967. MSP is part of the Formerly Utilized Sites Remedial Action Program (FUSRAP), a DOE program to identify and decontaminate or otherwise control sites where residual radioactive materials (exceeding current guidelines) remain from the early years of the nation's atomic energy program or from commercial operations. Bechtel National, Inc. (BNI), project management contractor for FUSRAP, conducts environmental monitoring at this site. The monitoring program at MSP measures radon concentrations in air;

external gamma radiation levels; and radium-226, thorium-232, and total uranium concentrations in surface water, groundwater, and sediment. Additionally, several nonradiological parameters are measured in groundwater, surface water, and sediment. The data from these monitoring programs, which are presented in this report, show that concentrations of contaminants of concern were all below applicable standards. The radiation dose was calculated for a hypothetical, maximally exposed individual to verify that the site is in compliance with the DOE radiation protection standard (100 mrem/yr) and to assess its potential effects on public health. Based on a conservative scenario, this hypothetical individual would receive an annual external exposure (excluding background) of approximately 2.6 mrem/yr. The cumulative dose to the population within an 80 kilometer (50 mile) radius of MSP that results from radioactive materials at the site is 0.28 person-rem/yr, which is extremely small compared to the collective population dose from natural background radiation of 9.6 X 10(E+5) person-rem/yr. The EPA-approved AIRDOS computer model calculated the dose to a hypothetical maximally exposed individual due to airborne radionuclides from the site to be 3.4 X 10(E-3) mrem/yr, well below the 10 mrem/yr limit. During 1990, site activities were limited to environmental monitoring, a special study on stream sediments in the MSP vicinity, and site maintenance. There were no nonroutine releases from the site; MSP was in compliance with all applicable regulations for releases from the site, as has been the case since it was included in FUSRAP in 1980.

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Wayne Interim Storage Site Annual Environmental Report for Calendar Year 1990

DOE/OR/21949-286; 181 pp. (September 1991)

The environmental monitoring program, which began in 1984, continued in 1990 at the Wayne Interim Storage Site (WISS), a U.S. Department of Energy (DOE) facility and National Priorities List site located in Wayne Township, New Jersey. WISS is currently used as an interim storage area for contaminated materials removed during cleanup of the site and vicinity properties. Contamination is the result of wastes produced during processing of monazite sands to extract thorium and rare-earth elements, an activity carried out at the site by Rare Earths, Inc. and W.R. Grace and Company from 1948 to 1971. WISS is part of the Formerly Utilized Sites Remedial Action Program (FUSRAP), a DOE program to identify and decontaminate or otherwise control sites where residual radioactive materials (exceeding current guidelines) remain from the early years of the nation's atomic energy program or from commercial operations. Bechtel National, Inc. (BNI), project management contractor for FUSRAP, conducts remedial actions and environmental monitoring at this site and vicinity properties. The monitoring program at WISS measures thoron and radon concentrations in air; external gamma radiation levels; and thorium-232, radium-226, and total uranium concentrations in surface water, groundwater, and sediment. Sediment samples were also analyzed for thorium-230. Additionally, several nonradiological parameters (specific conductivity, pH, total organic carbon, total organic halides, metals) are measured in groundwater. The data from these monitoring programs, presented in this report, show that concentrations of contaminants of concern were all below applicable standards. The radiation dose was calculated for a hypothetical maximally exposed individual to verify that the site is in compliance with the DOE radiation protection standard (100 mrem/yr) and to assess its potential effects on public health. Based on the conservative scenario described in this report, this hypothetical individual receives an annual external exposure of 0.84 mrem/yr. The collective dose to the population within an 80-kilometer (50-mile) radius of WISS that results from radioactive materials at the site is 0.080 person-rem/yr. The EPA-approved AIRDOS computer model calculated the dose to a hypothetical maximally exposed individual due to airborne radionuclides from the site to be 3 X 10(E-4) mrem/yr, well below the 10 mrem/yr limit. Site activities included routine maintenance and sampling the interim storage pile for Resource Conservation and Recovery Act (RCRA) hazardous waste. Results of the pile sampling will be reported in 1991. During 1990, WISS was in compliance with all applicable release regulations.

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Bechtel National, Inc., Oak Ridge, TN

Colonie Interim Storage Site Annual Environmental Report for Calendar Year 1990

DOE/OR/21949-284; 161 pp. (September 1991)

Environmental monitoring of the U.S. Department of Energy (DOE) Colonie Interim Storage Site (CISS) in Colonie, New York and the surrounding area began in 1984. CISS is part of the Formerly Utilized Sites Remedial Action Program (FUSRAP), a DOE program to decontaminate or otherwise control sites where residual radioactive materials remain from the early years of the nation's atomic energy program or from commercial operations causing conditions that Congress has authorized DOE to remedy. The routine environmental monitoring program at CISS includes sampling networks for external gamma radiation exposure and for radium-226, thorium-232, and total uranium concentrations in surface water, sediment, and groundwater. Additionally, nonradiological parameters (volatile and semivolatile organics, pesticides, polychlorinated biphenyls, metals, total organic carbon, total organic halides, specific conductivity, and pH) are measured in groundwater. During 1990, the average external gamma radiation exposure levels were 14 mR/yr on site and 5 mR/yr at the property line, excluding background radiation, which averages 58 mR/yr in the area. Annual average concentrations of the radionuclides in both surface and groundwater were well below applicable guidelines. Concentrations of radium-226 and thorium-232 in sediment (0.5 to 0.7 pCi/g) were below the FUSRAP soil guideline of 5 pCi/g; total uranium concentrations ranged from 3.9 to 49 pCi/g, with one sample exceeding the guideline for uranium (35 pCi/g). The sample was located on-site and upstream of other sampling locations. All other samples were well below the guideline. In response to a DOE request, surface water, groundwater, and sediment were sampled for gross alpha, gross beta, and technetium-99 contamination. Results of this study confirm that the environmental monitoring program currently in place is testing the media for the principal radionuclides known to have been present at the site. The radiation dose was calculated for a hypothetical, maximally exposed individual to verify that the site is in compliance with the DOE public dose limit (100 mrem/yr). Based on a conservative scenario, this hypothetical individual would receive an annual external exposure (excluding background) of 1.5 mrem/yr. The cumulative dose to the population within an 80-kilometer (50-mile) radius of CISS resulting from radioactive materials at the site is 3.9 X 10(E 4) person-rem/yr. The EPA-approved AIRDOS computer model calculated the dose to a hypothetical maximally exposed individual due to airborne radionuclides from the site to be 2 X 10(E-4) mrem/yr, well below the 10 mrem/yr limit.

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Performance Monitoring Report for the Niagara Falls Storage Site Waste Containment Structure, Lewiston, New York, for Calendar Year 1990

DOE/OR/21949-303; 64 pp. (March 1992)

A performance monitoring program was developed in 1986 for the waste containment structure (WCS) at the Niagara Falls Storage Site (NFSS), Lewiston, New York. The WCS contains soil contaminated with residual radioactive materials, rubble, and radioactive residues removed from various areas of NFSS and vicinity properties during remedial action conducted by the U.S. Department of Energy from 1981 through 1986. The purpose of the performance monitoring program is to verify that the main engineering elements of the WCS are functioning to minimize infiltration of rainfall, prevent pollution of groundwater, and prevent radon emanation. This report presents the findings of performance monitoring conducted at the WCS during calendar year 1990. It contains data for surface, subsurface, and environmental monitoring; conclusions based on walkover surveys; comparisons with previous data; and actions required. The data collected during the initial performance monitoring period in 1986 established a baseline for the interpretations contained in this report.

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R.D. Foley and M.S. Uziel, Oak Ridge National Laboratory, Health and Safety Research Division, Oak Ridge, TN

Results of the Radiological Survey at the Former McKinney Tool and Manufacturing Company, 1688 Arabella Road, Cleveland, Ohio (MTC001 and MTC002)

ORNL/RASA-91/7; 20 pp. (November 1991)

At the request of the U.S. Department of Energy (DOE), a team from Oak Ridge National Laboratory conducted a radiological survey at the site of the former McKinney Tool and Manufacturing Company, 1688 Arabella Road, Cleveland, Ohio. The survey was performed on November 17 and 18, 1990. The purpose of the survey was to determine whether the property was contaminated with radioactive residues, principally U-238, as a result of work done for the Manhattan Engineer District in 1944. The survey included: (1) a gamma scan, a beta-gamma scan, and measurement of alpha level; (2) measurements of direct and removable alpha and beta-gamma levels; and (3) the collection of soil and sediment, dust, and air samples for radionuclide analyses. The survey and sampling covered accessible areas of buildings currently occupied by Parker Rust-Proof and Meistermatic, Inc., and exterior areas immediately adjacent to these buildings.

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R.D. Foley and R.F. Carrier, Oak Ridge National Laboratory, Health and Safety Research Division, Oak Ridge, TN

Radiological Characterization Survey of the Former Diamond Magnesium Company Site, 720 Fairport-Nursery Road, Painesville, Ohio (DMP001, DMP002)

ORNL/TM-11817; 96 pp. (December 1991)

In September 1990, a group from Oak Ridge National Laboratory performed an investigative radiological survey at the former Diamond Magnesium Company (DMC) site at 720 Fairport Road, Painesville, Ohio, for the Department of Energy (DOE). The survey was to determine if the site is contaminated with radioactive residues from federal operation of the facility for nuclear defense-related projects. Separate parcels of the site are currently owned by the Uniroyal Chemical Company and the Lonza Chemical Company. The survey included a gamma scan over the ground surface, the determination of gamma-exposure rates at the surface and at one meter above the surface at points on a grid, the collection and radionuclide analysis of soil samples, and the direct measurement of radiation levels inside three buildings that were used during the original DMC processing. Results of the survey revealed widespread radiological contamination outdoors on the Uniroyal property and several isolated spots of elevated radiation of the Lonza property. The contaminants consisted of radium, uranium, and thorium in surface and subsurface soil, in concentrations exceeding the DOE guidelines for the release of property for unrestricted use.

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Bechtel National, Inc., Oak Ridge, TN

Post-Remedial Action Report for Phase II Work Conducted During 1990-1991 at the Albany Research Center, Albany, Oregon

DOE/OR/21949-302; 69 pp. (May 1992)

This report documents remedial actions performed at the Albany Research Center (ARC) in Albany, Oregon, which is owned by the U.S. Department of Interior and operated by the U.S. Bureau of Mines. ARC was established in 1943 to investigate innovative approaches for developing strategic mineral resources in the United States, reducing costs for metallurgical manufacturing processes, developing materials to reduce corrosion, and conducting other metallurgical research. Phase I of the remedial action project was conducted in 1987 and 1988, and a post-remedial action report describing this work was published in 1989. Subsequent radiological survey data indicated that additional remedial action was necessary; this formed the basis for Phase II work. In Phase II, radioactive contamination was removed from 5 exterior areas and from portions of 15 buildings at ARC during the 1990-91 remedial action. This report documents the methods used to determine the extent of contamination, the type of remedial

action performed during Phase II, guidelines used in performing this remedial action, final excavation limits and depths, and post-remedial action data on the current radiological status of the property.

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R.D. Foley, W.D. Cottrell, and J.W. Crutcher, Oak Ridge National Laboratory, Health and Safety Research Division, Oak Ridge, TN

Results of the Radiological Survey at Conviber, Inc., 644 Garfield Street, Springdale, Pennsylvania (CVP001)

ORNL/RASA-89/18; 30 pp. (October 1991)

As part of the Formerly Utilized Sites Remedial Action Program (FUSRAP), the U.S. Department of Energy (DOE) is implementing a radiological survey program to determine the radiological conditions at sites that were used by the department's predecessor agencies. During the mid-1940s, and possibly continuing until 1951, the Conviber, Inc., site in Springdale, Pennsylvania, was used to machine extruded uranium in support of government efforts. In 1980, a radiological scanning survey of this site was conducted by DOE and Argonne National Laboratory (ANL) staffs. Their report noted one anomaly: elevated radiation levels over a small area inside the building where uranium had been machined. Because much of the floor was inaccessible for surveying, and because of the lack of definitive records documenting the use of this site, a comprehensive radiological assessment was recommended. The radiological survey was conducted by members of the Measurements Applications and Development Group of Oak Ridge National Laboratory (ORNL) in June 1989. The survey included a gamma-surface scan, collection of concrete and soil samples, and measurement of direct and removable alpha and beta-gamma contamination. One indoor location with a gamma measurement of 20 uR/h was found. In June 1990, ORNL staff returned to investigate the location with the elevated gamma measurement. A hole was drilled through the concrete, gamma measurements were taken, and soil samples were obtained for analysis. In these eight indoor soil samples, concentrations of U-238 ranged rom 90 to 20,000 pCi/g. However, under current site use, residual uranium covered by concrete does not pose a threat. Based on the above findings, it is recommended that this site be considered for inclusion under FUSRAP.

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W.D. Cottrell, R.D. Foley, and L.M. Floyd, Oak Ridge National Laboratory, Health and Safety Research Division, Oak Ridge, TN

Results of the Radiological Survey at the Jessop Steel Company Site, 500 Green Street, Washington, Pennsylvania (JSP001) - Environmental Restoration and Waste Management Non-Defense Programs

ORNL/RASA-89/20; 39 pp. (April 1991)

At the request of the U.S. Department of Energy (DOE), a group from Oak Ridge National Laboratory conducted investigative radiological surveys at the Jessop Steel Company, 500 Green Street, Washington, Pennsylvania (JSP001) in 1989. The purpose of the surveys was to determine whether the property was contaminated with radioactive residues, principally U-238, as a result of work contracted to the Atomic Energy Commission. The survey included (1) gamma scans; (2) direct and transferable measurements of alpha and beta-gamma radiation levels; and (3) soil dust, debris, grinding wheel, and air sampling for radionuclide analyses. The survey and sampling covered portions of the exterior ground surface, the roof and gutter section above the saw shop and rolling mill area of building D, and the interiors of buildings A, B, C and D. Results of the survey demonstrated no radionuclide concentrations in excess of the DOE Formerly Utilized Sites Remedial Action Program guidelines for radium, thorium, and uranium. The radionuclide distributions were not significantly different from typical background levels in the Pennsylvania area.

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Bechtel National, Inc., Oak Ridge, TN

Health and Safety Plan for the Seymour Site - Seymour, Connecticut

DOE/OR/21949-349; 118 pp. (1992)

Bechtel National, Inc. (BNI) is the project management contractor for the Formerly Utilized Sites Remedial Action Program (FUSRAP), a U.S. Department of Energy (DOE) program to decontaminate or otherwise control sites where residual radioactive materials remain from the early years of the nation's atomic energy program or from commercial operations causing conditions that Congress has authorized DOE to remedy. BNI has prepared a generic health and safety plan (HSP) that contains guidelines for general health and safety activities at all FUSRAP sites. However, the FUSRAP HSP does not contain site-specific information. The purposes of this site-specific HSP are to define the health and safety requirements to be followed at the Seymour Site, an 8 acre FUSRAP site in Seymour, Connecticut, for all BNI-contracted work and to provide information needed to implement a site-specific health and safety programs. This plan was developed according to (1) safety standards defined by the Environmental Protection Agency, the Occupational Safety and Health Administration, and the National Institute for Occupational Safety and Health; (2) health standards for known contaminants; and (3) procedures designed to prevent exposure to unknown substances.

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Bechtel National, Inc., Oak Ridge, TN

Health and Safety Plan for the Ventron Site - Beverly, Massachusetts

DOE/OR/21949-347; 141 pp. (June 1992)

Bechtel National, Inc. (BNI) is the project management contractor for the Formerly Utilized Sites Remedial Action Program (FUSRAP), a U.S. Department of Energy (DOE) program to decontaminate or otherwise control sites where residual radioactive materials remain from the early years of the nation's atomic energy program or from commercial operations causing conditions that Congress has authorized DOE to remedy. BNI has prepared a generic health and safety plan (HSP) that contains guidelines for general health and safety activities at all FUSRAP sites. However, the FUSRAP HSP does not contain site-specific information. The purposes of this site-specific HSP are to define the health and safety requirements to be followed at the Ventron Site, a 2.5 acre FUSRAP site in Beverly, Massachusetts, for all BNI-contracted work and to provide information needed to implement a site-specific health and safety programs. This plan was developed according to (1) safety standards defined by the Environmental Protection Agency, the Occupational Safety and Health Administration, and the National Institute for Occupational Safety and Health; (2) health standards for known contaminants; and (3) procedures designed to prevent exposure to unknown substances.

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U.S. Department of Energy, Oak Ridge Field Office, Oak Ridge, TN

DOE Begins Final Phase of Elza Gate Cleanup

DOE News (911001):1-2 (October 1, 1991)

The U.S. Department of Energy (DOE) Oak Ridge Field Office has begun the final phase of the Elza Gate Site cleanup. The Elza Gate Site is located at the east end of the city of Oak Ridge, Tennessee. Contamination present at the site includes uranium, thorium, radium, and polychlorinated biphenyls (PCBs) used by the Army during World War II and later by DOE predecessors. The final phase of the Elza Gate Site cleanup is expected to be completed in February 1992. Cleanup will consist of removing the remaining contaminated materials on site and shipping the bulk of the material to a disposal site on the Oak Ridge Reservation. Soil containing PCBs at concentrations greater than 50 parts-per-million will be disposed of at a commercial facility in accordance with provisions of the Toxic Substances Control Act.

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Roy F. Weston, Inc., Oak Ridge, TN

Modeling of Elza Gate Contaminated Material for Use as Fill Material at the United Nuclear Corporation Waste Disposal Site, Oak Ridge Y-12 Plant, Oak Ridge, Tennessee

Y/ER/Sub-90/99927/2; 106 pp. (September 1991)

This report presents the results of groundwater impact modeling to predict the migration of contaminants of concern from the United Nuclear Corporation (UNC) Waste Disposal Site at the Oak Ridge Y-12 Plant in Oak Ridge, Tennessee. This analysis considers contaminants in the current UNC-Site waste materials (nitrates and Sr-90) and contaminants in soils from the Elza Gate Site (U-238, Th-232, Th-230, Ra-226, and polychlorinated biphenyls) proposed for disposal at the UNC Site. Results are presented both for a conservative screening evaluation that assumes immediate introduction of contaminants into the groundwater, and for a more reasonable, but still conservative, approach that considers contaminant migration and dispersion through the soil column. Results are presented both for the proposed remedial alternative, which includes construction of a multilayered cap over the waste materials, and for a no-action alternative, which considers emplacement of the waste materials at the site with no cap or cover system. Predicted contaminant concentrations appear to be within acceptable levels in both cases.

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J.R. Kannard, EG&G Idaho, Inc., Idaho Falls, ID

Status of Disposal Sites for the Department of Energy's Formerly Utilized Sites Remedial Action Program

CONF-880839; Disposal Technology and Facility Development - Session 3, Proceedings of the Tenth Annual Department of Energy Low-Level Waste Management Conference, Denver, Colorado, August 30-September 1, 1988, 105 pp.; (pp. 69-81) (December 1988)

The Formerly Utilized Sites Remedial Action Program (FUSRAP) is a U.S. Department of Energy program to evaluate and remedy radiological and chemical contamination conditions at sites across the nation where contamination exceeding current guidelines remains from the early years of the nation's atomic energy program or from commercial operations that resulted in conditions which Congress has mandated DOE to remedy. The need for permanent disposal facilities for the low-level radioactive wastes and mixed wastes resulting from the FUSRAP program was recognized early. The selection and development of disposal sites was known to require significant time. Because of the complexities of developing a disposal site, a plan was developed to proceed with remedial action prior to availability of permanent disposal sites. To accomplish this, the waste from remedial action activities would be placed in temporary storage at interim storage sites. The paper provides a description of the wastes involved, and issues requiring attention including public relations, regulations, government agency interaction, mixed waste requirements. Current status of the program along with evolving strategies are discussed.

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N.C. Ring, S.G. Wilkinson, and B.C. McConnel, Bechtel National, Inc., Oak Ridge, TN

Live Stream Remediation at Sheffield Brook

Water Environment Technology 2(10):17-18 (October 1990)

Radioactive waste that was spread for more than 20 years at an industrial site in northern New Jersey is being remediated by the U.S. Department of Energy (DOE) and Bechtel. Wastes and residues from processing operations typically contained less than 5% of the original thorium concentration. Under the 1984 Energy and Water Appropriations Act, Congress authorized DOE to conduct a decontamination research and development project at the Wayne Interim Storage Plant Site and at properties in its vicinity. This report describes remediation of the Sheffield Brook area of the site.

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M.M. Benge, Bechtel National, Inc., Oak Ridge, TN

Remedial Action for the Baker and Williams Warehouses Site, New York, New York

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 377-382) (September 1991)

The Baker and Williams Warehouses site in the Borough of Manhattan on the west side of New York City was remediated as part of the Formerly Utilized Sites Remedial Action Program (FUSRAP). FUSRAP is a U.S. Department of Energy (DOE) effort to identify and clean up or control sites where residual radioactive contamination exceeding current guidelines remains from the early years of the nation's atomic energy program. The site, formerly owned by Baker and Williams Company, was used during the 1940s by the Manhattan Engineer District, predecessor to DOE, for short-term storage of uranium concentrates. A 1989 radiological survey of the warehouse conducted by Oak Ridge Associated Universities indicated the presence of residual contamination in the east bay basement and west bay first floor of one of three buildings on the site. This paper describes the selection of a remedial alternatives for the contaminated surfaces in these areas. The selected actions included: (1) mechanical decontamination by scarification and (2) chemical decontamination using Nutech-755, a nonhazardous, non-toxic product that breaks down the concrete and releases entrapped contaminants by a process similar to etching. A verification survey of the remediated areas in April 1991 confirmed that the contamination had been removed to meet current radiological criteria.

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Bechtel National, Inc., Oak Ridge, TN

Post-Remedial Action Report for Building 521-527, Baker and Williams Warehouses Site - New York, New York

DOE/OR/21949-301; 55 pp. (February 1992)

The Baker and Williams Warehouses, on West 20th Street in Manhattan, were used by the Manhattan Engineer District and the Atomic Energy Commission for short-term storage of uranium concentrates. This report documents radiological conditions at one of the warehouses, Building 521-527, following remedial action conducted by Bechtel National, Inc. (BNI) from April 1 through April 26, 1991. The remediation was performed under the Formerly Utilized Sites Remedial Action Program, a Department of Energy (DOE) project that identifies and decontaminates or otherwise controls sites where residual radioactive contamination that exceeds current guidelines remains from the early years of the atomic energy program. A radiological survey of Building 521-527 conducted by Oak Ridge Associated Universities (ORAU) in late August 1989 found residual contamination that exceeded guidelines in two areas, the east bay of the basement and the floor surface in the west bay of the first floor. Another ORAU survey of the basement in March 1991 identified four locations in the east bay that exceeded residual activity criteria. All surface contamination was fixed (not readily removable), but BNI performed remedial actions to ensure that the building meets current radiation protection guidelines, and so that planned renovations would not spread contamination. After the cleanup was completed, a radiological survey of the remediated areas was conducted to ensure that no radioactivity that exceeded DOE guidelines remained. The data indicate that the contaminated areas in Building 521-527 were successfully remediated and are now in compliance with applicable DOE guidelines. Based on a review of the post-remedial action measurements, measurement procedures, and quality control data, an independent verification contractor (IVC) will verify whether these areas have been decontaminated to meet the guidelines established for the site. The IVC may visit the site and conduct direct measurements, sampling, and/or split-sample analyses. DOE will review the data from the IVC review to determine whether the remedial action was successful, and to certify the site as appropriate for future use.

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U.S. Department of Energy, Oak Ridge Field Office, Oak Ridge, TN

DOE Completes Elza Gate Restoration

DOE News (920306):1 (March 6, 1992)

This press release announces the completion of restoration of residual radioactive contamination and polychlorinated biphenyls (PCBs) at the Elza Gate Site in Oak Ridge, Tennessee. The site, now known as Melton Lake Industrial Park, can now be used without any radiological restrictions. The restoration project was managed by the U.S. Department of Energy's Formerly Used Sites Remedial Action Program (FUSRAP), which identifies and restores sites contaminated with radioactive materials from the early years of the nation's atomic energy program. During the 1940s, the Elza Gate Site consisted of five warehouses and other smaller structures and was used to unload and store uranium ore for the Manhattan Project. The restoration included the excavation and temporary on-site storage of contaminated soils and concrete rubble from the Manhattan Project Site, then a second phase in which 818 truckloads of the contaminated materials were transported to an engineered disposal facility near the Oak Ridge Y-12 Plant.

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J.J. Cheng, C. Yu, F. Monette, and L. Jones, Argonne National Laboratory, Argonne, IL

Derivation of Uranium Residual Radioactive Material Guidelines for the Shpack Site

ANL/RP-74354; 19 pp. (August 1991)

Residual radioactive material guidelines for uranium were derived for the Shpack Site in Norton, Massachusetts. This site has been identified for remedial action under the Formerly Utilized Sites Remedial Action Program of the U.S. Department of Energy (DOE). The uranium guidelines were derived on the basis of the requirement that the 50-year committed effective dose equivalent to a hypothetical individual who lives or works in the immediate vicinity of the Shpack Site should not exceed a dose of 100 mrem/yr following decontamination. The DOE residual radioactive material guideline computer code, RESRAD, which implements the methodology described in the DOE manual for implementing residual radioactive material guidelines, was used in this evaluation. Three potential scenarios were considered for the site; the scenarios vary with regard to time spent at the site, sources of water used, and sources of food consumed. The results of the evaluation indicate that the basic dose limit of 100 mrem/yr will not be exceeded for uranium (including uranium-234, uranium-235, and uranium-238) within 1000 years, provided that the soil concentration of combined uranium (uranium-234 and uranium-238) at the Shpack Site does not exceed the following levels: 2500 pCi/g for Scenario A (recreationist: the expected scenario); 1100 pCi/g for Scenario B (industrial worker: a plausible scenario); and 53 pCi/g for Scenario C (resident farmer using well water as the only water source: a possible but unlikely scenario). The uranium guidelines derived in this report apply to the combined activity concentration of uranium-234 and uranium-238 and were calculated on the basis of a dose of 100 mrem/yr. In setting the actual uranium guidelines for the Shpack Site, DOE will apply the as-low-as-reasonably-achievable policy to the decision-making process, along with other factors, such as whether a particular scenario is reasonable and appropriate.

DEPARTMENT OF ENERGY (DOE) URANIUM MILL TAILINGS REMEDIAL ACTION PROJECT

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U.S. Department of Energy, Albuquerque Field Office, Albuquerque, NM

DOE Selects Subcontractor for Gunnison, Colorado, Tailings Cleanup

DOE News (920604):1-4 (June 4, 1992)

The U.S. Department of Energy's Uranium Mill Tailings Remedial Action Project, through its remedial action contractor, the M-K Ferguson Company, has selected a subcontractor to begin cleanup of the inactive uranium processing site near Gunnison, Colorado. The $12 million construction contract for the four-year cleanup project was awarded to Ames Construction Company of Denver, Colorado. The contract does not include the remedial action design and field management of the Gunnison project, or the engineering and cleanup of vicinity properties nearby. Construction activity is scheduled to begin the week of June 15, 1992. The project will employ an estimated 105 workers at peak activity in 1993 and 1994. The planned remedial action involves relocating tailings form the processing site to a disposal site 9.6 km east of Gunnison. A disposal cell will be constructed there to isolate the tailings from the environment, in accordance with U.S. Environmental Protection Agency standards.

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U.S. Department of Energy, Albuquerque Field Office, Albuquerque, NM

DOE, State, Local Officials to Break Ground for Gunnison, Colorado, Tailings Cleanup

DOE News (920716):1-3 (July 16, 1992)

This news release announces that the U.S. Department of Energy and the state of Colorado commemorated, with a groundbreaking ceremony, the start of Phase II remedial action construction at the Gunnison, Colorado, Uranium Mill Tailings Remedial Action Project Site. The Gunnison Mill Site is a 25-hectare tract located southwest of the city of Gunnison, adjacent to the municipal airport. All the structures from the old mill were demolished during Phase I construction in 1991. There are an estimated 547,200 cu m of tailings remaining at the site. The Gunnison remedial action involves moving the tailings to a remote disposal site (called the landfill site) located 13 km east of Gunnison, about 1.2 km south of the county's solid waste landfill.

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U.S. Department of Energy, Albuquerque Field Office, Albuquerque, NM

DOE and State to Hold Phase II Groundbreaking Ceremony in Rifle, Colorado

DOE News (920612):1-3 (June 12, 1992)

This news release announces the groundbreaking ceremony to commemorate the start of Phase II remedial action construction at the Rifle, Colorado, Uranium Mill Tailings Remedial Action (UMTRA) Project sites on June 25, 1992. Phase I cleanup began in August 1988 and was completed in 1989. Phase I included demolishing mill structures, removing asbestos and other hazardous materials, improving site security, and establishing temporary construction facilities. Phase II remedial action is scheduled to take approximately 50 months to complete. During Phase II, the tailings from both sites and vicinity properties will be relocated to a disposal site at Estes Gulch, Colorado, 8 km north of the city of Rifle.

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U.S. Department of Energy, Albuquerque Field Office, Albuquerque, NM

DOE Selects Contractor for Falls City, Texas, Tailings Cleanup

DOE News (920116):1-3 (January 16, 1992)

This newsletter announces that the U.S. Department of Energy, through its remedial action contractor, MK-Ferguson Company, has selected a contractor to begin cleanup of the inactive Susquehanna-Western uranium processing site at Falls City, Texas. The contract for the 36-month cleanup project has been awarded to Gilbert Texas Construction Corporation of Hurst, Texas. Gilbert was scheduled to begin work in late January, 1992. The Susquehanna-Western processing site, later operated by Solution Engineering, Inc., has been inactive since 1982. The site includes two parcels

of 185.8 ha and 54.3 ha. An estimated 4,434,000 cu m of tailings and contaminated material will be cleaned up at the site. The planned remedial action involves combining six tailings piles, material from a contaminated tailings pond, and other contaminated material into a single disposal cell, stabilized in accordance with U.S. Environmental Protection Agency standards for longevity, control of radon emanation, and groundwater protection.

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U.S. Department of Energy, Albuquerque Field Office, Albuquerque, NM

Public Meeting to Be Held on Falls City, Texas, Tailings Cleanup

DOE News (910813):1-2 (August 13, 1991)

This news release announces a public meeting on August 21, 1991, held by the U.S. Department of Energy and the Texas Department of Health regarding plans to clean up the inactive Susquehanna-Western Uranium Processing Site at Falls City, Texas. The meeting focus was to update the public on the status and schedule of activities at the Falls City Site. The proposed remedial action involves combining the tailings and other contaminated material on the site into a single embankment and stabilizing the material in accordance with U.S. Environmental Protection Agency standards.

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L.B. Fahy, U.S. Department of Energy, Uranium Mill Tailings Remedial Action Project Office, Albuquerque, NM

Working with States on a Joint DOE/State Funded Cleanup Project

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 169-171) (September 1991)

The Uranium Mill Tailings Radiation Control Act of 1978 authorizes the U.S. Department of Energy, with the active participation of affected states and Indian tribes, to remediate mill tailings at 24 designated sites. Specific state and tribal responsibilities are detailed in cooperative agreements. This paper provides information on the Uranium Mill Tailings Remedial Action Project experience in fulfilling its mission in cooperation with states and tribes. The UMTRA Project is a success: nine of the 24 sites have been remediated; two sites are presently undergoing remedial action; and remedial action is scheduled to start at four sites in fiscal year 1992. It has succeeded through its partnership with the participating states and tribes. UMTRA has also learned valuable lessons which can be applied now and in future cost-shared projects: (1) states and tribes should be involved as early as possible in any activities associated with the sites; (2) state and local issues often take precedence in the selection of remedial alternatives; (3) state agencies must be kept informed of recognized cost increases as they occur (the UMTRA Project Office developed an estimate-at-completion report which is sent to states and tribes on a monthly basis); (4) good lines of communication among state and tribal representatives and the Department of Energy assure support; and (5) cooperation is the key to success.

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R.E. Hall, U.S. Nuclear Regulatory Commission, Uranium Recovery Field Office, Denver, CO

Receipt of Request and Intent to Issue License Amendment Regarding Reclamation Plans for Inactive Uranium Mill

Federal Register 56(217):57360 (November 8, 1991)

In accordance with a Memorandum of Understanding (MOU) between the U.S. Environmental Protection Agency (EPA) and the U.S. Nuclear Regulatory Agency (NRC), NRC has received a request for revision of a reclamation-plan timetable from Western Nuclear, Inc., for their Split Rock facility, Docket 40-1162, License SUA-056. This request, dated October 21, 1991, justifies a change of the scheduled completion date from November 1, 1991 to January 31, 1992, for placement of the interim cover over the uranium mill tailings pile. The basis

for the change as presented was a significant increase in the required amount of earthmoving over that envisioned. The NRC staff has reviewed the proposal and intends to issue a license amendment to change the scheduled completion date.

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B. Hunt and J. Monaghan, Jacobs Engineering Group, Inc., Albuquerque, NM; Monaghan & Associates, Inc., Denver, CO

How Public Issues Shape Environmental Restoration Plans: Experiences with Colorado UMTRA Projects

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 39-42) (September 1991)

Federal environmental restoration plans are being significantly affected by "grassroots" public pressure and by community demands. Some of these community demands have little relation to the technical standards of remediation and go well beyond the guidelines of authorizing legislation. These demands often represent significant additional project costs. This paper is a review of the Uranium Mill Tailings Remedial Action (UMTRA) Program experiences in Colorado. The review suggests that the more serious "grassroots" issues concerning remediation rarely diminish and, in fact, will intensify over time. This presents program administrators with the dilemma of keeping projects within budget, while at the same time trying to respond to community concerns. After prolonged public debate, project officials may be forced to meet certain community demands. Often this results not only in increased costs, but also in a loss of public confidence in the cleanup efforts. However, when critical public issues can be identified and addressed before they become overly contentious, significant problems and controversy can be avoided. But project officials often lack a policy to determine which community demands to accept and to what extent they should be met. The adoption of five key public policy principles by program administrators will enable them to address community demands in a timely and successful manner. These principles are: (1) the significance of community opinion should be recognized; (2) the importance and impact of public pressure should be anticipated; (3) remediation projects should be monitored to identify major policy disputes; (4) project officials should engage community issues and should intervene before these issues become out of control; and (5) leadership and accountability must be instilled at all project levels.

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Introduction of a Bill to Reauthorize the Uranium Mill Tailings Radiation Control Act of 1978

Congressional Record 137(168):H10268 (October 29, 1991)

Senator Hank Brown of Colorado addresses the Senate to introduce Senate bill S-1885, a bill to reauthorize the Uranium Mill Tailings Radiation Control Act of 1978. The bill will extend the Act from its current expiration date of 1994 to September 30, 1998. This extension will ensure adequate time to complete remediation of the 24 inactive uranium mill tailing sites included in the program. Nine of the 24 sites have been remediated to date. The bill is referred to the Senate Committee on Energy and Natural Resources.

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R.R. Knott and C.A. Little, Oak Ridge National Laboratory, Oak Ridge, TN

Quality Assurance Program Plan for the Radiological Survey Activities Program - Uranium Mill Tailings Remedial Action Project

ORNL/TM-9684/R2; 37 pp. (August 1991)

The Pollutant Assessments Group (PAG) of Oak Ridge National Laboratory (ORNL) at the Grand Junction Office (GJO), Colorado, is responsible for surveying designated sites in the vicinity of 24 inactive mill sites involved in the Department of Energy's (DOE) Uranium Mill Tailings Remedial Action Project (UMTRAP). The purpose of these

surveys is to provide a recommendation to DOE whether to include or exclude these sites from UMTRAP, based on whether the on-site residual radioactive material (if any) originated from the former mill sites, and on whether radiation levels on-site are in excess of appropriate Environmental Protection Agency (EPA) criteria. This report describes the Quality Assurance Plan (QAP) for the PAG in conducting all activities related to UMTRAP. All quality assurance provisions given by the DOE, DOE/UMTRA and ORNL organizations are integrated into this plan. Specifically, this report identifies the policies and procedures followed in accomplishing the PAG/UMTRA QA program, identifies those organizational units involved in the implementation of these procedures and outlines the respective responsibilities of those groups.

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C. Reith and J.E. Till, Jacobs Engineering Group, Inc., St. Charles, MO; Radiological Assessments Corporation, Neeses, SC

DECHEM: A Remedial Planning Tool for Chemical Contaminants in Soil

Proceedings of the 1990 ENVIROTECH Symposium, Vienna, Austria, September 20-25, 1990. International Society for Environmental Protection, Vienna, Austria; (pp. 335-340) (1990)

Radium-226 has been the basis for uranium-mill-tailing remediation planning in the U.S. However, evidence indicates that metallic toxicants are more mobile and present a greater persistent health risk. The DECHEM (decontamination of chemicals) procedure, developed to address metallic contamination, addresses site-specific criteria based on known contamination risks of these chemicals, particularly after remedial action has been taken. This procedure been carried out at various uranium mill tailings remedial action (UMTRA) sites.

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U.S. Department of Energy, Albuquerque Field Office, Albuquerque, NM

Uranium Mill Tailings Remedial Action (UMTRA) Project 1992 Site-Specific Plan Available

DOE News (910912):1-3 (September 12, 1991)

As part of its Environmental Restoration and Waste Management Five-Year Plan, the U.S. Department of Energy (DOE) announces a 60-day period of public comment following the release of a Site-Specific Plan (SSP) for surface remedial action and groundwater restoration activities at the 24 inactive uranium processing sites associated with the Uranium Mill Tailings Remedial Action (UMTRA) Surface and UMTRA Groundwater Projects. The SSP is part of the DOE public-planning process to address environmental restoration at DOE-managed sites across the country. The SSP emphasizes the near-term actions being performed at UMTRA Project sites in fiscal year 1992, and includes planned actions through fiscal year 1997. Under the UMTRA Surface Project, both the abandoned mill sites, and any properties where uranium mill tailings were relocated after processing was complete, are remediated. The UMTRA Groundwater Project involves examination and restoration of potential groundwater contamination from UMTRA Surface sites.

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U.S. Department of Energy, Uranium Mill Tailings Remedial Action Project Office, Albuquerque, NM

Environmental Assessment of Remedial Action at the Gunnison Uranium Mill Tailings Site Near Gunnison, Colorado

DOE/EA-0376; 101 pp. (February 1992)

Contaminated materials at the Gunnison, Colorado, uranium mill tailings site cover an estimated 60.5 acres at the designated site and an additional 7.5 acres on adjacent properties. Contaminated areas include a tailings pile, subsurface contamination, windblown contamination, and miscellaneous areas that have been contaminated by uranium processing activities. In addition to the contamination in the processing site area, 11 properties off of the site

(vicinity properties) were found to contain contamination. The contaminated materials from the vicinity properties are being stored on the processing site. The total volume of contaminated materials is estimated at 718,900 cu yds. Contamination associated with the processing site has leached into the groundwater and is affecting the water quality of 22 residences hydrologically downgradient from the tailings pile. The proposed action for remediation of the Gunnison processing site consists of removing all contaminated materials found within the designated site boundary or associated with the processing site and stabilizing them at a remote location, approximately six air miles east of the processing site and the town of Gunnison. The contaminated materials will be partially buried and covered with layers of soil and rock. Adverse environmental impacts associated with the proposed action include the following: (1) noise impacts to the residents of a subdivision who live near the proposed haul route; (2) the destruction of a small population of the Gunnison milkvetch, a federal candidate plant species growing on the tailings pile; (3) the loss of wetlands; (4) possible impacts to a recently transplanted antelope herd and sage grouse use areas; (5) temporary and permanent loss of 92 acres of open range for grazing and wildlife use; and (6) possible impacts on the Colorado squawfish, humpback chub, bonytail chub, and razorback sucker from the project's use of water from the Colorado River Basin.

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U.S. Department of Energy, Uranium Mill Tailings Remedial Action Project Office, Albuquerque, NM

Environmental Assessment of the Provision of a Water Supply System - Gunnison, Colorado - Final

DOE/EA-0529; 60 pp. (December 1991)

Domestic water wells located downgradient of the Gunnison, Colorado, Uranium Mill Tailings Remedial Action Project Site contain elevated levels of uranium. To reduce the public health risk until a permanent solution could be developed and studied, the U.S. Department of Energy (DOE) began providing bottled water to all affected or potentially affected domestic well users in 1990. In the summer of 1990, a risk assessment was performed to evaluate health risks to the residents with contaminated wells. A significant potential for noncarcinogenic health risks was identified. The highest individual lifetime carcinogenic risk, based on current considerations, was estimated to be 1 in 1000. Action was also considered necessary since the exposure concentrations in the future, as well as over the past 20 to 30 years, are unknown. As required by the National Environmental Policy Act (NEPA), this Environmental Assessment (EA) documents the DOE's permanent solution, the provision of a water supply system to the affected well users. The EA recommends that provision of a water supply would result in temporary, minor impacts that would extend over an estimated six-month period; however the positive benefits of providing potable water to the residents of Dos Rios would last indefinitely. Additional benefits relate to temporary employment for about ten workers and the positive effects of salaries and monies spent locally for supplies. Attached to the EA is a Finding of No Significant Impact (FONSI), in which the DOE has determined, based on an analysis of the EA, that construction of a permanent alternate water supply is not a major Federal action significantly affecting the quality of the human environment. Therefore, preparation of an Environmental Impact Statement is not required.

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Mineralogical Residence of Alpha-Emitting Contamination and Implications for Mobilization from Uranium Mill Tailings

Journal of Contaminant Hydrology 8(1):1-21 (September 1991)

The rate and magnitude of contaminant release from mill tailings to ground water are known to depend on the form and mineralogy of the host grains. Using samples from three uranium mill sites in the western United States, we identified four types of alpha-emitting host grains: (1) those containing barium-strontium sulfates, (2) those

containing authigenic siliceous material, (3) those containing uranium minerals, and (4) those containing iron-titanium-vanadium oxides. These four grain types constitute a classification scheme for the tailings. Each milling process (acid or alkaline) produces distinct types of grains. In acid-milled tailings, such as those at Slick Rock, Colorado, the dominant source of alpha emissions is from barium-strontium sulfate. The barium-to-strontium ratio covers the entire solid-solution range between barite and celestite. In alkaline-milled tailings, alpha emissions come predominantly from siliceous composite grains, which are interpreted as grains from the mill feed that have been altered during milling. In the siliceous composite grains, radionuclides are encased by siliceous material resembling chalcedony. Other alpha-emitting grains appear to be unrelated to milling; some uranium minerals and iron-titanium-vanadium oxides appear to have passed through the milling process relatively unaltered. The classification scheme identified in this study reflects the geochemical reactivity of the tailings with groundwater. Our findings can be used to improve confidence levels when predicting (a) source loading to a groundwater system, (b) health effects from inhaled radioactive dust, and (c) long-term performance of uranium tailings containment cells.

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U.S. Department of Energy, Uranium Mill Tailings Remedial Action Project Office, Albuquerque, NM

Environmental Assessment of Remedial Action at the Lowman Uranium Mill Tailings Site Near Lowman, Idaho

DOE/EA-0353; 94 pp. (January 1991)

This document assesses the environmental impacts of stabilization on site of the contaminated materials at the Lowman Uranium Mill Tailings Site. The Lowman Site is 0.5 miles northeast of the unincorporated town of Lowman, Idaho, and 73 miles from Boise, Idaho. The site consists of piles of radioactive sands, an ore storage area, abandoned mill buildings, and windblown/waterborne contaminated areas. A total of 29.5 acres of land are contaminated, most of which is within the 35-acre designated site boundary. The proposed action is to stabilize the tailings and other contaminated materials on the site. A radon barrier will be constructed over the consolidated residual radioactive materials, and various erosion control measures will be implemented to ensure the long-term stability of the disposal cell. Radioactive constituents and other hazardous constituents were not detected in the groundwater beneath the Lowman Site. No significant impacts were identified as a result of the proposed remedial action.

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Radon Emissions During Mill Tailings Backfill Operations in a Uranium Mine

Environmental Geology and Water Sciences 10(3):129-133 (1987)

Experimental measurements of airflow and radon concentrations in a part of an underground uranium mine in the Ambrosia Lake, New Mexico, area were used to determine total radon release rates during construction/maintenance, mining, and backfill operations. A mathematical model of the airflow and radon emissions was developed to simulate radon release in this same mine area. Calculated estimates were high by a factor of about 2.6. When calibrated using the experimental data, the simulation model predicted release rates and trends very well. Backfilling of mined-out rooms resulted in a small decrease in total radon release.

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U.S. Department of Energy, Uranium Mill Tailings Remedial Action Project Office, Albuquerque, NM

Final Environmental Assessment of Remedial Action at the Falls City Uranium Mill Tailings Site, Falls City, Texas - Finding of No Significant Impact

DOE/EA-0468; 103 pp. (December 1991)

The Falls City Tailings Site is in Karnes County, Texas, approximately 46 miles southeast of San Antonio and eight miles southwest of Falls City.

The site consists of two parcels (A and B), including an office building, six tailings piles, one tailings pond, and associated waterborne and wind-blown contamination west/northwest of the intersection of Roads 1344 and 791. Areas adjacent to both parcels are still used for cattle grazing and dry-land farming. Groundwater underlying the site is generally of limited use. Potable water in the area is drawn from the Carizzo Sandstone aquifer, over 3000 feet deep. The principal potential hazard from the tailings is the production of radon gas, a decay product of the radium in the piles: exposure to radon emanating from the piles and its decay products over a long period of time will increase the possibility that cancers may develop in persons living and working near the piles. If the tailings are not properly stabilized, erosion or human removal of the contaminated materials could spread the contamination. Seepage from the tailings piles and pond at the site has impacted the naturally poor water quality in the shallow aquifer there. The proposed remedial action is stabilization on-site within Parcel A. The tailings piles would be consolidated on Parcel A, and covered with a low-permeability radon barrier, erosion protection, and vegetative cover. Disturbed areas would be graded for positive drainage and reseeded. The remedial action would include the materials from seven vicinity properties. The environmental impacts of the proposed action and the no-action alternative are listed. The cumulative impacts presented here are based on conservative impact assessments and represent a realistic upper limit on the severity of the potential impacts of on-site stabilization. This environmental assessment (EA) of the Falls City Site is accompanied by a Finding of No Significant Impact (FONSI). Based on the analysis presented in the EA, the U.S. Department of Energy (DOE) has determined that the proposed remedial action does not constitute a major Federal action that would significantly affect the quality of the human environment, within the meaning of the National Environmental Policy Act (NEPA). Therefore, preparation of an environmental impact statement is not required, and DOE issued this FONSI.

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U.S. Department of Energy, Office of Environmental Audit, Washington, DC

Environmental Audit - Rifle, Gunnison and Grand Junction UMTRA Project Sites

DOE/EH-0209; 226 pp. (August 1991)

This report documents the results of the comprehensive baseline environmental audit completed for the Uranium Mill Tailings Remedial Action (UMTRA) sites at Grand Junction, Rifle, and Gunnison, Colorado. Included in the audit were the actual abandoned mill sites, associated transportation and disposal-cell facilities, and representative examples of the more than 4000 known vicinity properties. Sites investigated include: Climax Mill Site, Truck/Train Haul Route, Cotter Transfer Station, Cheney Disposal Cell, Rifle Mill Sites (Old and New Rifle), Gunnison Mill Site, Vicinity Properties, and the Estes Gulch and Proposed Landfill Site No. 1 Disposal Cells. The UMTRA audit was a comprehensive baseline audit which considered all environmental programs and the activities associated with ongoing and planned remediation at the UMTRA sites listed above. Compliance with the National Environmental Policy Act (NEPA) was not considered during this investigation. The audit team looked at the following technical disciplines: air, surface water/drinking water, groundwater, soil/sediment/biota, waste management, toxic and chemical materials, quality assurance, radiation, inactive waste sites, and environmental management.

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Results of the Engineering Special Studies for the UMTRA Project - FY90

CONF-9107139; Environmental Engineering, Proceedings of the 1991 Specialty Conference, Reno, NV, July 8-10, 1991. American Society of Civil Engineers, New York, NY; (pp. 443-448) (1991)

This paper summarizes four studies of issues associated with the performance of the fine-grained soil layer (radon/infiltration barrier) that is included in all Uranium Mill Tailings Remedial

Action (UMTRA) project disposal-cell covers. The proposed U.S. Environmental Protection Agency (EPA) ground water standards (40 CFR 192) require that UMTRA project remedial action designs will meet specific numerical limits for groundwater quality at a downgradient point of compliance. To meet the EPA standards, a layer of fine-grained soil makes up a part of the cover placed over each UMTRA project tailings embankment. The soil layer limits water infiltration into the disposal cell. This reduces seepage from the cell base to the extent necessary to comply with the proposed EPA groundwater standards. The cover also limits the emission of radon gas.

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Management of the Pipp Program for UMTRA Project Groundwater Restoration

CONF-9008109; Environmental Issues and Waste Management in Energy and Minerals Production, T.M. Yegulalp and K. Kim (eds.), Proceedings of the First International Conference, Secaucus, NJ, August 27-29, 1990. Battelle Press, Columbus, OH, 602 pp.; (pp. 244-254) (1992)

The Uranium Mill tailings Radiation Control Act (UMTRCA) of 1978 (PL 95-604) grants the Secretary of Energy the authority and responsibility to perform such actions as are necessary to minimize radiation health hazards and other environmental hazards caused by inactive uranium mill sites. The U.S. Department of Energy (DOE) is meeting this responsibility through the Uranium Mill Tailings Remedial Action (UMTRA) Projects. This paper discusses the program, which involves the surface stabilization of 24 uranium mill tailings piles in ten states and the restoration of contaminated groundwater at affected sites. It also discusses the site-specific decommissioning criteria to be employed, and identifies special problems that may occur in remediating the groundwater at UMTRA sites to legislated standards.

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UMTRA Project Management of Residual Radioactive Material Commingled with Hazardous Waste at Vicinity Properties

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 829-832) (September 1991)

The U.S. Department of Energy (DOE) has established a program of assessment and remedial action at properties in the vicinity of designated uranium-processing sites to stabilize and control residual radioactive material (RRM). However, in addition to being contaminated with RRM, some vicinity properties are also contaminated with hazardous waste not derived from processing site activities. As a result, the RRM at these vicinity properties may have been commingled with the hazardous waste. The DOE has determined that it has limited authority to spend public funds to manage the hazardous waste component of commingled waste. Therefore, the property owner must assume responsibility for managing the hazardous-waste component. To ensure that commingled waste is handled in a manner that protects public health and safety and the environment, the DOE has developed guidelines that define the management responsibilities for the RRM and hazardous waste components of commingled waste. The DOE will develop agreements for managing commingled waste with the affected states/tribes and the property owners with the concurrence of the appropriate regulatory agencies. The agreements will reflect the resolution of regulatory and liability issues concerning commingled waste management. The site-specific agreements will address the following issues: notification, characterization, packaging and storage, treatment, disposal, supplemental standards and refusals, and cost sharing.

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Completed Remedial Cleanup at the Durango, Colorado Uranium Mill Tailings Remedial Action Site: A Case Study

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 761-764) (September 1991)

The uranium mill tailings site near Durango, Colorado, is one of twenty-four inactive uranium mill sites designated for remediation by the U.S. Department of Energy (DOE) under the Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA) as part of the Uranium Mill Tailings Remedial Action (UMTRA) Program. Remedial activities were conducted by the DOE to long-term stabilize and control the radioactive materials at the inactive uranium mill site. As required by UMTRCA, remedial action at the Durango UMTRA site had to comply with regulations established by the U.S. Environmental Protection Agency (EPA). The remedial action at the Durango site consolidated approximately 2,400,000 cu yds of contaminated materials from the uranium mill site and vicinity properties into a single disposal cell, partially below grade. The cell is located approximately 3.5 road miles southwest of the inactive mill site. During the construction sequencing of contaminated material within the cell, the concept of reducing the radon flux to below EPA standards, to levels as low as reasonably achievable (ALARA), was a consideration. To accomplish this goal, a compacted earthen radon barrier two feet thick was placed directly over the contaminated material. Additional cover components were then placed sequentially above the primary earthen radon barrier. These components provide the required low hydraulic conductivity that is necessary to reduce water infiltration into the disposal cell and to provide for its long-term stability. The Durango UMTRA project, completed in May 1991, can be characterized by these significant factors: (1) the disposal cell design reduced the surface radon flux levels to below EPA standards; (2) the disposal cell was designed to control contaminants to conform with EPA groundwater protection standards; (3) the disposal site was designed to stabilize and control residual radioactive material for at least 200 years; and (4) the remedial action provided reasonable assurance that the concentration of Ra-226 at the mill site did not exceed the background level by more than 5 pCi/g for the first 15 cm of soil below the surface, nor by more than 15 pCi/g for the soil layers below that.

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The Grand Junction, Colorado, UMTRA Program: Engineering Design and Management of More than 4,000 Remedial Action Designs

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 745-750) (September 1991)

Uranium mill tailings from the Climax Mill in Grand Junction, Colorado, were made available to the public in the 1950s and 1960s, and were widely used as a sand substitute and as backfill material at more than 4000 construction sites throughout the area. These sites later became known as the "vicinity properties." Through the 1978 Uranium Mill Tailings Radiation Control Act, these areas they became the U.S. Department of Energy's (DOE's) responsibility to remediate. The engineering organization of DOE's Grand Junction Projects Office has successfully completed 4095 of an expected 4150 designs for remedial action on vicinity properties; 3908 of the designs have been constructed. This paper discusses the uniqueness of the project and the distinctive engineering management and engineering design approaches implemented to permit successful completion of the remedial action designs. To achieve cleanup, each vicinity property progresses through the remedial action process that begins with its inclusion in the Uranium Mill Tailings Remedial Action (UMTRA) Program and ends with property being certified clean as a completed remedial

action project. A property is recommended for inclusion in the UMTRA Program by Oak Ridge National Laboratory and approved for inclusion by the Grand Junction Projects Office. Then a "cradle-to-grave" management concept is applied to the project under the guidance of several Chem-Nuclear Geotech, Inc., project managers. The project is scheduled through the various stages of the remedial action process to enable each functional organization that is responsible for a particular portion of the process to plan its future work loads. The project managers follow assigned vicinity properties through the process and facilitate its timely completion by working with the functional organizations to solve problems.

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Managing a Site Cleanup Under an Accelerated Schedule - The Lowman Story

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 455-458) (September 1991)

This paper sheds light on the multitude of problems and issues related to the acceleration of remedial action activities at the U.S. Department of Energy's Lowman, Idaho, Uranium Mill Tailings Remedial Action Project site, 121 km northeast of Boise. The pre-remedial action and construction activities at the Lowman site were accelerated to accommodate limited funding. The paper concentrates on several of these pre-remedial actions that enabled construction activities to begin one year ahead of schedule, including (1) vicinity property remedial action, (2) site remedial action design, (3) environmental documents, and (4) permits. The paper describes some problems that arose during cleanup and construction, and lists six lessons learned from the accelerated cleanup: (a) coordination and communication are the key to remedial action activities; (b) commitment of all parties involved is essential; (c) changing and unexpected comments on the Lowman remedial action plan from new reviewers at the Nuclear Regulatory Commission, who were using new review procedures, almost derailed the remedial activities; (d) increased communication, coordination, and commitment provided the ability to quickly react to such unexpected events; (e) budget underruns in both planning and construction can be achieved under an accelerated schedule using aggressive management techniques; and (f) be prepared for the unexpected.

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Architecture and Environmental Restoration: Remediating Uranium Mill Tailings from Buildings

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 751-754) (September 1991)

The U.S. Department of Energy (DOE) Grand Junction Projects Office (GJPO) manages the Uranium Mill Tailings Remedial Action (UMTRA) Program in Grand Junction, Colorado. This program is a congressionally mandated cleanup of by-product waste that resulted from the extraction of yellow cake from uranium ore. The by-product waste, a fine sand commonly called "mill tailings," is contaminated with low-level radioactivity. These mill tailings were available to the community for use as a construction material from approximately 1952 to 1966. Their use as a bedding material for concrete slabs, utilities, backfill materials, concrete sand, and mortar created unique remediation problems that required innovative solutions. This paper describes how design personnel approach the remediation of existing structures, the evaluation of the buildings, and the factors that must be considered in completing the remediation design. This paper does not address the health risks of the tailings in an inhabited space, the remediation of exterior areas, or the process of determining where in the building the tailings exist.

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U.S. Department of Energy, Albuquerque Field Office, Albuquerque, NM

DOE, State, Local Officials Break Ground for Rifle, Colorado, Tailings Cleanup

DOE News (920625):1-3 (June 25, 1992)

This news release marks the start of Phase II cleanup at the two inactive uranium processing sites at Rifle, Colorado. The two sites are located adjacent to the Colorado River just outside the city of Rifle. They are part of the nationwide Uranium Mill Tailings Remedial Action project, managed by the Department of Energy's Albuquerque Field Office, to clean up 24 inactive uranium processing sites and their vicinity properties. Phase II involves relocating the tailings from both Rifle sites and the associated materials from vicinity properties to a disposal site at Estes Gulch, approximately 8 km north of Rifle. At the Estes Gulch Site, a disposal cell will be constructed to isolate the tailings from the environment in accordance with U.S. Environmental Protection Agency standards.

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U.S. Department of Energy, Albuquerque Field Office, Albuquerque, NM

Ceremony Marks Lowman Mill Site Cleanup Progress

DOE News (910919):1-4 (September 19, 1991)

The U.S. Department of Energy (DOE) and the Idaho Department of Health and Welfare held a ceremony to mark progress toward completion of the cleanup of the abandoned uranium mill site at Lowman, Idaho. The site of the former Porter Brothers uranium mill in Lowman is one of 24 inactive uranium mill tailings sites nationwide being cleaned up by the DOE as part of the Uranium Mill Tailings Remedial Action (UMTRA) Project. In addition to the mill sites themselves, the DOE, in conjunction with local, state or tribal governments, is cleaning up vicinity properties where tailings were used in construction or transported by wind or water erosion. The project is cleaning up radioactive sands left after the milling operations in Lowman were terminated. The sands contain radium, which releases radon gas as it undergoes decay. Long-term exposure to elevated concentrations of radium is believed to increase human health risks. Vicinity property cleanup near the former Porter Brothers uranium mill began in the summer of 1990, and 23 properties were remediated. Contaminated materials from those properties were hauled to the mill site. Cleanup of 11 other vicinity properties, including the Idaho Parks and Recreation Building in Boise, has been completed. Approximately 69,600 cubic meters of radioactive sands on the site have been consolidated into a single pile, along with 29,600 cubic meters of contaminated material from the vicinity properties. The entire pile is now being stabilized with an earth-and-rock cover designed to prevent escape of radon and resist erosion.

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U.S. Department of Energy, Albuquerque Field Office, Albuquerque, NM

DOE Sets Falls City, Texas, Tailings Cleanup Groundbreaking

DOE News (920207):1-3 (February 7, 1992)

This newsletter announces that the U.S. Department of Energy (DOE) and the Texas Department of Health will conduct a groundbreaking ceremony on March 9, 1992, to mark the startup of cleanup at the inactive Susquehanna-Western Uranium processing site in Falls City, Texas. The Falls City Site is one of 24 inactive uranium mills nationwide being cleaned up by the DOE as part of the Uranium Mill Tailings Remedial Action (UMTRA) Project. The Susquehanna-Western processing plant, later operated by Solution Engineering, Inc., has been inactive since 1982. The site includes two parcels of 185.3 and 54.3 ha. An estimated 4,434,000 cu m of tailings and contaminated material are being cleaned up there. Gilbert Texas Construction Corporation of Hurst, Texas, is performing the cleanup. Gilbert Texas will combine the six tailings piles on the site, material from one contaminated pond, and other contaminated material into a single disposal cell, stabilized in accordance with U.S. Environmental Protection Agency standards.

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U.S. Department of Energy, Albuquerque Field Office, Albuquerque, NM

DOE to Hold Public Meeting on Mexican Hat Tailings Cleanup

DOE News (911008):1 (October 8, 1991)

The U.S. Department of Energy (DOE) and the Navajo Nation announce a public meeting to discuss the status of the Uranium Mill Tailings Remedial Action (UMTRA) Project at Mexican Hat, Utah and Monument Valley, Arizona. Representatives from the Navajo Nation Natural Resources Council, the DOE's UMTRA Project Office in Albuquerque, New Mexico, and MK-Ferguson Company (remedial action contractor for DOE) will be at the meeting. A status report on the construction schedule and vicinity property work at the two sites will be given. The United States Congress authorized DOE to clean up the two sites, along with 22 other uranium mill tailings sites across the country. DOE's mission is to restore the environment at these sites and to protect the public health.

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P.T. Mann, U.S. Department of Energy, Uranium Mill Tailings Remedial Action Project Office, Albuquerque, NM

Uranium Mill Tailings Remedial Action Project Vicinity Property Program

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 765-768) (September 1991)

This paper outlines the steps developed by the Uranium Mill Tailings Remedial Action Project Office to assure the proper identification, remediation, and certification of vicinity properties. Some of the more unique aspects of the UMTRA Project vicinity property program are also discussed, centering on the voluntary nature of the program, public information efforts, and coordinating the work of several different agencies and private firms. The UMTRA vicinity property program has been extremely successful with over 3800 properties remediated to date, out of over 5100 that are scheduled. The paper discusses (1) the remedial action design and remedial action agreements needed at UMTRA vicinity properties; (2) remediation activities, including property types, schedules, post-cell closure policy, and verification; (3) annotation of vicinity property condition; (4) commingled waste, or hazardous wastes not derived from the milling process that are mixed with vicinity property tailings; (5) owner refusals; (6) public information efforts; (7) project management activities; and (8) conclusions.

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Remediation Technology Development from the UMTRA Program

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 573-577) (September 1991)

The U.S. Department of Energy is conducting the Uranium Mill Tailings Remedial Action Project to accomplish environmental remediation of approximately 40 million cubic yards of uranium tailings at 24 abandoned uranium milling sites. The tailings are radioactive and contain varying amounts of leachable heavy metals. Regulations require that any environmental controls be effective for up to 1000 years, if reasonably achievable, and for at least 200 years in any case. Meeting this criterion has required technology development in two areas. The first is predicting the rate of flow of leachate from compacted tailings as a function of placement moisture content and other parameters. This allows determination of an upper bound limit on compaction moisture content to avoid drainage of excess water at a rate which would exceed groundwater standards. The technology developed to address this problem consists of the application of quasi-theoretical procedures to generate relationships between suction, moisture content,

and permeability. The computer program UNSAT2 was used to model unsaturated flow. The second area entails providing a rational basis for riprap design which enables use of the best available rock within a reasonable haul distance. Oversizing of the riprap to allow for deterioration of average size during the 200 to 1000 year design life is necessary. The method developed consists of a scoring system utilizing the results of durability tests and accounting for the relative importance of the different durability parameters to various rock types, combined with a quantitative procedure for increasing riprap diameter to allow for future weathering.

URANIUM MILL TAILINGS MANAGEMENT

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Bundesministerium fuer Umwelt-, Naturschutz und Reaktorsicherheit, Bonn, Federal Republic of Germany

Announcement of the Recommendation by the Strahlenschutzkommission (SSK): Radiation Protection Principles to be Applied in Measurements for the Decontrol and Reclamation for Industrial Use of Areas Contaminated by Uranium Mining Activities as of July 24, 1991

Bundesanzeiger 43(156):5684 (August 22, 1991)

The Strahlenschutzkommission (SSK) recommends the following: (1) below a measured radioactivity level of 0.2 Bq/g, terrain can be cleared for use without restrictions; (2) below a measured radioactivity level of 1 Bq/g, a terrain can be cleared for use with the following restrictions: residential buildings, recreation areas, kindergarten buildings and the like can be installed and used only in areas with a measured radioactivity of less than 0.2 Bq/g; and (3) all new buildings to be erected in these areas are to be designed so as to keep the expected radon concentration below a limit of 250 Bq/cu m.

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Implementation Planning for Remedial Design and Remedial Action at the Department of Energy's Monticello Mill Tailings Site

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 755-760) (September 1991)

The Monticello Mill Tailings Site, also known as the Monticello Remedial Action Project, is located in San Juan County, Utah, within the city of Monticello. Mill tailings and associated contaminated material remain on the mill site as a result of uranium and vanadium mill tailings operations. The U.S. Department of Energy (DOE) is the party responsible for site remediation. The record of decision (ROD) for the Monticello site, completed on September 20, 1990, requires DOE to commence substantial, continuous, physical on-site remedial action within 15 months of that date. The completion of the ROD required a remedial action plan that would meet the 15-month start-up requirement. The plan must also meet the requirements for review by the oversight agencies specified in the Federal Facility Agreement for the site. The development of a plan that would meet the project's schedule was conceived through a value engineering (VE) session. This VE session was designed to bring together representatives from the agencies involved and their contractors in a "team approach" to plan the project. As a result of this team approach, 48 key issues important to the development of the remedial action project were identified. Another outcome of the VE session was the formulation of two concepts aimed at streamlining the remedial design: (1) the review by regulatory agencies of working-level discussion documents, and (2) the phasing of remedial design/remedial action activities. A specific example of a working-level discussion document, the "Point-of-Compliance for Ground-Water Monitoring" document, is discussed in further detail.

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M.J. Wilson and J.W. Crutcher, Oak Ridge National Laboratory, Health and Safety Research Division, Oak Ridge, TN

Results of the Independent Verification of Radiological Remedial Action at 87 East 500 South Street, Monticello, Utah

ORNL/RASA-91/2; 20 pp. (July 1991)

In 1980, the site of a vanadium and uranium mill at Monticello, Utah, was accepted into the U.S. Department of Energy's (DOE's) Surplus Facilities Management Program, with the objectives of restoring the government-owned mill site to safe levels of radioactivity, disposing of or containing the tailings in an environmentally safe manner, and performing remedial actions on off-site (vicinity) properties that had been contaminated by

radioactive material resulting from mill operations. During 1987 and 1988, UNC Geotech, the remedial action contractor designated by DOE, performed remedial action on the vicinity property at 87 East 500 South Street, Monticello, Utah. The Pollutant Assessments Group (PAG) of Oak Ridge National Laboratory was assigned the responsibility of verifying the data supporting the adequacy of remedial action and confirming the site's compliance with DOE guidelines. The PAG found that the site successfully meets the DOE remedial action objectives. Procedures used by PAG are described.

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U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, DC

Superfund Record of Decision (EPA Region 8): Monticello Mill Tailings Site, San Juan County, UT (First Remedial Action), August 1990

PB-91-921482/XAB; EPA/ROD/R08-90/034; 83 pp. (August 22, 1990)

The 300-acre Monticello Mill Tailings Site is comprised of a 78-acre inactive uranium and vanadium milling operation and affected peripheral properties in Monticello, San Juan County, Utah. Surrounding land use is rural-residential and agricultural. Milling of ore began in 1942, and a vanadium/uranium sludge product was produced on-site from 1943 to 1944. The mill was permanently closed in 1960, and the tailings piles were covered and vegetated. In 1972, 15,000 cu yds of contaminated soil were excavated and disposed of on the on-site tailings piles. Site investigations from 1989 to 1990 identified the presence of on-site and off-site radioactively contaminated soil and ground water, and elevated concentrations of metals within the tailings piles. The Record of Decision addresses remediation of two operable units (OUs): the 78-acre mill site area (OU1), and the 240-acre peripheral properties (OU2). The primary contaminants of concern affecting the soil and debris are metals, including arsenic, chromium, and lead; and radioactive materials, including radium-226 and radon.

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A Bill to Establish the United States Enrichment Corporation to Operate the Federal Uranium Enrichment Program on a Profitable and Efficient Basis in Order to Maximize the Long Term Economic Value to the United States, to Provide Assistance to the Domestic Uranium Industry and to Provide a Federal Contribution for the Reclamation of Mill Tailings Generated Pursuant to Federal Defense Contracts at Active Uranium and Thorium Processing Sites

U.S. Senate Bill S-210, Introduced in the Senate of the United States, One Hundred Second Congress, First Session, January 15, 1991; 80 pp. (1991)

Senate Bill S-210 amends the Atomic Energy Act of 1954 to establish the U.S. Enrichment Corporation to operate the Federal uranium enrichment program on a profitable and efficient basis in order to maximize the long term economic value to the U.S. the bill would provide a Federal contribution for the reclamation of mill tailings generated as a result of Federal defense contracts at active uranium- and thorium-processing sites, and would provide assistance to the domestic uranium industry.

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W.J. Almas, Landmark Reclamation, Inc., Denver, CO

Discussion of the Economic Impacts of Regulations Governing the Stabilization and Decommissioning of Uranium Milling Facilities

Proceedings of the 1991 Society of Mining Engineers Annual Meeting, Denver, CO, February 25-28, 1991. Society of Mining Engineers of American Institute of Mining and Metallurgical Engineers, Littleton, CO; (11 pp.) (1991)

Operating uranium-mill tailings containment and mill-decommissioning activities are regulated by the Nuclear Regulatory Commission (NRC) and the Environmental Protection Agency (EPA)

through numerous regulatory mechanisms. Reduction of radon emissions from tailings-disposal areas, remedial actions to return groundwater to baseline constituent concentrations, and 200- to 1000-year stabilization of tailings are major focus areas of regulation. The cumulative economic impact and the uncertainty associated with regulation are very significant and will hinder future development of uranium milling facilities.

420
E.F. Hawkins, U.S. Nuclear Regulatory Commission, Washington, DC

NRC Mill Tailings Regulation

CONF-890907; Uranium Seminar '89, Proceedings of a Conference, Santa Fe, NM, September 17-20, 1989. U.S. Council for Energy Awareness, Washington, DC; (pp. 1-18) (1989)

This paper reports on U.S. Nuclear Regulatory Commission (NRC) mill tailings regulation. The Congress passed Public Law 95-604 entitled the Uranium Mill Tailings Radiation Control Act of 1978, as amended. The Act was divided into three parts, or Titles. The purposes of the Act include providing, in cooperation with the interested States, Indian Tribes and persons who own or control inactive mill tailings sites, a program of assessment and remedial actions at such sites that will stabilize and control tailings in a safe and environmentally sound manner while minimizing or eliminating radiation health hazards to the public. The Act also calls for a program to regulate mill tailings during uranium or thorium ore processing at active mill operations.

421
D.W. Moeller, Harvard University, School of Public Health, Boston, MA

Report of the Advisory Committee on Nuclear Waste: Final Staff Technical Position on the Design of Erosion Protection Covers for Stabilization of Uranium Mill Tailings Sites

NUREG-1423 (Vol. 1); (pp. 89-90) (May 31, 1990)

This letter from the Advisory Committee on Nuclear Waste (ACNW) to the chairman of the Nuclear Regulatory Committee (NRC) presents the committee's assessment of the NRC staff report, "Final Staff Technical Position, Design of Erosion Protection Covers for Stabilization of Uranium Mill Tailings Sites," (May, 1990). The ACNW is pleased with the Technical Position, as modified, and believes it will be helpful to applicants and licensees in designing erosion protection covers that comply with federal regulations. Specifically, the staff recommendations aid in defining the concept of "reasonable assurance" as set out in the regulations, and provide a consistent basis for site-specific designs and reviews. The ACNW believes the Technical Position, contrary to several public comments, is not too conservative and is in accordance with the NRC Uranium Mill Tailings Management Position.

422
P.D. Thorne, Pacific Northwest Laboratory, Richland, WA

Information for Consideration in Reviewing Groundwater Protection Plans for Uranium Mill Tailings Sites

NUREG/CR-5858; PNL-7986; 48 pp. (May 1992)

Acceptance criteria and guidelines for reviewing certain aspects of groundwater protection plans for uranium mill tailings sites were developed. The aspects of the groundwater protection plans that were covered in this research include: (1) leaching and long-term releases of hazardous and radioactive constituents from tailings and other contaminated materials; (2) attenuation of hazardous and radioactive constituents in groundwater under saturated and unsaturated conditions; (3) design and implementation of groundwater monitoring programs; (4) design and construction of groundwater protection barriers; and (5) efficiency and effectiveness of groundwater cleanup programs. The objective of these guidelines is to assist the U.S. Nuclear Regulatory Commission to review Remedial Action Plans for inactive waste sites and licensing application documents for active commercial uranium and thorium mills.

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U.S. Environmental Protection Agency, Office of Radiation Programs, Washington, DC

National Emission Standards for Hazardous Air Pollutants - Uranium Mill Tailings Disposal Sites

Federal Register 56(207):55432-5 (October 25, 1991)

The U.S. Environmental Protection Agency (EPA) proposes a rule to stay the effectiveness of 40 CFR part 61, subpart T, as it applies to owners and operators of uranium mill tailings disposal sites that are licensed to the Nuclear Regulatory Commission (NRC). This proposal does not concern subpart T sites that are under the control of the Department of Energy (DOE). Subpart T, which regulates radon emissions into ambient air, is one of EPA's National Emissions Standards for Hazardous Air Pollutants (NESHAPs) for radionuclides, which were promulgated on December 15, 1989, pursuant to Clean Air Act (CAA) section 112 as it existed prior to the 1990 amendments. This proposed stay is pursuant to EPA's general rulemaking authority under CAA section 301(a) and the authority of section 112(d)(9) as amended in 1990, which more particularly addresses NRC-licensed facilities. Supporting this proposal is a Memorandum of Understanding (MOU) between EPA, NRC, and the affected NRC Agreement States, as signed by EPA on October 18, 1991. The MOU is reprinted at the end of this notice. If finalized, this proposal will stay the effectiveness of subpart T as applied to NRC-licensed uranium mill tailings disposal sites until EPA concludes related rulemaking under section 112(d)(9) of the Clean Air Act as amended, and the Atomic Energy Act as amended, both described in the MOU. These rulemakings are designed to reduce duplication of regulatory effort between EPA, NRC, and the affected Agreement States, while assuring that public health is protected with an ample margin of safety. The stay will expire at the conclusion of this rulemaking or June 30, 1994, whichever occurs first. EPA intends to take final action on this proposal by December 15, 1991.

424
Uranium Enrichment Act of 1990; Uranium Security and Tailings Reclamation Act of 1989; and The Solar, Wind, Waste, and Geothermal Power Production Incentives Act of 1990, Introduced in the Senate, One Hundred First Congress, Second Session, April 4, 1990

U.S. Senate Bill S-2415; 74 pp. (1990)

Senate Bill S-2415 started out as a bill to encourage solar and geothermal power generation. In the version described here, it now would amend the Atomic Energy Act of 1954 to redirect uranium enrichment enterprises to further the national interest, respond to competitive market forces, and to ensure the nation's common defense and security. Part of the bill directly addresses the decontamination and decommissioning of the nuclear facilities it would engender. The bill would first establish a United States Enrichment Corporation for the following purposes: (1) to acquire feed materials, enriched uranium, and enrichment facilities; (2) to operate these facilities; (3) to market enriched uranium for governmental purposes and qualified domestic and foreign persons; (4) to conduct research into uranium enrichment; and (5) to operate as a profitable, self-financing, reliable corporation and in a manner consistent with the health and safety of the public. The bill describes (a) powers and duties of the corporation; (b) the organization, finance, and management; and (c) the decontamination and decommissioning for uranium enrichment facilities. The second part of the bill would ensure an adequate supply of domestic uranium for defense and power production; provide assistance to the domestic uranium industry; and establish, facilitate, and expedite a comprehensive system for financing reclamation and remedial action at active uranium and thorium processing sites. The third part of the bill would remove the size limitations on power production facilities now part of the Public Utility Regulatory Policies Act of 1978. Solar, wind, waste, or geothermal power facilities would no longer have to be less than 80 MW to qualify as a small power production facility.

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W.J. Snodgrass and D.R. Hart, Beak Consultants Limited, Montreal, Quebec, Canada; Atomic Energy Control Board, Ottawa, Ontario, Canada

Remeasurement of Thorium-230 in the Pore Water of Lacnor Tailings

INFO-0353; 144 pp. (February 1990)

A resampling of the Lacnor tailings management area was undertaken under a comprehensive quality assurance program to establish levels of thorium-230 in pore water. A quality assurance program was established for field sampling, sample handling and transport, and laboratory procedures and reporting. The external audit was used to evaluate analytical bias (on synthetic and field samples) and precision (by comparison of duplicate-duplicate results). Accuracy was assessed using synthetic samples. The external audit indicates that thorium-230 measurements taken by the main laboratory are not significantly different from the interlaboratory average within standard statistical limits. The results of the audit are based on measurement of environmental samples and known synthetic samples. The audit shows that present and previous measurements of thorium-230, varying from 0.1 to 150 Bq/l, are valid data. A qualitative interpretation of the controls on thorium-230 geochemistry is provided in terms of control by thorium-232 and thorium dioxide solid phase. Generic dose estimates for consumption of water containing thorium-230 are made, but require refinement to account for the actual pH of the drinking water and the degree of dilution of the pore water. The results of this project indicate that the performance of the laboratory that will conduct future thorium-230 measurements can be assessed satisfactorily with a smaller-scale, external laboratory assurance program. The program should include replicate samples sent to each laboratory and interlaboratory comparison on samples having high and low values of thorium-230.

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Ra-226 and Other Radionuclides in Water, Vegetation, and Tissues of Beavers (Castor Canadensis) from a Watershed Containing Uranium Tailings near Elliot Lake, Canada

Environmental Pollution 69(4):277-310 (1991)

The Serpent River drainage basin near Elliot Lake, Ontario, Canada contains uranium mill tailings. Radionuclide levels were measured in adult beavers captured in the Serpent River drainage basin and from beavers taken from nearby control sites. Tissues, gut contents, diet items, and water at the site of capture were tested for radionuclide levels. Levels of radium-226 in beaver bone, muscle and kidney were highest in animals taken from locations close to uranium tailings; liver levels did not vary by site. Levels in beaver gut contents reflected levels in diet items. Environmental radium-226 levels were within ranges previously reported at these or similar locations. Concentration ratios exceeded unity in some vegetation items and beaver bone at the Elliot Lake site. In two beavers with tissue levels of radium-226 that were higher than others sampled, neither thorium-232 nor thorium-230 were detected in bone, muscle or liver tissues. Uranium-238 was measurable in bone, muscle and liver; thorium-228 in bone; polonium-210 in bone, muscle and liver; and lead-210 was measurable only in bone. Estimated yearly intakes of radionuclides by people eating beavers were calculated to be below current allowable levels set by Canadian regulatory authorities.

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K.P. Eappen, P.M. Markose, M. Raghavayya, and K.C. Pillai, Bhabha Atomic Research Centre, Health Physics Division, Bombay, India

Distribution of Radioactivity in Surface Streams Around Uranium Mine-Mill Complex

Bulletin of Radiation Protection 12(1-2):57-65 (January-June 1989)

Disposal of the large volume of low specific activity (LSA) wastes from the Jaduguda uranium mine-mill complex is one of the most contentious issues facing the Indian nuclear industry and environmentalists. The worldwide accepted practice is to impound the neutralized (where necessary) tailings in manmade or natural facilities

and allow controlled discharge of the effluents. The uranium ore and the chemical reagent additives undergo solubilization to different degrees during the treatment of the ore. The solubilized activities and chemicals discharged from the tailing pond are distributed in three phases of the environmental aquatic system: the water, silt (suspended solids), and bottom sediments. Around the mine-mill complex at Jaduguda a systematic study was conducted in an attempt to characterize the environmental aquatic system vis-a-vis radionuclides of the uranium series and other chemical reagents. Samples of water, silt, and bottom sediments were periodically collected from fixed representative locations up to a distance of about 8 km from the tailings pond, and analyzed for uranium, thorium-230, radium-226, polonium-210, lead-210 and manganese. It was found that the specific activity of the suspended solids was higher than that of the bottom sediments. Specific activity distribution in the bottom sediments indicates the possibility of adsorption from the overflowing water and deposition on silt. Results of the analysis, carried out over a long period of time, are summarized in the paper.

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M.J. Wilson and J.W. Crutcher, Oak Ridge National Laboratory, Health and Safety Research Division, Oak Ridge, TN

Results of the Independent Verification of Radiological Remedial Action at 397 East 3rd South Street, Monticello, Utah

ORNL/RASA-91/1; 20 pp. (July 1991)

In 1980, the site of a vanadium and uranium mill at Monticello, Utah, was accepted into the U.S. Department of Energy's (DOE's) Surplus Facilities Management Program, with the objectives of restoring the government-owned mill site to safe levels of radioactivity, disposing of or containing the tailings in an environmentally safe manner, and performing remedial actions on off-site (vicinity) properties that had been contaminated by radioactive material resulting from mill operations. During 1987 and 1988, UNC Geotech, the remedial action contractor designated by DOE, performed remedial action on the vicinity property at 397 East 3rd South Street, Monticello, Utah. The Pollutant Assessments Group (PAG) of Oak Ridge National Laboratory was assigned the responsibility of verifying the data supporting the adequacy of remedial action and confirming the site's compliance with DOE guidelines. The PAG found that the site successfully meets the DOE remedial action objectives. Procedures used by PAG are described.

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Determination of the Probability for Radioactive Materials on Properties in Monticello, Utah

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 185-190) (September 1991)

The former uranium mill site at Monticello, Utah, is a surplus facility subject to cleanup under the Surplus Facilities Management Program (SFMP). Surrounding properties contaminated with mill site material are also subject to cleanup, and are referred to as Monticello Vicinity Properties (MVP). The Pollutant Assessments Group (PAG) of Oak Ridge National Laboratory (ORNL), Grand Junction, Colorado (GJ), was directed by the U.S. Department of Energy (DOE) in July 1988 to assess the radiological condition of properties in Monticello, Utah. Since the Monticello activities are on the National Priorities List, extra measures to identify potentially contaminated properties were undertaken. Thus, the likelihood that a random property could contain radioactive materials became a concern to the DOE. The objective of this study was to determine the probability that a vicinity property not addressed under the MVP project could contain Monticello mill-related residual radioactive material in excess of DOE guidelines. Results of this study may be used to predict the potential number of unassessed properties in Monticello that contain radioactive contamination that exceeds DOE guidelines and will require remedial action.

Statistical methods were used to select forty-eight random properties in the Monticello area. Consent to access the properties was obtained from the landowners, involving sensitive public relations. Radiological screening surveys were performed in accordance with procedures developed by the ORNL/PAG/GJ. The surveys covered the entirety of the forty-eight land parcels. Gamma exposure rates were recorded and mapped. Soil samples were collected at each property from locations exhibiting elevated gamma levels or from locations exhibiting general background if no elevated gamma exposure rates were detected. Each sample was thoroughly described in the field for petrologic makeup, color, texture, and content. The soil samples were then analyzed for Ra-226 using a sodium iodide (NaI) gamma spectrometer. Results suggest that approximately 20 percent of the properties in the Monticello area contain Monticello mill-related residual radioactive material in excess of DOE guidelines. This suggested that further designation measures should be taken prior to the close of the designation phase. A public relations effort that included a property-owner mailing effort, public posting, and newspaper advertisement was one measure taken to ensure that most properties were assessed. As a consequence of this study, DOE directed that radiological screening surveys be conducted on the entirety of the Monticello area.

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W.C. Harrison, B.E. Halbert, and D.B. Chambers, Canada Centre for Mineral and Energy Technology, Ottawa, Ontario, Canada; Senes Consultants, Willowdale, Ontario, Canada

Safety Assessment of Uranium Mill Tailings

INIS-mf-12870; CONF-8506403; National Uranium Mill Tailings Program, G.J. Phillips (ed.), Proceedings of the 25th Annual Canadian Nuclear Society Conference, Ottawa, Ontario, Canada, June 2-5, 1985, 375 pp.; (pp. 19.15-19.22) (1985)

Safe long-term disposal of uranium mill tailings in Canada requires that decisions be made on the acceptability of future effects on the environment and man. The National Uranium Tailings Program has the task of pulling together the scientific understanding of long-term behavior and developing a methodology to predict the long-term effects of tailings, and thus provide a sound basis for these decisions. This paper describes the program and presents results from the first phase of the system-model development work.

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Radon Problems and the Cost of Restoring the East German Uranium Projects

ATW, Atomwirtschaft, Atomtechnik 36(12):542-545 (December 1991)

Findings indicate that the data about the incidence of lung cancer in miners from the early years of East German uranium mining cannot be extrapolated to radon levels in the open air and in dwellings, given the synergies with smoking, the inhalation of ore dust, etc. These findings have raised doubts not only about the sensitive intervention levels for radon, but also about the assumption of negative biological impacts of low and even very low radiation doses. Consequently, very costly restoration measures should be decided upon only after unequivocal radioepidemiological findings have become available, provided they indicate the need to take action.

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Bundesministerium fuer Umwelt-, Naturschutz und Reaktorsicherheit, Bonn, Federal Republic of Germany

Radiological Protection Principles to be Applied to the Preservation and Use of Tailing Dams Resulting from Mining Activities

Bundesanzeiger 43(227):7859 (December 7, 1991)

The recommendation deals with tailings dams built for uranium mining and other mining activities. The recommendation urges the preservation and the use of these grounds for forestry and agriculture, or as sites for residential, public or

industrial buildings. The maximum permissible, specific activities are defined in order to protect the population from hazards of radioactivity.

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Bundesministerium fuer Umwelt-, Naturschutz und Reaktorsicherheit, Bonn, Federal Republic of Germany

Radiological Protection Principles to be Applied to Land Areas Radioactively Contaminated by Uranium Mining Activities, and Intended to be Used for Forestry or Agriculture, or as a Landscape Facility (Park) or as a Residential Area

Bundesanzeiger 43(227):7858-7859 (December 7, 1991)

The recommendation refers to radioactive contamination measured on operating grounds, at uranium ore-loading points, and along transportation routes. The recommendation involves the use of these areas for forestry or agriculture, landscape facilities (parks), or as residential areas. The maximum permissible specific activities are defined in order to provide protection of the population from the hazards of radioactivity.

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S. Hwang, Pacific Northwest Laboratory, Richland, WA

An Assessment of Health and Environmental Impact of Contaminant Releases from a Mine Tailings Pile

CONF-9008109; Environmental Issues and Waste Management in Energy and Minerals Production, T.M. Yegulalp and K. Kim (eds.), Proceedings of the First International Conference, Secaucus, NJ, August 27-29, 1990. Battelle Press, Columbus, OH, 602 pp.; (pp. 174-184) (1992)

The objectives of this paper are to: (1) illustrate the types of contaminants that can be present in tailings pile material, and in surface water affected by, and in, the aquifer underlying the tailings pile; (2) identify multimedia pathways of contaminant migration from the site, including wind-erosion, food-chain, and solid contamination; (3) present a need for compiling data which can be used to assess risks associated with each exposure pathway, and which can be compared with the estimated risks; (4) present a method of estimating short-term and long-term exposures to contaminants for each pathway; and (5) present a method of combining exposures with health effects data to estimate noncancer and cancer risks associated with each pathway.

435
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Radium-226 Dose to a Boy from Playing on Mill Tailings

Health Physics 61(2):203-207 (August 1991)

Two boys born in September 1949 played on uranium mill tailings from about ages 8 to 12. One of these boys was diagnosed as having leukemia at age 15.5. The Ra-226 body burden of the survivor was measured at age 38. The whole-body Ra-226 content measured by counting in vivo was 0 (plus or minus 17 Bq), and measured independently by Rn breath analysis was 4.3 (plus or minus 2.1 Bq). At the same time, a control subject with no known exposure to Ra-226, matched in age, height, and weight, was also measured. The whole-body content was estimated at 4 (plus or minus 15 Bq) and independently by Rn breath analysis as 5.5 (plus or minus 3.7 Bq). The body burden of the control subject was not significantly different from that of the exposed person. Since no excess was found for the radium-dial painters whose doses were much higher, the induction of leukemia by doses of this magnitude would seem quite unlikely.

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J.L. Russell, U.S. Environmental Protection Agency, Office of Radiation Programs, Washington, DC

Health Risks from Uranium Mill Tailings

CONF-900S109; Environmental Issues and Waste Management in Energy and Minerals Production, T.M. Yegulalp and K. Kim (eds.), Proceedings of the First International Conference, Secaucus, NJ, August 27-29, 1990. Battelle Press, Columbus, OH, 602 pp.; (pp. 236-243) (1992)

This paper reviews the risk to public health and the environment from uranium mill tailings. The steps taken by the Environmental Protection Agency (EPA) to reduce this risk from tailings are summarized.

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M.P. Filion, Eldorado Nuclear Limited, Ottawa, Ontario, Canada; Canadian Nuclear Society, Toronto, Ontario, Canada

Decommissioning and Reclamation of the Beaverlodge Mine/Mill Operations

CONF-840613; Proceedings of the 24th Annual International Conference of the Canadian Nuclear Association and the Fifth Annual Conference of the Canadian Nuclear Society, I.J. Itzkovitch (ed.), Saskatoon, Saskatchewan, Canada, June 3-6, 1984, 132 pp.; (pp. 111-117) (1984)

After 30 years of nearly continuous mining at Beaverlodge, Saskatchewan, approximately 6 X 10(E+6) tons of uranium mill tailings had been deposited, using shallow lake disposal, in three natural lake basins. This paper discusses the engineering, environmental and radiological assessments undertaken by Eldorado Resources Limited to achieve an acceptable close-out plan. Since the tailings had been placed in natural lake basins, with exposed tailings deltas at each site, the choice of close-out concepts were limited to the following options: (1) water cover of all tailings to a nominal depth of 2 m, (2) vegetation, and (3) physical cover. At one lake, removal of tailings with underground disposal was also evaluated. For each concept, realistic engineering options were selected in discussion with the regulatory agencies, and a feasibility study was conducted to determine methods and costs. An environmental data base was collected during the year prior to closure. These, together with routine water quality monitoring and meteorological data, were used to develop computer models to assess the close-out concepts from an environmental perspective. The data and model results also inputted into a pathways assessment of the concepts. As low as reasonably achievable (ALARA) optimization calculations were performed in order to aid in the selection of the preferred concept(s). In the end, the decision to reclaim the site was based on a code of practice which sought to minimize the migration of tailings through stabilization.

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Laboratory-Scale Tests of a Chemical Barrier for Use at Uranium Mill Tailings Disposal Sites

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 739-744) (September 1991)

This paper presents an initial laboratory evaluation of a chemical barrier design for use beneath the Monticello, Utah, uranium mill tailings repository. A chemical barrier is a permeable mixture of reactive materials that chemically extracts contaminants from groundwater passing through it. One application of chemical barriers is as a repository liner to protect an underlying aquifer from contamination. This paper concerns the development of a barrier consisting of FeSO4 overlying a layer of Ca(OH)2, to be used as a liner for the mill tailings repository. Batch tests were performed to determine the minimum amount of FeSO4 and Ca(OH)2 required to remove molybdenum and uranium, respectively. This barrier design was tested using a laboratory-scale column that allows sampling along the flow path. A redox front was observed propagating through the column, coinciding with the precipitation of ferrous iron by contact with Ca(OH)2. Dissolved molybdenum and uranium were successfully removed from solution for 6 to 9 days, respectively. Chemical mechanisms for removal of uranium include reduction to UO2 and precipitation of CaUO4 caused by elevated pH. Molybdenum is

extracted by the reduction of Mo3O8 or MoS2, or by precipitation of FeMoO4. Thus in the laboratory tests, uranium and molybdenum, the primary pollutants to groundwater in the vicinity of a uranium mill tailings repository, were effectively removed by the chemical barrier. A field demonstration will be conducted to determine if a large-scale chemical barrier performs similar to the laboratory-scale model.

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The Use of Geochemical Barriers for Reducing Contaminants Emanating from Uranium Mill Tailings

CONF-900629; Environmental Hydrology and Hydrogeology, J.E. Moore, R.A. Kanivetsky, J.S. Rosenshein, C. Zenone, and S.C. Csallany (eds.), Proceedings of the First USA/USSR Joint Conference, Leningrad, USSR, June 18-21, 1990. Kendall/Hunt Publishing Company, Dubuque, IA, 463 pp.; (pp. 312-324) (1991)

Contamination of local groundwater by leachate emanating from tailings piles is a problem facing the U.S. Department of Energy's Uranium Mill Tailings Remediation Action (UMTRA) Project. These leachate fluids have a low pH and contain heavy metals and trace elements such as arsenic, molybdenum, nitrate, selenium, and uranium. Low-hydraulic-conductivity covers are installed over the tailings embankment. In some cases it is necessary to install a geochemical barrier (down-gradient from the tailings embankment) to facilitate the removal of hazardous constituents. Fluids emanating from beneath the repository can be scrubbed before entering the water table by the use of geochemical barriers to remove undesirable species from the contaminant plume. Materials containing adsorbing clays, iron oxyhydroxides, zeolites, and reducing materials such as coal and peat are being effectively used to attenuate contaminants from uranium mill tailings. Experiments to directly determine attenuation capacities of selected buffer/adsorption materials were conducted in the laboratory. Batch leach tests were conducted instead of column tests when the hydraulic conductivity of materials was too low to use in columns and shales.

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Application of Sphagnum Peat, Calcium Carbonate, and Hydrated Lime for Immobilizing Radioactive and Hazardous Contaminants in the Subsurface

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 543-549) (September 1991)

Batch experiments, mineralogical studies, and geochemical modeling were conducted to evaluate the effectiveness of sphagnum peat, calcium carbonate, and hydrated lime in removing dissolved concentrations of arsenic, molybdenum, nitrate, and uranium present in uranium-tailings pore water at Gunnison, Colorado. Amounts of As, Mo, and U removal by sphagnum peat, calcium carbonate, and hydrated lime at 5.0, 2.5, and 2.5 weight percent, respectively, were typically above 97%. Nitrate removal ranged between 55 and 80%. Significant contaminant removal was achieved by sphagnum peat alone at pH 3.18. Results from base potentiometric titrations and infrared spectroscopy investigations suggest that U(VI) binds onto carboxylate and phenolate groups. Addition of 2.5 wt. percent hydrated lime to the acidic tailings increased Mo concentrations by a factor of two under moderately alkaline conditions (pH 12). During neutralization of tailings pore water, precipitation of ferric oxyhydroxides may provide additional removal of As, Mo, and U(VI) from solution through adsorption and coprecipitation processes. Sphagnum peat and other forms of solid organic matter effectively remove anthropogenic organic compounds from solution through hydrophobic sorption and partitioning processes.

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Chemical Modeling of the Neutralization Process for Acid Uranium Mill Tailings

CONF-910202; Proceedings of the 120th Annual Minerals, Metals and Materials Society Meeting and Exhibition, New Orleans, LA, February 17-21, 1991. The Metallurgical Society, Inc., Warrendale, PA, 146 pp. (1991)

This paper reports on neutralization of acid uranium mill tailings with lime or other alkaline materials. Chemical modeling of this process was carried out using the equilibrium code MINTEQA2. Computed dissolved metal and sulfate concentrations were compared with laboratory-based experimental data. It was found necessary to include the modeling of adsorption of trace metals (such as uranium and lead) by the precipitated ferric hydroxide in order to obtain acceptable concentrations in the neutralized liquors. Limitations of the modeling exercise, such as chemical reaction kinetics and the effect of high ionic strength, are discussed in the paper.

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Radioactive and Toxic Wastes from the Bancroft Uranium Mines: Where Are We Going Who Is in Charge

INIS-mf-12985; 60 pp. (May 1987)

In 1985, the Canadian Institute for Radiation Safety was asked by cottagers and residents in the Bancroft area for assistance in obtaining information about possible radiation hazards from the various uranium-mine waste dumps in the area, and for help in evaluating that information. This report reviews the history of the tailings piles and evaluates the risks they present.

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Factors Affecting the Leaching of Radium-226 from Barium-Radium Sulphate Sludges

Canadian Institute of Mining and Metallurgy Bulletin 82(928):60-66 (August 1989)

The Canadian National Uranium Tailings Program was established in 1982 to develop, in part, a mathematical predictive model to assess the impact of uranium mill tailings on the environment, particularly on humans. To achieve this, various studies were undertaken to establish the role played by key constituents of the tailings. This paper summarizes the findings of a study carried out under that program, to examine the leachability of barium-radium sulphate sludges, produced in the treatment of uranium mill tailings decants. The investigators performed detailed chemical analysis of the sludge, applied geochemical computer models to investigate sludge leaching behavior, and conducted experiments to assess the impact of bacteria on leaching. The modelling showed that the redox state of the sludge-leachant system was the most important factor. Substantial bacterially-mediated dissolution of the sludge and release of radium was demonstrated experimentally under suitable reducing conditions.

444
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Progress in the Research on Uranium Mill Tailings Treatment and Waste Reduction for Uranium Ore Milling Processes

Chinese Journal of Nuclear Science and Engineering 10(4):384-393 (December 1990)

The production of uranium mill tailings and associated risk assessment are described. The

methods of uranium mill tailings disposal and management are criticized, and the necessity for research on uranium mill tailings treatment and no-waste uranium ore-milling processes are demonstrated. Research progress in China and other uranium-producing countries is reviewed, and the corresponding conclusions are reported.

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Microbial Reduction of Uranium

Nature 350(6317):413-416 (April 4, 1991)

Reduction of the soluble, oxidized form of uranium, U(VI), to insoluble U(IV) is an important mechanism for the immobilization of uranium in aquatic sediments and for the formation of some uranium ores. U(VI) reduction has generally been regarded as an abiological reaction in which sulphide, molecular hydrogen or organic compounds function as the reductant. Microbial involvement in U(VI) reduction has been considered to be limited to indirect effects, such as microbial metabolism providing the reduced compounds for abiological U(VI) reduction and microbial cell walls providing a surface to stimulate abiological U(VI) reduction. However, it is reported here that dissimilatory Fe(III)-reducing microorganisms can obtain energy for growth by electron transport to U(VI). This novel form of microbial metabolism can be much faster than commonly cited abiological mechanisms for U(VI) reduction. These findings expand the known potential terminal electron acceptors for microbial energy transduction, offer a likely explanation for the deposition of uranium in aquatic sediments and aquifers, and suggest a method for biological remediation of environments contaminated with uranium.

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D. Wang

Environmental Renovation of a Uranium Mine and Practice After its Decommissioning

Uranium Mining and Metallurgy (China) 10(2):27-31 (May 1991)

The following works done after decommissioning of a uranium mine are described: (1) sealing various pits; (2) covering waste heaps and their vegetation; and (3) renovation of the mined stopes of open pits.

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Acid Mine Drainage Research in Canada

CONF-9008109; Environmental Issues and Waste Management in Energy and Minerals Production, T.M. Yegulalp and K. Kim (eds.), Proceedings of the First International Conference, Secaucus, NJ, August 27-29, 1990. Battelle Press, Columbus, OH, 602 pp.; (pp. 208-235) (1992)

Acidic drainage resulting from base metal, precious metal, and uranium mining is the largest single environmental problem facing the Canadian mining industry today. Technologies to prevent acidic drainage from occurring in waste rock piles and tailings sites, and on the walls of open pits and underground mines, need to be developed and demonstrated. There are two grounds in Canada which have accepted this challenge: the national Mine Environment Neutral Drainage (MEND) and the British Columbia Acid Mine Drainage (BC AMD) Task Force. This paper summarizes the activities of these two organizations.

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The Key Lake Project

INIS-mf-12933; 47 pp. (1991)

Key Lake is located in the Athabasca sandstone basin, 640 km north of Saskatoon, Saskatchewan, Canada. The three sources of ore at Key Lake contain 70,000 tons of uranium. Features of the Key Lake Project were described under the key headings: work force, mining, mill process, tailings storage, permanent camp, environmental features, worker health and safety, and economic benefits. Appendices covering the historical background, construction projects, comparisons of western world mines, mining statistics, Northern Saskatchewan surface lease, and Key Lake development and regulatory agencies were included.

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Can Ore Milling Technology Be Harmonized With the Environment?

Erzmetall 44(4):183-187 (April 1991)

Processes of uranium-ore beneficiation will be environmentally acceptable only if no major pollutants are discharged into the biosphere. Regulatory authorities have set maximum permissible contamination limits which must be respected by the operators of ore mills. Compliance with these limits requires extensive measuring and checking activities, as well as innovative recycling techniques. Recycling methods are being used in which contaminated partial flows are continuously cleaned. These methods yield valuable by-products and clean water, which can be used by the operator or sold to others. The author concludes that ore beneficiation and environmental concerns can be harmonized by applying recycling technologies.

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Advances in Uranium Mill Tailings Closure: USA and Spanish Practice

Proceedings of the 1990 ENVIROTECH Symposium, Vienna, Austria, September 20-25, 1990. International Society for Environmental Protection, Vienna, Austria; (pp. 225-234) (1990)

Twenty-four inactive uranium mill tailings piles in the U.S. are undergoing remediation managed by the U.S. Department of Energy. The engineers responsible for this project have worked closely with engineers remediating a similar site in the south of Spain. Procedures assessed by both groups include cover performance and transient seepage from the containment cells. Although these projects are conforming to different sets of laws as well as different site circumstances, both hold human health and environmental protection as high objectives in project design and implementation.

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Reclamation Plans at Uranium Mill Tailings Sites

CONF-9007232; Hazardous and Industrial Wastes, J.P. Moore, S.C. Cheng, and M.A. Susavidge (eds.), Proceedings of the 22nd Annual Mid-Atlantic Industrial Waste Conference, Philadelphia, PA, July 24-27, 1990. Technomic Publishing Company, Lancaster, PA, 800 pp.; (pp. 570-579) (1990)

Long-term stability of waste impoundments is of concern because of the long time periods over which various types of waste may remain active. Over the past decade much technology has been developed specifically for reclamation of uranium mill tailings impoundments. Aspects of this technology are discussed here and are presented as being directly applicable to reclamation of industrial waste impoundments in general. The paper discusses Title I and Title II sites, which represent two different generations in uranium-tailings impoundment construction. The comparison between the two represent differences in philosophies as well as in impoundment type. Reclamation of uranium mill tailings

impoundments in the United States is controlled by federal legislation, which sets forth the regulatory framework for reclamation plan approval. Title I requirements govern government-owned inactive sites and Title II requirements govern active tailings impoundments or those operated by private industries. While the Title I and Title II designation may result in a slightly different regulatory process, reclamation of uranium tailings sites has the same regulatory process. Differences between Title I and Title II reclamation plans to achieve surface stability relate primarily to the embankment and surface covers. The differences in the cover designs result from site-specific conditions, rather than from differences in engineering approaches or the regulatory process. This paper discusses the site-specific conditions that affect the selection of cover designs, and provides a comparative example to illustrate the effect of this condition.

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Geochemical Hosts of Solubilized Radionuclides in Uranium Mill Tailings

Hydrometallurgy 24(3):361-372 (August 18, 1989)

The solubilization and subsequent resorption of radionuclides by ore components or by reaction products during the milling of uranium ores may have both economic and environmental consequences. Particle-size redistribution of radium during milling has been demonstrated by previous investigators; however, the identification of sorbing compounds in the tailings has received little experimental attention. In this study, uranium-bearing sandstone ore was milled, on a laboratory scale, with sulfuric acid. At regular intervals, filtrate from this suspension was placed in contact with mixtures of quartz sand and various potential sorbents which occur as gangue in uranium ores; the potential sorbents included clay minerals, iron and aluminum oxides, feldspar, fluorspar, barite, jarosite, coal, and volcanic glass. After equilibration, the quartz sand-sorbent mixtures were separated from the filtrate and radioassayed by gamma-spectrometry to determine the quantities of U-238, Th-230, Ra-226, and Pb-210 sorbed, and the radon coefficients. Sorption of U-238 was low in all cases, with maximal sorptions of 1-2% by the bentonite- and coal-bearing samples. Th-230 sorption also was generally less than 1%; maximal sorption here was observed in the fluorspar-bearing sample and appears to be associated with the formation of gypsum during milling. Ra-226 and Pb-210 generally showed higher sorption than the other nuclides: more than 60% of the Ra-226 solubilized from the ore was sorbed on the barite-bearing sample. The mechanism(s) for this sorption by a wide variety of substrates is not yet understood. Radon emanation coefficients of the samples ranged from about 5 to 30%, with the coal-bearing samples clearly demonstrating an emanating power higher than any of the other materials.

DEPARTMENT OF ENERGY (DOE)
ENVIRONMENTAL RESTORATION PROGRAM

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Ecological Assessment at Environmental Restoration Sites: DOE's Dual Role as CERCLA Lead Agency and a Natural Resource Trustee

CONF-9010166; Waste Management and Environmental Restoration, Proceedings of the 1990 DOE Model Conference, Oak Ridge, TN, October 29-November 2, 1990, 343 pp.; (23 pp.) (1990)

Fifty years of research, development, and production in support of national defense have left the Department of Energy (DOE) with numerous radioactive, hazardous, and mixed waste sites which will require remediation and restoration. At inactive Environmental Restoration (ER) sites, DOE must respond to a release or threat of release of hazardous substances, pursuant to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), as amended, and the National Oil and Hazardous Substance Pollution Contingency Plan (NCP). DOE has a dual role at ER sites because the Department is also a Natural Resource Trustee. This means that DOE is responsible for ensuring the restoration or replacement of natural resources located on, over or under land managed by the Department. This paper provides an overview of a suggested approach to addressing the ecological impact assessment requirements of both CERCLA and the NCP at DOE's ER sites. It also summarizes the responsibilities and requirements for DOE as primary Federal Natural Resource Trustee, and discusses, in general terms, the type of evaluation which DOE must conduct pursuant to these regulations.

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Facilitation Techniques for Environmental Restoration Planning and Implementation

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 129-133) (September 1991)

Successful environmental restoration requires effective coordination among many disciplines. It is dependent upon a broad array of regulatory concerns, the selection of suitable technical solutions, and the consideration of various social and political aspects. Chem-Nuclear GeoTech, Inc. (Geotech) uses trained facilitators to apply special planning and problem solving techniques to achieve successful environmental restoration. Facilitated meetings, which may include representatives from agencies like the U.S. Environmental Protection Agency and state regulatory agencies, as well as representatives from Geotech and the U.S. Department of Energy (DOE), help in the planning and design of environmental restoration activities. These facilitated sessions provide substantial savings to DOE, reduce redesign, and eliminate schedule delay. This paper describes how Geotech facilitators use facilitation techniques to assist technical experts in environmental restoration planning and problem solving. It does not attempt to address all relevant facilitation methods nor does it provide sufficient detail about the techniques to allow the reader to conduct such activities without further training.

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Unified Theory of Sciences for Implementation of Environmental Restoration at Department of Energy Sites

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 21-26) (September 1991)

Using the unified theory of sciences to implement environmental restoration (ER) is an innovative approach for the U.S. Department of Energy (DOE) in solving its most pressing ER problems. This approach proposes a cohesive application of all sciences, both the technical/physical and the

political/social sciences. It would require that DOE increase its emphasis on public involvement, regulatory acceptance, and implementation strategies. Four case studies illustrate how difficult ER projects can be successful: (1) remediation of the business district in downtown Grand Junction, Colorado; (2) hazardous waste treatment and disposal in Mobile, Arizona; (3) Defense Base Closure and Realignment Act of 1990; and (4) the 1976 Winter Olympic Games. A successful ER project protects human health and the environment, conducts remediation expeditiously and cost effectively, and receives acceptance by regulatory agencies and the public. This paper recommends that DOE needs (a) to place more emphasis on implementation strategies, (b) to emphasize social and political sciences in its human resource development and training, (c) to approach every ER project as potentially controversial, involving potentially affected interests early in the process.

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Department of Energy: Task Assignment Subcontract Awards

Federal Register 56(206):55124-5 (October 24, 1991)

U.S. Department of Energy (DOE) Acquisition Regulations (48 CFR 909.570) impose strict requirements to prevent organizational conflicts of interest (OCIs) in the award and performance of contracts for technical and management support services. If an OCI exists, the contract may be awarded only if the Secretary of Energy (or his designee) determines the award is in the best interests of the United States. In the case at hand, DOE gives public notice of its decision to approve the assignment of a task and related subcontract awards for data collection and cost estimation relating to environmental remediation activities to an existing DOE contractor (Gilbert/Commonwealth, Inc.), in spite of any potential future OCI which may result from the performance of such work. Gilbert/Commonwealth, Inc. shall not be precluded from participation in future environmental remediation work for DOE. The environmental restoration cost estimation and data collection work awarded to Gilbert/Commonwealth, Inc. is highly specialized, so that there are a limited number of contractors with the expertise and experience to perform it. Because of the limited, fragmented nature of the work, it is highly unlikely that future DOE environmental restoration work will stem directly from the data collected, or that Gilbert/Commonwealth, Inc. will gain information which provides it with an unfair competitive advantage. There is an urgent need for the performance of this work, and competent contractors have been unwilling to enter into contracts for it since a potential OCI might limit their future participation in environmental restoration projects. For these reasons, it is determined to be in the best interest of the United States to assign this work (Task 41, Phases I and II, under Contract DE-AC01-88MA00236) to Gilbert/Commonwealth, Inc.

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Request for Public Review and Comment on a Preliminary Design Report: A Priority System for Environmental Restoration

Federal Register 56(173):44078-80 (September 6, 1991)

The U.S. Department of Energy (DOE) has been developing, in consultation with external review groups, a system for setting priorities in its Environmental Restoration (ER) program. The ER program directs studies and activities to clean up contamination at DOE sites. This work is being conducted with the goal of completing cleanup of all DOE sites by the year 2019. The priority system discussed in the Preliminary Design Report is a formal decision-aiding tool designed to help ensure that DOE's funding decisions reflect the primary objectives of protecting public health and the environment and complying with regulatory requirements and agreements; and that these funding agreements make the best possible

use of limited financial and human resources, based on facts and objective criteria. Although some aspects of the priority system are still being developed, DOE's views regarding the system's basic purposes, structure, and uses have been formulated and are discussed in the Preliminary Design Report. DOE is continuing research and discussion to resolve the outstanding issues, and is seeking public review and comment on the system's development to date.

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Program Management Strategies for Following EPA Guidance for Remedial Design/Remedial Action at DOE Sites

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 199-213) (September 1991)

At U.S. Department of Energy (DOE) facilities, environmental restoration is conducted in accordance with Federal Facilities Compliance Agreements (or Interagency Agreements). These agreements establish cooperative working relationships and define roles, responsibilities, and authorities for conduct and oversight of the Remedial Action Programs. The U.S. Environmental Protection Agency (EPA) also has guidelines on how to initiate and perform remedial actions for sites they are remediating under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) as amended by the Superfund Amendments and Re-Authorization Act (SARA). This paper addresses some of the differences and commonalities between the DOE project management procedures and EPA guidance documents covering the remedial design/remedial action (RD/RA) phase of environmental restoration. Many of the apparent differences between DOE and EPA project management are really just instances of applying different terminology to the same phase of a project. Comparing and understanding the two processes helps avoid communication problems and also helps determine the extent of EPA participation required in DOE cleanup activities. This paper discusses the steps in the DOE RD/RA process and compares them to the EPA process. Each element in the process is defined. Activities common to EPA and DOE are correlated. The annual DOE budget cycle for remediation projects and the four-year cycle for appropriation of remediation funds are discussed, and the constraints of this process examined. DOE orders and requirements for RD/RA activities are summarized and correlated to EPA regulations where possible. Finally, schedules for typical RD/RA activities are presented and DOE project schedules are compared to EPA restoration schedules. An innovative schedule is presented to meet the CERCLA time constraint requirements for continuous remedial activity within 15 months of the Record of Decision.

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Putting Ecology in Environmental Restoration: The Strategic Planning Process

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 443-446) (September 1991)

Traditional ecological studies have been conducted on many hazardous waste sites. In many cases, however, the massive amount of information obtained has limited value in the selection of remediation options. This paper discusses the importance of developing a risk-based ecological strategy to fulfill the scientific and social needs that arise in the remediation and restoration of hazardous waste sites. Ecological issues need to be seriously considered at the earliest phases of the scoping process. The decisions regarding selection of assessment endpoints and data quality objectives must be incorporated from the start to ensure that cost-efficient and useful measurements are used. It is too late to develop effective ecological studies after engineering decisions have been made.

Strategic planning that integrates ecological concerns will minimize the frustration and the cost associated with cleanup of hazardous waste sites, and will maximize the likelihood of successful site restoration.

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When RCRA Meets ALARA

CONF-9010166; Waste Management and Environmental Restoration, Proceedings of the 1990 DOE Model Conference, Oak Ridge, TN, October 29-November 2, 1990, 343 pp.; (10 pp.) (1990)

This paper proposes a method to identify an inconsistency between Resource Conservation and Recovery Act (RCRA) and Atomic Energy Act (AEA) and for distinguishing a true inconsistency from a compliance difficulty. The paper also provides examples of each situation, accommodating specific RCRA requirements to maintain adherence to radiation protection requirements. The proposed method is derived from radiation protection guidance to Federal agencies for occupational exposure that was issued by EPA, under authority derived from Executive Order 10831, the AEA, and Reorganization Plan 3 of 1970. This EPA guidance was approved by President Reagan on January 20, 1987 and closely reflects the guidance of national and international radiation standard-setting groups.

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Comparative Overview of Federal Facility Compliance Agreements and Consent Orders

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 801-805) (September 1991)

This paper provides a layman's guide through the labyrinth of regulatory, political, economic, and contractual issues associated with the development of Federal Facility Compliance Agreements (FFCAs) and related Consent Orders. These agreements between the U.S. Environmental Protection Agency (EPA), U.S. Department of Energy (DOE), and state governments control the environmental cleanup of federal facilities and specify the rights and responsibilities of the three parties involved. A comparative analysis of the FFCAs of eight major DOE Weapons Complex facilities is summarized. These sites include: (1) the Feed Materials Production Center (Fernald), (2) Hanford, (3) Idaho National Engineering Laboratory, (4) Kansas City Plant, (5) Lawrence Livermore National Laboratory, (6) the Mound facility, (7) Oak Ridge Reservation, and (8) the Rocky Flats Plant. Several key provisions addressing primary issues subject to negotiation among the parties are common to most FFCAs. These include: jurisdiction; purpose and scope; regulatory compliance or Resource Conservation and Recovery Act (RCRA) and Comprehensive Environmental Response, Liability, and Compensation Act (CERCLA) integration; interagency consultations; dispute resolution process; stipulated penalties; enforceability; extensions and terminations; force majeure events; funding; and covenants not to sue and reservation of rights. Variation in FFCA provisions reflect site-specific characteristics, evolutionary refinements in terms and tactics of negotiation, heightened awareness among the parties of policy implications, increased participation, and the application of "lessons learned" from implementing practices at other federal facilities subject to similar tri-party deliberations.

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U.S. Department of Energy Office of Environmental Restoration and Waste Management Waste Reduction Workshop

DOE/HWP-116; CONF-9108124; Proceedings of the Seventh DOE Waste Reduction

Workshop, Kansas City, MO, August 6-8, 1991, 188 pp. (November 1991)

This workshop focused on goal-setting and methods of establishing meaningful goals for a waste-minimization program. These workshops help U.S. Department of Energy (DOE) waste-generating sites implement waste-minimization plans and programs. All forms of wastes (liquid, solid, and airborne) are considered, as are all categories of wastes. These categories consist of high-level waste, transuranic waste (TRU), low-level waste (LLW), hazardous waste, mixed waste, office waste, and sanitary waste. Workshop discussions encompass a wide spectrum of subjects including any method or technical activity involved in the process extending from waste generation to disposal. Ways to reduce wastes include process design improvements, substitution of materials, waste segregation and recycling/reuse, waste treatment and processing, and administrative controls such as procurement and waste awareness training. Remedial action and decontamination and decommissioning are also considered.

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Department of Energy Policy for Acceptance of Facilities for Environmental Restoration

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 59-60) (September 1991)

This paper summarizes the policy of the U.S. Department of Energy (DOE) Office of Environmental Restoration for accepting new facilities into the Environmental Restoration Program. Facilities that are eligible include DOE buildings, structures, and sites that are currently the responsibility of DOE's Office of Nuclear Energy, Office of Defense Programs, and Office of Energy Research. The policy states that the Office of Environmental Restoration, part of DOE's Office of Environmental Restoration and Waste Management (EM), will accept DOE-contaminated facilities that are surplus to DOE needs and have no intended use in the future. The facilities will be turned over to EM for remediation and decommissioning when they are completely shutdown and when stored nuclear and hazardous materials have been removed.

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The Prioritization of Environment, Safety, and Health Activities

LA-12175-MS; 20 pp. (September 1991)

Federal facilities, including the national laboratories, must bring existing operations into compliance with environment, safety, and health (ES&H) regulations while restoring sites of past operations to conform with today's more rigorous standards. The need for ES&H resources is increasing while overall budgets are decreasing, and the resulting staffing and financial constraints often make it impossible to carry out all necessary activities simultaneously. This has stimulated interest in formal methods to prioritize ES&H activities. The development of an approach called MAPP (Multi-Attribute Prioritization Process) is described, which features expert judgment, user values, and intensive user participation in the system design process. Results of its application to the prioritization of 41 ES&H activities having a total cost of over $25 million is presented. It is concluded that the insights gained from user participation in the design process and the formal prioritization results are probably of comparable value.

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Risk Assessment of Designs for RCRA and CERCLA Sites

CONF-911250; Superfund '91: Hazardous Materials Control, Proceedings of the 12th

National Conference and Exhibition, Washington, DC, December 3-5, 1991; (pp. 596-599) (December 1991)

A recent spate of papers have called into question the efficacy of the pump-and-treat groundwater methods of remediating hazardous chemical contaminated sites. However, there has been no such re-examination of the long-term effectiveness RCRA and CERCLA regulations to protect human health and the environment. Using a probabilistic risk methodology, the designs for containment and remedial action at such sites are examined. Results of the RCRA containment design and a limited number of CERCLA remediation techniques are presented. These results and the results of earlier studies of the containment of long- and short-lived radioactive materials indicate that containment mechanisms for long-lived hazardous materials like lead and mercury (which have no half-lives) or plutonium-239 (which has a half-life of 24,500 years) do not last far beyond the hazardous lifetime of the pollutants and only delay their release. The RCRA containment design, which uses synthetic liners with expected lifetimes of 50 to 100 years, allows not only the heavy metals but also many refractory chemicals to impinge upon the environment and impact human health after the RCRA-mandated liners fail. It is also clear that CERCLA pump-and-treat techniques in most cases will not restore aquifers to their previous condition. This is not surprising, since oil extraction technologies are only 30 to 40 percent effective, and even with enhanced techniques are only 50 to 60 percent effective. If this is true for the recovery of a valuable product, there is no reason to expect that recovering a hazardous material would be more efficient. These preliminary studies indicate that the present system of landfills and remediation will eventually fail. The paper concludes that those hazardous substances that pose a long-term threat must be disposed more securely than they currently are, in near-surface facilities with minimum, engineered barriers.

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Nuclear Weapons Complex - Major Safety, Environmental, and Reconfiguration Issues Facing DOE

GAO/T-RCED-92-31; 9 pp. (February 25, 1992)

In this testimony before the U.S. Senate Committee on Governmental Affairs, J. Dexter Peach, Assistant Comptroller General of the Resources, Community, and Economic Development Division of the General Accounting Office (GAO), referred to several previous GAO studies on safety policy and the safety culture at the U.S. Department of Energy (DOE). He also addressed the questions confronting DOE in its cleanup of the nuclear weapons complex and its reconfiguration of the nuclear weapons complex. In summary, the problems facing the complex are diverse, formidable, and costly. DOE's efforts in safety and environmental restoration face significant technological, compliance, and management challenges. DOE needs to develop a sound framework for implementing its safety programs and needs realistic cleanup goals and defensible cleanup priorities. DOE must make key decisions on how to reconfigure the weapons complex to meet the nation's needs into the 21st century: (1) the size of the complex, (2) what technologies should be used for new tritium production, and (3) what to do with excess weapons-grade nuclear material.

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TSD Capacity Model Interface with Waste Reduction Planning in the Environmental Restoration Program

CONF-9108124; Proceedings of the Seventh DOE Waste Reduction Workshop, Kansas City, MO, August 6-8, 1991, 188 pp.; (13 pp.) (1991)

This report provides a picture of how the integration of waste-generation forecasting with treatment, storage, and disposal (TSD)-capacity modeling interfaces with waste-reduction planning in the U.S. Department of Energy (DOE)

Environmental Restoration Program. Background information is given for the major activities at the seven Martin Marietta Energy Systems, Inc. sites: (1) Oak Ridge National Laboratory, (2) Oak Ridge Y-12 Plant, (3) Oak Ridge K-25 Site, (4) Paducah Gaseous Diffusion Plant, (5) Portsmouth Gaseous Diffusion Plant, (6) Oak Ridge Associated Universities, and (7) the off-site contaminated areas near DOE facilities. A perspective is provided for strategies to achieve waste reduction, how waste-generation forecast rates were developed, and how those forecasted waste-generation rates will be used in TSD-capacity modeling. The generation forecasting in combination with TSD modeling allows development of quantifiable goals and subsequent waste reduction.

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V.S. Rezendes, U.S. General Accounting Office, Resources, Community, and Economic Development Division, Washington, DC

Managing the Environmental Cleanup of DOE's Nuclear Weapons Complex

GAO/T-RCED-91-27 (April 11, 1991)

This report is a transcript of testimony given by the General Accounting Office's (GAO) Victor S. Rezendes before the Department of Energy (DOE) Defense Nuclear Facilities Panel of the U.S. House of Representatives' Committee on Armed Services. The topic is GAO's review of and recommendations concerning DOE's efforts to clean up environmental problems at the nation's nuclear weapons plants. Mr. Rezendes notes some areas in which DOE has made progress, including its reorganization and formation of the Office of Environmental Restoration and Waste Management, the establishment of "Tiger Teams" to perform environmental, safety, and health reviews, and the identification of about 3700 contaminated sites nationwide. The escalating cost estimates for cleanup found in DOE's second five year plan for 1992-1996 are cause for concern. Technical and management problems impede DOE's cleanup efforts. The Hanford facility's difficulties and delays in treating its 57 million gallons of high-level radioactive wastes stored in tanks provide an example of the technical problems. Management problems include a need for improved cost estimation and budgeting. A prioritization system is also needed to characterize and identify sites in need of immediate remediation to prevent further environmental damage. A major concern of GAO is DOE's oversight of its contractors. Poor cost control of management and operating (M&O) contractor expenditures, especially their failure to use competitive bidding in awarding subcontracts, is a problem. DOE's plan to have its M&O contractors turn over their cleanup responsibilities to independent environmental restoration contractors is seen as a positive step.

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What are the Basic Requirements that Cleanup Standards Should Satisfy?

EPA/520/1-90-013; CONF-8909236; Residual Radioactivity and Recycling Criteria, A.B. Wolbarst, H. Terada, and A.C.B. Richardson (eds.), Proceedings of a Workshop, St. Michaels, MD, September 27-28, 1989, 311 pp.; (pp. 179-185) (September 1989)

In radiation protection, three objectives were set forth in 1960 as guidance for regulation of radiation exposure by federal agencies: (1) there should not be any man-made radiation exposure without the expectation of benefit resulting from exposure; (2) every effort should be made to keep radiation doses as far below the recommended limits as practicable; and (3) recommended limits for the general population are 0.5 rem per year for the whole body and 5 rem in 30 years for the gonads. These three objectives have been characterized by the International Commission on Radiological Protection (ICRP) as the principles of justification, optimization, and limitation. The ICRP now makes a distinction between limits for short-term and for long-term exposure. The U.S. Environmental Protection Agency has updated the 1960 federal guidance. The draft version at the time of publication of these proceedings reads: (a) there should be no exposure to the general public unless it is justified by the expectation of an

overall benefit; (b) a sustained effort should be made to ensure that doses to individuals and in populations are maintained as low as reasonably achievable; and (c) the combined radiation doses incurred in any year from all sources of exposure should not normally exceed a limiting value of 0.1 rem. Other applicable or useful concepts or criteria include the concept of acceptable risk (as applied to regulation of chemicals in the United States), with radiation doses corresponding to a range of lifetime risk of 0.04 to 4 mrem/yr; national groundwater policy (groundwater classification and drinking water standards) of 4 mrem/yr exposure; and below regulatory concern criteria (BRC) for residual radioactivity, currently proposed by the Nuclear Regulatory Commission as 10 mrem/yr, which does not meet the current concepts of acceptable risk or existing drinking water standards. This paper urges the adaptation of simple numerical cleanup criteria that apply to all sites, expressed directly in terms of contamination levels or total amount of contaminant.

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What Should Cleanup Standards Do?

EPA/520/1-90-013; CONF-8909236; Residual Radioactivity and Recycling Criteria, A.B. Wolbarst, H. Terada, and A.C.B. Richardson (eds.), Proceedings of a Workshop, St. Michaels, MD, September 27-28, 1989, 311 pp.; (pp. 186-192) (September 1989)

Standards for residual radioactivity on soils and other materials should provide adequate protection for: (1) individuals using the materials or occupying the site; (2) other critical population groups that may be exposed due their proximity to the site or materials; and (3) the general population at risk from atmospheric transport of contaminants or from ingestion of contaminated water or food. Past analyses have shown that the individual site reclaimer or recycled material user is the critical receptor, but that risks to other components of the public should also be considered. Doses received by site reclaimers or recycled material users are generally proportional to the nuclide concentration (pCi/g) for bulk contamination and nuclide surface concentration (dpm/100 sq cm) for surface contamination. Therefore, standards should limit the concentration of individual nuclides or groups of nuclides. Limiting concentration values should be based on appropriate exposure scenarios and multipathway risk assessments. For example, the ease of nuclide removal or leachability from the material should affect the concentration limits.

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Comparison of RCRA SWMU Corrective Action and CERCLA Remedial Action

AD-A-243385/2/XAB; AFIT/CI/CIA-91-091; 161 pp. (September 30, 1991)

With the passage of the Hazardous and Solid Waste Amendments of 1984 and the addition of expanded authorities to require corrective action for release of hazardous constituents from solid waste management units (SWMUs) at hazardous waste treatment, storage, and disposal facilities, the Solid Waste Disposal Act (hereafter referred to as the Resource Conservation and Recovery Act or RCRA) will dramatically influence the Superfund program under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Not only will the RCRA corrective action program help prevent current RCRA sites from becoming Superfund sites, but it also offers EPA and the states an important alternative to address Superfund sites that already exist. EPA recognized this and, hoping to conserve Superfund resources, developed a policy to defer listing of sites from the National Priority List if those sites can be addressed under RCRA's corrective action authorities. Private industry and federal agencies with problem sites that could qualify under either program need to compare the advantages and disadvantages of each program. EPA's deferral policy continues to evolve and appears to be ripe for expansion.

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Creating a Context for Public Confidence in the Environmental Restoration Programs

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 31-36) (September 1991)

Achieving public, political, and regulatory confidence in environmental remediation programs challenges every member of the remediation team. Based on review of many controversial projects, this paper proposes a process-oriented approach to gaining and maintaining public confidence. It emphasizes the need to identify and understand potential stakeholders, and to design an overall context that incorporates public and institutional involvement into the investigation and remediation program. It calls for early strategy development, "ownership" of the public confidence strategy by all levels of staff and management, and a proactive approach. It suggests practical actions that can be taken to implement an overall approach that is tailored for a specific program. Finally, it encourages environmental professionals to recognize the positive elements of remediation and use them effectively to enhance communication, consensus, and confidence.

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Programmatic Environmental Impact Statement for the Office of Environmental Restoration and Waste Management

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 55-58) (September 1991)

This paper describes the background for the Environmental Restoration (ER) program's Programmatic Environmental Impact Statement (PEIS) and its development process. The ER PEIS (1) provides a broad environmental analysis of the program, (2) evaluates environmental effects of the program's interactions and cumulative impacts, (3) addresses program-wide (not site-specific) alternatives, and (4) provides for subsequent National Environmental Pollution Act documents of narrower scope to evaluate site-specific actions. Activities covered by the PEIS include (a) the assessment and physical cleanup of contamination at U.S. Department of Energy installations and other properties; (b) decontamination and decommissioning or dismantling of DOE's surplus facilities; and (c) the treatment, storage, and disposal of wastes managed by the DOE Office of Environmental Restoration and Waste Management that are generated by ongoing nuclear energy and energy research, defense, restoration, and other activities. Results of the 23 scoping meetings held in relation to the document development are described in detail. Scoping meetings are public meetings where the public is invited to comment on the proposed scope of the PEIS. The new ER PEIS management structure, contracting vehicle, and future activities are also explained in this paper.

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Remedial Action Measures

ES/ER/TM-2; 39 pp. (September 1990)

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

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

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Costs of RCRA Corrective Action

ORNL/TM-11864; 91 pp. (September 1991)

This report estimates the cost of the corrective action provisions of the Resource Conservation and Recovery Act (RCRA) for all non-federal facilities in the United States. This exercise is part of a larger project conducted at Oak Ridge National Laboratory and the University of Tennessee-Knoxville to estimate the costs of cleaning up all the hazardous wastes in the United States. The 1984 amendment to RCRA, the Hazardous and Solid Waste Amendments, stipulates that facilities that treat, store, or dispose of hazardous wastes (TSDs) must remediate situations where hazardous wastes have escaped into the environment from their solid waste management units (SWMUs). The U.S. Environmental Protection Agency, among others, believes that the costs of RCRA corrective action could rival the costs of Superfund. This report evaluates costs associated with actual remedial actions. Cost associated with RCRA facility assessments, facility investigations, and corrective measures studies are excluded.

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U.S. Department of Energy, Assistant Secretary for Environment, Safety, and Health, Washington, DC

Performance Objectives and Criteria for Conducting DOE Environmental Audits

DOE/EH-0229; 178 pp. (1992)

This document contains the performance objectives and criteria (POC) that have been developed for environmental audits and the environmental portion of Tiger Team assessments conducted by the Office of the Assistant Secretary for Environment, Safety and Health. The Environmental POC can serve multiple purposes. Primarily, they are to serve as guidelines for the technical specialists conducting the audits and assessments, and for the team management. The POC can also serve as supporting documents for training technical-discipline specialists and team leaders and as the bases for Department of Energy programs, or for field offices and contractors who are establishing self-assessment programs or improving their environmental protection programs. The POC cover nine technical disciplines: (1) air, (2) surface water and drinking water, (3) groundwater, (4) waste management, (5) toxic and chemical materials, (6) radiation, (7) quality assurance, (8) inactive sites and releases, and (9) environmental management. The National Environmental Protection Act (NEPA) has not been included in this initial version of the document because that discipline is the responsibility of NEPA Oversight. However, in response to comments on the draft document, plans have been made to include NEPA in future revisions.

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U.S. Department of Energy, Assistant Secretary for Environment, Safety, and Health, Washington, DC

DOE Environmental Audit Program Guidance

DOE/EH-0232; 125 pp. (January 1992)

Secretary of Energy Notice (SEN) 6B-90 and SEN-11-89 assign the responsibilities for implementing the Department of Energy (DOE) environmental policy with line management organizations within DOE. This includes Headquarters Program Offices, Field Offices, and Area/Site Offices. Further, SEN-6B-90 assigns the Office of Environment, Safety and Health (ES&H) the responsibility for developing DOE environmental policy and conducting independent internal oversight to assure compliance with

applicable laws related to environmental protection. SEN-20-90 emphasizes the need for, and value of, assessments by authorized oversight organizations to ensure DOE activities are undertaken in an "environmentally sound manner." Specifically, DOE 5482.1B authorizes the Assistant Secretary for Environment, Safety and Health to: (1) conduct management appraisals of line organization ES&H programs; (2) conduct ES&H functional appraisals of field activities; (3) conduct review of facilities and operations; (4) participate in selected field organization appraisals of contractor facilities/operations; (5) provide advice and interpretation regarding ES&H appraisal program policy; and (6) provide technical assistance, support, and guidance. This report serves as a guide to the components of an environmental audit.

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U.S. Department of Energy, Assistant Secretary for Environment, Safety, and Health, Washington, DC

Environmental Guidance for Public Participation in Environmental Restoration Activities

DOE/EH-0221; 127 pp. (November 1991)

The U.S. Department of Energy (DOE) is issuing this document to summarize policy and provide guidance for public participation in environmental restoration activities at DOE Headquarters, field offices, facilities, and laboratories. While the Office of Environmental Restoration and Waste Management (EM) has environmental restoration responsibility for the majority of DOE sites and facilities, other DOE project offices have similar responsibilities at their sites and facilities. This guidance is applicable to all environment restoration activities conducted by or for DOE under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA); the Resource Conservation and Recovery Act of 1976 (RCRA) as amended by the Hazardous and Solid Waste Amendments of 1984 (HSWA) (corrective actions only); and the National Environmental Policy Act of 1969 (NEPA). This guidance also is applicable to CERCLA remedial action programs under the Uranium Mill Tailings Radiation Control Act of 1978 and the Formerly Utilized Sites Remedial Action Program, where DOE is the designated lead agency. The primary objectives of this guidance document are as follows: (1) acclimate DOE staff to a changing culture that emphasizes the importance of public participation activities; (2) provide direction on implementing these public participation activities; and (3) provide consistent guidance for all DOE Field Offices and facilities. The purpose of this document is to provide guidance on conducting effective public-participation activities for environmental restoration activities under CERCLA and for RCRA corrective actions under sections 3004(u), 3004(v), and 3008(h); and NEPA public participation activities.

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U.S. Department of Energy, Office of Environmental Guidance and Compliance, Washington, DC

Natural Resource Trusteeship and Ecological Evaluation for Environmental Restoration at Department of Energy Facilities

DOE/EH-0192; 267 pp. (June 1991)

This document is a guidance that provides U.S. Department of Energy (DOE) field organizations with information on DOE's responsibilities as federal Natural Resource Trustee at DOE facilities. The guidance also concerns requirements relating to ecological evaluation during DOE response actions under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA), and under the Resource Conservation and Recovery Act (RCRA), as amended. This guidance focuses on the initial actions to be taken by DOE as both a Natural Resource Trustee and as a lead response agency performing environmental restoration and how these requirements affect DOE's Environmental Restoration Program. The National Resource Trustee and Natural Resource Damage Assessment (NRDA) provisions of CERCLA apply to releases

of CERCLA hazardous substances, pollutants or contaminants from any facility or marine vessel. Many of DOE's environmental restoration activities will be conducted under RCRA. The specific releases to be addressed under RCRA include "hazardous waste" and "hazardous waste constituents," which by definition are also CERCLA "hazardous substances." Therefore, when RCRA authorities are used to remediate a site, Natural Resource Trustees such as DOE are not precluded from assessing damages and filing natural resource damage claims, notwithstanding the fact that injuries may have been due to releases of CERCLA hazardous substances. Thus the "notification and coordination" requirements and the NRDA regulations discussed in this guidance are relevant to releases of CERCLA hazardous substances, regardless of whether the environmental restoration activities to address these releases are conducted according to CERCLA response action authorities or RCRA corrective action authorities. The NRDA is the process which Natural Resource Trustees use to determine money damages which the Trustee may pursue in a CERCLA action (the natural resource damage claim). The U.S. Department of the Interior published the NRDA regulations (43 CFR 11). Performance of an NRDA is only one aspect of Natural Resource Trusteeship under CERCLA. Formal NRDA procedures are not covered in detail in this guidance document; instead it discusses other DOE responsibilities, including (1) requirements to notify and coordinate with other affected Natural Resource Trustees and (2) the performance of scientific (ecological) investigations and ecological risk assessments.

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U.S. Department of Energy, Office of Environmental Restoration and Waste Management, Washington, DC

Environmental Restoration and Waste Management (EM) Program: An Introduction

DOE/EM-0013P; 95 pp. (June 1991)

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

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U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, DC

Superfund Community Relations Program - A Guide to Effective Presentations with Visual Aids

PB-89-167985; EPA/540/G-89/001; 94 pp. (June 1988)

This guide is designed to assist Superfund community relations personnel and their contractors in preparing presentations to enhance public understanding and encourage informed participation in the cleanup process. It specifically addresses the selection and development of effective visual aids which are best suited for presenting complex technical matters clearly and concisely to increase the understanding of the non-technical public.

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U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, DC

Superfund LDR Guide No. 6A (2nd edition) - Obtaining a Soil and Debris Treatability Variance for Remedial Actions

PB-91-921327/XAB; 7 pp. (September 1990)

This fact sheet outlines the process for obtaining and complying with a Treatability Variance for soil and debris that are contaminated with Resource Conservation and Recovery Act (RCRA) hazardous wastes until such time that the Agency promulgates treatment standards for soil and debris. In the interim (before the Agency promulgates a third set of treatment standards specifically for soil and debris wastes), there is the presumption that Comprehensive Environmental Response and Compensation Liability Act response actions involving the placement of soil and debris contaminated with RCRA restricted wastes will utilize a Treatability Variance to comply with the LDRs. Treatment levels outlined in the fact sheet will serve as alternative treatment standards.

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U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, DC

Guide to Obtaining No Migration Variances for CERCLA Remedial Actions

OSWER Directive 9347.3-10FS; 5 pp. (April 1991)

A "No Migration" Variance allows land disposal of restricted wastes that do not meet the U.S. Environmental Protection Agency's Land Disposal Restrictions (LDR) treatment standards in a specific waste disposal unit. This guide outlines procedures for obtaining a No Migration Variance for RCRA hazardous wastes as part of a CERCLA response when the LDRs are Applicable and Relevant Regulations (ARARs).

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U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, DC

EPA Oversight of Remedial Designs and Remedial Actions Performed by PRPs - Fact Sheet

PB-91-921357/XAB; OSWER Directive 9355.5-16FS; 8 pp. (February 1990)

The Fact Sheet presents an overview of the United States Environmental Protection Agency's guidance for oversight of enforcement-lead projects in which a Potentially Responsible Party (PRP) conducts the Remedial Design (RD) and Remedial Action (RA). PRP oversight is to ensure that selected remedies are protective of the public health and the environment and are in compliance with the Settlement Agreement. For further information, refer to Interim Final Guidance on EPA Oversight of Remedial Designs and Remedial Actions Performed by Potentially Responsible Parties, OSWER Directive 9355.5-01, February 1990.

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U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, DC

Community Relations During Enforcement Activities and Development of the Administrative Record

OSWER Directive 9836.0-1A; 28 pp. (November 3, 1988)

The directive discusses superfund enforcement and community relations. The directive, which is Chapter VI of "Community Relations in Superfund: A Handbook", discusses developing community relations plans, the relationship between the administrative record for response selection and community relations, and community relations during specific enforcement actions and settlements. The document supersedes directive number 9836.0 "Interim Guidance on Community Relations in Enforcement", dated March 22, 1985, and directive number 9836.0-1a "Community Relations Activities at Superfund Enforcement Sites", dated August 8, 1985.

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Meeting Health-Based Standards at Hazardous and Mixed Waste Sites: Are We Deluding Ourselves?

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 393-400) (September 1991)

Achieving health-based standards is clearly a desirable goal in hazardous and mixed-waste remediation. However, the application of such standards is only appropriate if the standards can be applied with reasonable accuracy, and the criteria can be met using available technology. This paper contends that for a substantial number of sites, health-based goals cannot be applied with the necessary accuracy. Furthermore, current technologies may not be able to achieve those standards. The paper outlines the uncertainties and complexities that undermine current risk assessment and site remediation processes. The paper concludes with a discussion of how uncertainty can be managed during remediation, using techniques derived from geotechnical engineering, i.e. the observational method.

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DOE Guidelines and Modeling in Determination of Soil Cleanup Guidelines

EPA/520/1-90-013; CONF-8909236; Residual Radioactivity and Recycling Criteria, A.B. Wolbarst, H. Terada, and A.C.B. Richardson (eds.), Proceedings of a Workshop, St. Michaels, MD, September 27-28, 1989, 311 pp.; (pp. 166-170) (September 1989)

This presentation summarizes the current guidelines used by the Department of Energy for its remedial actions under the Office of Nuclear Energy's Formerly Utilized Sites Remedial Action Program and Surplus Facilities Management Program. It discusses soil criteria and surface contamination limits used for buildings and equipment. A brief description of the computer code, RESRAD, which is used to develop soil criteria and estimate doses from residual radioactivity, is provided.

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Approach and Strategy for Setting Remedial Action Goals for Multiple Sites with Multiple Contaminants

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 91-94) (September 1991)

In the 1980s, most of the decisions to remediate Superfund sites were based on the mere existence of contamination rather than on the degree of actual risk to public health. Cost was the most significant factor in the selection of the remedial action alternative. The final version of the National Contingency Plan, which implements the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), specifies that one of the two threshold criteria for the final remedy of a site is overall protection of human health and the environment. This paper discusses what is meant by protection and what level of risk is acceptable. It describes approaches developed for soil/sediments, surface water and groundwater contaminated by hazardous chemicals. It does not address radionuclide standards or issues related to contaminated air. The paper suggests that goals and priorities in the decision-making process need to be clearer. It further recommends that remedial action goals be established early in the remedial investigation/feasibility study of a site so that (1) the baseline risk assessment can determine whether the risks posed by the site are acceptable and (2) alternative operations that can achieve the remedial action goals are identified. The paper presents approaches for setting remedial action goals that are both consistent with Environmental Protection Agency regulations and sufficiently flexible to meet diverse environmental concerns, like those of the multiple hazardous waste sites of the Environmental Restoration Division, Department of Energy Field Office, Oak Ridge, Tennessee. These approaches should be relevant to other large facilities with multiple sites and multiple contaminants.

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Department of Energy Environmental Restoration and Waste Management Five-Year Plan - Environmental Restoration Program

EPA/520/1-90-013; CONF-8909236; Residual Radioactivity and Recycling Criteria, A.B. Wolbarst, H. Terada, and A.C.B. Richardson (eds.), Proceedings of a Workshop, St. Michaels, MD, September 27-28, 1989, 311 pp.; (pp. 17-27) (September 1989)

On September 1, 1989, the U.S. Department of Energy (DOE) made available for public comment the first Five-Year Plan for Environmental Restoration and Waste Management. This plan establishes an agenda for compliance and cleanup against which progress will be measured. It establishes a 30-year goal for the completion of environmental cleanup. Specific implementation plans are being developed by the DOE's field operations offices. The Five-Year Plan and Operations Office Implementation Plans are "living documents" that will be updated annually. The Environmental Restoration (ER) program, as addressed by these plans, deals with the assessment and cleanup of inactive, potential-release sites, the decontamination and decommissioning of surplus nuclear facilities, and the technology development needed for remediation activities. Preparation of the Five-Year Plan began in March 1989, when a task force was created. At that time, a guidance was issued for field input that provided the basis for the plan. Validated field input was integrated and manipulated electronically to generate the data needed to establish the problem scope, priorities, funding requirements, and other elements of the plan. The data show that the problems within the ER program include approximately 3700 potential release sites, more than 5000 vicinity properties connected with the remediation of uranium mill tailings, and approximately 500 contaminated facilities. The estimated funding required for all ER activities for the period 1991-95 is $6.8 billion. In addition, several key needs were identified while preparing the plan. DOE has developed strategic objectives for ER that include an aggressive applied research and development effort, and it is taking actions to address the problems and needs associated with environmental restoration and waste management. As part of the implementation process, these efforts include participation and review by involved parties.

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The National Environmental Policy Act and DOE's Programmatic Environmental Impact Statement

CONF-910603; Proceedings of the 1991 American Nuclear Society Annual Meeting, Orlando, FL, June 2-6, 1991; Transactions of the American Nuclear Society 63:71-72 (1991)

The National Environmental Policy Act (NEPA) of 1969 requires that all agencies of the federal government prepare a detailed statement on any action significantly affecting the quality of the human environment. Such a statement must include the environmental impact of the proposed action, any adverse environmental effects that cannot be avoided should the proposed action be implemented, and alternatives to the proposed action. In requiring environmental statements, NEPA encourages viewing related actions collectively and looking at cumulative impacts. A programmatic environmental impact statement (PEIS) is a broad environmental analysis of a program or policy prepared when actions are connected and may have cumulative environmental impacts. The PEIS benefits include providing input into an agency's planning and decision making, assessing potential environmental consequences of a wide range of alternatives before options have been foreclosed, and allowing consideration of system-wide impacts of various alternatives early in the decision-making process. The U.S. Department of Energy (DOE) will prepare its PEIS on the Environmental Restoration and Waste Management program. The PEIS will consider programmatic issues and integrated approaches to the program; address national, program-wide alternatives rather than site-specific actions; and provide for subsequent

NEPA documents of narrower scope to be prepared to address site-specific or project-specific actions.

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Lessons Learned and New Initiatives in Cost and Schedule Estimating

CONF-910603; Proceedings of the 1991 American Nuclear Society Annual Meeting, Orlando, FL, June 2-6, 1991; Transactions of the American Nuclear Society 63:72 (1991)

The purpose of this paper is to discuss the challenges surrounding the development of accurate cost and schedule estimates for the U.S. Department of Energy's (DOE's) environmental restoration projects and to describe the innovative set of initiatives designed to address cost and schedule issues. Accurately estimating the cost or schedule of a large, technology-based project early in the life-cycle of the project is a difficult, if not impossible, task. The DOE has developed a four-point program to improve the consistency, and ultimately the accuracy, of the environmental restoration cost and schedule estimates. The major initiatives are presented in this paper.

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Environmental Monitoring at U.S. Department of Energy Facilities

PNL-SA-18876;CONF-891053;Environmental Monitoring, Restoration and Assessment: What Have We Learned?, R.H. Gray (ed.), Proceedings of the 28th Hanford Life Sciences Symposium, Richland, WA, October 16-19, 1989, 340 pp.; (pp. 1-4) (1989)

The U.S. Department of Energy (DOE) requires that environmental monitoring programs be conducted at each DOE facility. The emphasis on environmental monitoring can be attributed partly to increased public awareness and understanding of DOE operations and partly to concerns resulting from possible contamination of the environment as a result of the Three Mile Island and Chernobyl accidents. Advances in computer modeling and technology have contributed to monitoring procedures that are designed to provide greater protection to the public and the environment. This paper briefly discusses the regulatory history for environmental monitoring and concentrates on integrating DOE environmental monitoring requirements with Environmental Protection Agency (EPA) regulations. Cost-effectiveness, size, and complexity of an environmental monitoring program will be considered. A specific example will compare and contrast DOE and EPA approaches and requirements.

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Characterization Technologies for Environmental Remediation

CONF-9111105; Proceedings of the Caribbean Haztech Conference, San Juan, Puerto Rico, November 13-15, 1991; (28 pp.) (1991)

Improved site characterization technologies are being developed at Martin Marietta Energy Systems for the U.S. Department of Energy (DOE) Office of Technology Development (OTD) in support of environmental restoration activities throughout the DOE complex. Since site characterization is an expensive and time consuming process that must be performed prior to, during, and following remediation efforts, an obvious way to reduce the overall cost of remediation is to develop improved characterization methods. For example, the Derivative Ultraviolet Absorption Spectrometer, which is being field-tested as part of the OTD program, is a fiberoptic device for in situ, real-time measurement of aromatic organic compounds in groundwater. A transportable, direct sampling Ion Trap Mass Spectrometer (ITMS) is being developed for continuous monitoring of hazardous organic compounds in air. In areas where the

environment is hazardous to human health, it is desirous to perform site characterization remotely; if robotics are to be employed, the Ultrasonic Ranging and Data System (USRADS) can be used to provide telemetry information on robot location as well as sensor measurements. Once fully developed, these technologies can be transferred to the private sector.

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Chemical Contaminants on DOE Lands and Selection of Contaminant Mixtures for Subsurface Science Research

DOE/ER-0547T; 89 pp. (April 1992)

This report identifies individual contaminants and contaminant mixtures that have been measured in the ground at 91 waste sites at 18 U.S. Department of Energy (DOE) facilities within the weapons complex. The inventory of chemicals and mixtures was used to identify generic chemical mixtures to be used by DOE's Subsurface Science Program in basic research on the subsurface geochemical and microbiological behavior of mixed contaminants. The generic mixtures contain specific radionuclides, metals, organic ligands, organic solvents, fuel hydrocarbons, and polychlorinated biphenyls (PCBs) in various binary and ternary combinations. The mixtures are representative of the in-ground contaminant associations at DOE facilities that are likely to exhibit complex geochemical behavior as a result of intercontaminant reactions and/or microbiologic activity stimulated by organic substances. Use of the generic mixtures will focus research on important mixed contaminants that are likely to be long-term problems at DOE sites and that will require cleanup or remediation.

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Observational Approach in Environmental Restoration

PNL-SA-18817; CONF-9107139; Environmental Engineering, Proceedings of the 1991 Specialty Conference, Reno, NV, July 8-10, 1991. American Society of Civil Engineers, New York, NY; (19 pp.) (July 1991)

The U.S. Department of Energy (DOE) has committed to completing environmental restoration of its facilities within the next 28 years (DOE 1990b). In order to achieve this, DOE must ensure that its restoration activities are both effective and efficient. A key aspect of fulfilling this commitment is the recognition and management of uncertainty that is inherent in waste-site clean-up actions. The DOE Office of Environmental Restoration (DOE-ER) requested Pacific Northwest Laboratory (PNL) to investigate the applicability and implementation of what is known as the "observational approach" to better address these needs. PNL's initial investigation resulted in the positive conclusion that the observational approach had potential benefit to DOE during environmental restoration. In a follow-on effort, PNL, supported by CH2M Hill, has been providing guidance to DOE field-offices on observational approach fundamentals, implementation, and application to waste-site remediation. This paper outlines the fundamentals of the observational approach and discusses the progress in integrating the observational approach in DOE's environmental restoration efforts.

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An Overview of Public Health Service Health-Related Activities as They Relate to the Department of Energy's Environmental Restoration Program

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 627-632) (September 1991)

The Agency for Toxic Substances and Disease Registry (ATSDR) was created by the

Comprehensive Response, Compensation, and Liability Act of 1980 (CERCLA) as an agency of the Public Health Service (PHS). Under the Superfund Amendments and Reauthorization Act (SARA) of 1986, the public health responsibilities of ATSDR were greatly expanded. Among these responsibilities are: (1) preparing health assessments for each site proposed for or listed on the National Priorities List (NPL); (2) conducting epidemiologic and other health studies around NPL sites; (3) establishing registries of exposed individuals; (4) establishing health surveillance programs; (5) developing toxicological profiles for hazardous substances; (6) performing health and emergency response consultations; and (7) performing other health-related activities, such as health education. In October 1990, ATDSR signed a memorandum of understanding (MOU) with the Department of Energy (DOE) headquarters, requiring that DOE operations offices sign interagency agreements (IAGs) with ATSDR for its conduct of CERCLA Section 104(i)-regulated health activities at DOE sites. These activities include health assessments, related health studies such as surveillance programs, epidemiologic studies and registries of exposed persons, and toxicological profiles of hazardous substances unique to DOE sites. ATSDR's studies will focus more on an assessment of the health risk to human populations residing in and around DOE sites than on an evaluation of the health risk to on-site workers. Nevertheless, CERCLA, the MOU, and site-specific IAGs authorize ASTDR's access to health and environmental data concerning each site. The IAGs contemplate that ATSDR work closely with DOE operations offices in their implementation of their respective environmental restoration programs. In addition to the agreements between ATSDR and the DOE and its operations offices, the U.S. Department of Health and Human Services (HHS) last December signed an MOU with DOE for the management and conduct by HHS of energy-related analytic epidemiologic studies. The Centers for Disease Control (CDC), which maintains close ties to ATSDR, has been designated as the agency within HHS to implement this MOU. The CDC derives its authority to manage and conduct health studies from the Public Health Service Act and the Occupational Health and Safety Act of 1970. Thus two separate but closely allied agencies within the PHS will be involved with and share responsibilities with DOE in the health-related issues of its environmental restoration program. This paper provides a brief overview of ATSDR's 104(i) activities and CDC's role at DOE sites, followed by a discussion of how these activities will impact DOE's environmental restoration program.

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Martin Marietta Energy Systems, Inc., Oak Ridge, TN; Science Applications International Corporation, Oak Ridge, TN

Environmental Restoration Program Waste Minimization and Pollution Prevention Awareness Program Plan

ES/ER/TM-21; 48 pp. (September 30, 1991)

In response to DOE Order 5400.1, this plan outlines the requirements for a Waste Minimization and Pollution Prevention Awareness Program for the Environmental Restoration (ER) Program at Martin Marietta Energy System, Inc. Statements of the federal, Department of Energy, Energy Systems, and Energy Systems ER Program policies on waste minimization are included, and reflect the attitudes of these organizations and their commitment to the waste-minimization effort. Organizational responsibilities for the waste-minimization effort are clearly defined and discussed, and the program objectives and goals are set forth. Waste assessment is addressed as being a key element in developing the waste-generation baseline. Included are discussions on the scope of ER-specific waste-minimization techniques and approaches to employee awareness and training. There is also a discussion on the process for continuous evaluation of the Waste Minimization Program. Appendixes present an implementation schedule for the Waste Minimization and Pollution Prevention Program, the program budget, an organization chart, and the ER waste-minimization policy.

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U.S. Department of Energy, Office of Environmental Restoration and Waste Management, Washington, DC

Integrated Data Base for 1991: U.S. Spent

Fuel and Radioactive Waste Inventories, Projections, and Characteristics

DOE/RW-0006 (Rev. 7); 338 pp. (October 1991)

The Integrated Data Base (IDB) Program has compiled current data on inventories and characteristics of commercial spent fuel and both commercial and U.S. government-owned radioactive wastes through December 31, 1990. These data are based on the most reliable information available from government sources, open literature, technical reports, and direct contacts. Current projections of future waste and spent fuel to be generated generally through the year 2020 and characteristics of these materials are also presented. The information forecast is consistent with the latest U.S. Department of Energy/Energy Information Administration (DOE/EIA) projections of U.S. commercial nuclear power growth and the expected DOE-related and private industrial and institutional activities. The radioactive materials considered, on a chapter-by-chapter basis, are spent fuel, high-level waste, transuranic waste, low-level waste, commercial uranium mill tailings, environmental restoration wastes, commercial reactor and fuel cycle facility decommissioning wastes, and mixed (hazardous and radioactive) low-level waste. For most of these categories, current and projected inventories are given through the year 2020, and the radioactivity and thermal power are calculated based on reported or estimated isotopic compositions. In addition, characteristics and current inventories are reported for miscellaneous radioactive materials that may require geologic disposal.

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Advisory Committee on Nuclear Facility Safety, Washington, DC

Final Report on DOE Nuclear Facilities

PB-92-119809/XAB; 189 pp. (November 1991)

Risk analysis policy and guidance is recommended, especially for the non-Department of Energy (DOE) nuclear facilities. Minimum standards should be set on issues including risk management, the scope and depth of risk analysis (e.g., site-wide analysis, worker risk), and approaches to treatment of external events. Continued vigilance is required in maintaining operation staffing levels at the DOE research and testing reactors. Safety analysis reports should be updated to reflect the evolving configurations of the facilities and the current safety-analysis requirements. The high-level waste storage programs at Hanford, Savannah River and Idaho National Engineering Laboratory were evaluated. DOE has not adopted a cleanup policy with specific, clear objectives. DOE should define the respective roles of Headquarters, the field offices, and contractors. The proposed budget priority-setting system should not be implemented. The plan to develop a nation-wide programmatic environmental impact statement (PEIS) should be rethought. An environmental impact statement on the total cleanup program is inconsistent with the localized nature of cleanup decisionmaking. DOE must provide for significant improvements in its radiation protection and safety programs to meet current, and future, technical, engineering, and scientific procedures and practices for controlling sources and contamination, performing external and internal dosimetry, and implementing incident response plans, including applicable protective action guides. The culture of safety is not yet well established at Rocky Flats. The philosophy of DOE and the management of Rocky Flats is not understood, accepted and believed by the work force. The Advisory Committee has serious concerns about whether DOE's current program at the Waste Isolation Pilot Plant will be able to demonstrate, in a timely manner, compliance with the Environmental Protection Agency's proposed long-term performance and human-intrusion requirements for disposal of transuranic and high-level radioactive wastes.

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K.R. Cressman

Cost Components of Remedial Investigation/Feasibility Studies

Cost Engineering 33(7):25-29 (July 1991)

The U.S. Department of Energy (DOE) is beginning major environmental restoration projects at active and inactive sites throughout the United States. IT Corporation, under the direction of the DOE Office of Independent Cost Estimating,

developed a list of environmental problems at the sites, and probable cleanup technologies and techniques to be used. Some procedures were identified that were common to many or all cleanup projects. These included site characterization, remedial investigation (RI), and feasibility studies (FS). This article focuses on the cost components of the RI and FS processes.

501
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The US DOE Prepares for its Multi-Billion Dollar Cleanup

Nuclear Engineering International 36(441):32-36 (April 1991)

The U.S. Department of Energy (DOE) is faced with the formidable task of cleaning up, over the next 30 years, substantial levels of radioactive and chemical pollutants introduced into the soil and surface water at DOE and related sites as a result of 40 years of defense production activities. To help achieve this, an "integrated demonstration" approach has been used, whereby a group of related and synergistic technologies are evaluated together. Brief summaries are given of work at some of the most significant sites where radioactive wastes are present.

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Resolution of Conflicts Among the Regulatory Programs Governing Remedial Action

CONF-9010166; Waste Management and Environmental Restoration, Proceedings of the 1990 DOE Model Conference, Oak Ridge, TN, October 29-November 2, 1990, 343 pp.; (9 pp.) (1990)

Though the need to integrate is imperative in many areas of environmental compliance and cleanup, this paper is limited to considering remediation of federal facilities under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and the U.S. Department of Energy (DOE) Environmental Restoration Program (ERP). Under CERCLA, a remedial action is defined as a response action that can be performed in a manner consistent with the cleanup standards of Section 121 of the Superfund Amendments and Reauthorization Act (SARA). These actions are frequently referred to as "planned" and typically follow the remedial investigation/feasibility study/remedial design/remedial action (RI/FS/RD/RA) process. This paper does not consider removal response action or emergency response. However, the propositions offered in this paper are applicable to remedial actions, whether or not the facility is listed on the National Priorities List (NPL). The propositions also apply to corrective action taken under the Resource Conservation and Recovery Act (RCRA), as amended by the Hazardous and Solid Waste Amendments (HSWA). A general discussion of an integration strategy is followed by specific implementation suggestions.

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K.O. Fultz, U.S. General Accounting Office, Resources, Community, and Economic Development Division, Washington, DC

Environmental Problems in the Nuclear Weapons Complex

GAO/T-RCED-89-18; 12 pp. (April 1989)

This paper provide the authors' views on the environmental problems facing the Department of Energy (DOE). Testimony is based on a large body of work (over 50 reports and testimonies since 1981) on environmental, safety, and health aspects of DOE's nuclear weapons complex. This work has shown that the complex faces a wide variety of serious problems, including aging facilities, safety concerns (which have shut down DOE's production reactors), and environmental cleanup.

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Environmental Restoration and Statistics: Issues and Needs

PNL-SA-20036; CONF-9110266; Proceedings of the 1991 Alberta Applied Statistics and Biometrics Workshop, Alberta, Canada, October 21-22, 1991; (12 pp.) (October 1991)

Statisticians have a vital role to play in environmental restoration (ER) activities. One facet of that role is to point out where additional work is needed to develop statistical sampling plans and data analyses that meet the needs of ER. This paper is an attempt to show where statistics fits into the ER process. The statistician, as member of the ER planning team, works collaboratively with the team to develop the site characterization sampling design, so that data of the quality and quantity required by the specified data quality objectives are obtained. At the same time, the statistician works with the rest of the planning team to design and implement, when appropriate, the observational approach to streamline the ER process and reduce costs. The statistician will also provide the expertise needed to select or develop appropriate tools for statistical analysis that are suited for problems that are common to waste-site data. These data problems include highly heterogeneous waste forms, large variability in concentrations over space, correlated data, data that do not have a normal (Gaussian) distribution, and measurements below detection limits. Other problems include environmental transport and risk models that yield highly uncertain predictions, and the need to effectively communicate to the public highly technical information, such as sampling plans, site characterization data, statistical analysis results, and risk estimates. Even though some statistical analysis methods are available "off the shelf" for use in ER, these problems require the development of additional statistical tools, as discussed in this paper.

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Cleaning up Radioactive and Chemical Waste Sites: Is the Benefit Worth the Cost and Risk

Fisheries 16(3):2-3 (May-June 1991)

Although decisions to remediate radioactive and chemical waste sites are based on environmental regulations, it appears to some members of the public and the scientific community that these decisions are also driven by public perception and politics, rather than by quantitative-risk and cost-benefit analyses based on sound scientific data. One example involves the U.S. Department of Energy's Hanford Site in southeastern Washington. Nuclear and nonnuclear industrial and research activities have been conducted at Hanford since 1943. Environmental surveillance and monitoring have been conducted to ensure that public exposures to radiation and chemicals are maintained as low as reasonably achievable, and to assess potential environmental impacts. The resulting data show that current environmental and public health risks are low. The current radiological dose to a person living within an 80-km (50-mi) radius of Hanford is estimated to be less than 0.01 mrem annually. But to comply with current environmental regulations, cleanup at the Hanford Site over the next several decades will cost in excess of $50 billion. The lack of consistency between actual exposures and the high cost of regulatory compliance has caused both scientists and the public to question the wisdom of some cleanup initiatives.

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Tiger Team Findings Related to DOE Environmental Restoration Activities

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 807-810) (September 1991)

Tiger Team Assessments were implemented in June 1989 as part of a strategy to ensure that U.S. Department of Energy (DOE) facilities fully comply with Federal, state, local, and DOE environment, safety and health (ES&H) requirements. The Tiger Teams provide the Secretary of Energy with information on current

ES&H compliance status of each DOE facility and causes for noncompliance. To date, Tiger Team Assessments have been completed at 25 DOE facilities. The performance of DOE facilities with regard to environmental restoration activities was evaluated against the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended; the National Contingency Plan (NCP); and DOE Order 5400.4, CERCLA Requirements. A table summarizes the findings for each of the 25 facilities. Five major categories of environmental restoration-related nonconformances were identified: (1) environmental restoration program planning and management (found at 60 percent of the sites assessed); (2) community relations/administrative record (60 percent); characterization of extent of contamination (56 percent); identification and evaluation of inactive waste sites (56 percent); and DOE and NCP requirements for response action studies (44 percent). The major causes of these findings appear to be insufficient procedures, resources, and supervision, resulting in inadequate implementation of the DOE policy of adhering to CERCLA and NCP requirements. The finding categories and causal factors are widespread among DOE facilities and do not appear to be correlated to specific DOE field offices or program offices.

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Complex Cleanup: The Environmental Legacy of Nuclear Weapons Production

PB-91-180158/XAB; 29 pp. (1991)

Until recently, federal regulations to control pollution and clean up toxic wastes have been mainly focused on private industry. It is now clear that the federal government itself ranks high among the contributors to environmental contamination, because of decades of inadequate attention to safe storage and poor management of toxic waste products. The environmental problems at the Department of Energy (DOE) nuclear weapons facilities are among the most serious and costly to correct. Widespread contamination of soil and water, leaks from old waste burial grounds, and possible public health impacts from radioactive and hazardous releases have all contributed to congressional concerns about this problem and to a national search for feasible solutions. The Senate Committee on Armed Services asked the Office of Technology Assessment to evaluate what is known about the contamination and public health problems at nuclear weapons complexes and to investigate technological and other approaches to solutions. The report analyzes current and proposed methods of waste management and environmental restoration and evaluates the major DOE programs. It also discusses the prospects for improvement and describes certain initiatives that could enhance those prospects.

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Long Road to Recovery Begins at DOE Plants

Forum for Applied Research and Public Policy 6(1):19-22 (1991)

Major problems at U.S. Department of Energy (DOE) facilities are summarized. Poor waste management of the effluent from the nuclear weapons production facilities has caused extensive and, in some cases, perhaps irreversible soil and ground-water contamination. Cleaning up these sites could cost $65 billion and take more than 30 years. Nuclear weapons production has been brought to a standstill because of the shutdown of aging (many more than 40 years old) facilities nationwide for safety-related concerns. A modernization program to restore this production capability could cost $45 billion. The management and permanent disposal of radioactive waste and the decontamination of nuclear facilities could cost another $45 billion. Admission by DOE of the many problems it faces is only the first step on the long and costly road to solutions. Finding money to address the problems at a time of federal budget deficits will be difficult. But even if the money can be found, DOE does not have the technology or personnel to solve the problems. Nor does it have a prioritization system to focus limited resources on those problems in the weapons complex most needing attention. These are issues that will not be resolved quickly or solely with money.

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Closure of Hazardous and Mixed Radioactive Waste Management Units at US DOE Facilities

CONF-9010166; Waste Management and Environmental Restoration, Proceedings of the 1990 DOE Model Conference, Oak Ridge, TN, October 29-November 2, 1990, 343 pp.; (8 pp.) (1990)

As part of its routine operations in carrying out its national-security missions, the U.S. Department of Energy (DOE) generates and manages large volumes of hazardous and mixed radioactive wastes. Recognizing the potential environmental threat posed by these operations, DOE and the U.S. Environmental Protection Agency (EPA) reached an agreement in February of 1984 which stipulated that DOE facilities that manage hazardous waste or hazardous components of radioactive mixed wastes must comply with all EPA regulations governing the generation and management of these wastes. The regulatory complications for DOE radioactive mixed-waste units also extend beyond the federal/state interaction to various federal programs. The Resource Conservation and Recovery Act (RCRA) and the Comprehensive Emergency Response, Compensation, and Liability Act (CERCLA) have several overlapping provisions, particularly in the area of remedial action and cleanup. Many DOE units subject to RCRA are also on CERCLA's National Priorities List (NPL). Therefore, when closing DOE units, it is necessary to integrate RCRA and CERCLA procedures and standards. This paper addresses the key regulatory requirements applicable at closure of DOE hazardous and mixed waste units at DOE facilities. Because of the site-specific nature of many of these provisions, this paper does not attempt to prescribe a set of technical requirements, but rather identifies the procedures and technical issues that must be considered.

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Contracting for Engineering and Design Services in the Environmental Restoration Field

Thesis; 72 pp. (December 1991)

This thesis examines and analyzes the nature of work in the environmental restoration field. The analysis was conducted using archival and opinion research to define the unique qualities associated with the engineering and design phases of the environmental restoration process. Based on this analysis, justification for the use of cost-reimbursement contracts for the engineering services used in this field is provided. The moral hazard/incentive issue associated with cost-reimbursement contracts is then analyzed. With the moral hazard issue in mind, Naval Facilities Engineering Command's choice of the cost-plus-award-fee contract for the Comprehensive Long-Term Environmental Action Navy (CLEAN) contract is evaluated. This evaluation looks at how the use of a long-term cost-reimbursement contract, such as CLEAN, provides incentives to overcome the moral hazard problem.

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NEPA Compliance Strategies for Environmental Restoration Activities

CONF-9010166; Waste Management and Environmental Restoration, Proceedings of the 1990 DOE Model Conference, Oak Ridge, TN, October 29-November 2, 1990, 343 pp.; (7 pp.) (1990)

Compliance with the National Environmental Policy Act (NEPA) is being re-emphasized within the U.S. Department of Energy (DOE). The memo-to-file procedure, which was unique to DOE, is replaced by categorical exclusions and other NEPA documentation. Of particular interest to persons involved in environmental restoration activities at DOE sites is DOE Order 5400.4, which requires that the procedural and documentation requirements of NEPA be integrated into the Comprehensive Environmental Response, Compensation and Liability Act

(CERCLA) remedial investigation/feasibility study (RI/FS) process. Strategies for this integration are discussed for the Oak Ridge Reservation Environmental Restoration Program, the Portsmouth Gaseous Diffusion Plant Remedial Action Program, the Hanford Reservation, and the Feed Materials Production Facility. How to deal with cumulative impacts, tiering, and generic issues associated with environmental restoration activities are key issues at most sites. Current status of the various strategies and issues are addressed.

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U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, DC

Bibliography of Federal Reports and Publications Describing Alternative and Innovative Treatment Technologies for Corrective Action and Site Remediation

EPA/540/8-91/007; OSWER Directive 9380.1-08; 29 pp. (May 1991)

The Federal Remediation Technologies Roundtable developed this bibliography to publicize the accessibility of federal documents pertaining to innovative and alternative technologies to treat hazardous wastes. The bibliography contains references for documents and reports from the U.S. Environmental Protection Agency, the U.S. Army, the U.S. Army Corps of Engineers, the U.S. Navy, the U.S. Air Force, the U.S. Department of Energy, and the U.S. Department of Interior Bureau of Reclamation. The publication contains references and order information for reports on research concerning the application of innovative and alternative hazardous waste treatment options. The bibliography is scheduled to undergo periodic revisions.

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DOE and Restoration at Weapons Plant Sites

Forum for Applied Research and Public Policy 6(1):16-18 (1991)

The U.S. Department of Energy's (DOE's) previous management structure, which was splintered into three organizations managing pieces of the environmental restoration program, was consolidated into a single Office of Environmental Restoration in November, 1989. The DOE Environmental Restoration program now consists of two parts: remedial actions and decontamination and decommissioning activities. These activities were previously managed by the defense programs and nuclear energy and energy research organizations. The objectives of remedial actions are to: (1) identify inactive contaminated facilities and sites; (2) assess their condition; (3) confine and contain the contamination; (4) clean up the contamination; and (5) provide for long-term monitoring to ensure regulatory compliance. Decontamination and decommissioning refers to work needed at surplus nuclear facilities. The objectives involve: (a) assessment and characterization; (b) surveillance and maintenance; (c) engineering; (d) operations, and (e) closeout activities leading to decontamination for reuse or to complete removal of the facilities. These activities are carried out in accordance with provisions of the National Environmental Policy Act, the Atomic Energy Act, and DOE orders.

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The Department of Energy's Environmental Restoration Program

CONF-910603; Proceedings of the 1991 American Nuclear Society Annual Meeting, Orlando, FL, June 2-6, 1991; Transactions of the American Nuclear Society 63:71 (1991)

The U.S. Department of Energy operates a large industrial complex located at various production, processing, testing, and research-and-development installations across the country. This complex has generated, and continues to generate, significant quantities of radioactive, hazardous, and mixtures of radioactive and hazardous (mixed) wastes that must be disposed of. To assure consistency within the environmental restoration program and to

make the most efficient use of resources (financial and human), these programs were consolidated into the Office of Environmental Restoration in 1989. The environmental restoration program encompasses approximately 3700 sites where radioactive, hazardous chemicals, or both contaminate soil, buildings, or surface or groundwater. In addition, approximately 500 surplus facilities are awaiting decontamination or decommissioning, and approximately 5000 vicinity properties have contaminated soil that has been, or will be, removed through the Uranium Mill Tailings Radiation Act program. The focus of the environmental restoration activities is on large volumes of groundwater and large volumes of soil contaminated with relatively low concentrations of radioactivity and/or chemicals.

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D.E. Wood (ed.), U.S. Department of Energy, Office of Environmental Restoration and Waste Management, Washington, DC

Environmental Remediation '91: Cleaning Up the Environment for the 21st Century

CONF-910981; Proceedings of the ER '91 Conference, Pasco, WA, September 8-11, 1991, 970 pp. (September 1991)

Environmental Remediation '91 was sponsored by the Department of Energy's (DOE's) Office of Environmental Restoration and hosted by the DOE Field Office, Richland, Washington. The conference was the presentation of DOE Environmental Restoration (ER) program activities underway and completed between May 1990 and September 1991. The meeting is held every two years. The 1991 meeting was the most successful in the series, with over 850 attendees and over 200 papers presented. Presentations by DOE-Headquarters senior management and staff ensured that persons and organizations affected by new policies had an opportunity to hear about these policies from the policy makers themselves. Presentations by DOE contractor personnel discussed the specifics of ER projects. Presentations by federal and state regulators allowed DOE and contractor personnel to understand more fully the constraints under which the regulators operate. Presentations by universities and industry encouraged DOE and contractors to consider technologies and ideas which were developed outside the DOE complex. These proceedings include the complete papers from the authors' manuscripts, offering a record of the presentations to conference attendees and documentation of the presentations to those unable to attend. Besides the Plenary session, sessions were held on the following topics: (1) earning public confidence and support, (2) ER programmatic issues and site summaries, (3) in situ remediation, (4) a poster session on remediation projects and quality assurance, (5) Hanford tank operations and safety issues, (6) risk assessment/pathway analysis, (6) cleanup project field experience, (7) decontamination and decommissioning project activities, (8) achieving risk-based standards, (9) site characterization and monitoring, (10) ER approaches and lessons learned, (11) a poster session on cleanup technologies, (12) coping with regulatory issues impacting the ER program, (13) education and ER methods and programs, (14) cleanup technologies, (15) environmental quality assurance and data management, (16) UMTRA project case studies and lessons learned, (17) remedy selection, (18) ER program compliance issues, and (19) a poster session on characterization and risk assessment. Individual papers and posters are given separate records.

DEPARTMENT OF ENERGY (DOE)
SITE-SPECIFIC REMEDIAL ACTIONS

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Sandia National Laboratories, Livermore, CA

Sandia National Laboratories, Livermore Environmental Protection Implementation Plan for the Period November 9, 1991 - November 9, 1992

SAND-91-8018; 31 pp. (October 1991)

Sandia National Laboratories, as part of the Department of Energy complex, is committed to full compliance with all applicable environmental laws and regulations. This Environmental Protection Implementation Plan (EPIP) is intended to ensure that the environmental program objectives of DOE Order 5400.1 are achieved at Sandia National Laboratories, Livermore, California. The EPIP will serve as an aid to management and staff to implement these new programs in a timely manner.

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Rocky Flats Community Relations: Coming Out of the Dark

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 51-54) (September 1991)

Community relations is becoming an increasingly prominent aspect of environmental restoration operations. Historically, the U.S. Department of Energy (DOE), dating back to the origins of the weapons complex in the Manhattan Project, has been closed to public scrutiny. Rocky Flats community relations can be viewed as having its painful start on June 6, 1989, when over fifty Federal Bureau of Investigation agents entered the Rocky Flats plant to gather information on alleged operational and procedural violations of environmental law. In May 1990, the Plutonium Recovery Modification Project was the first Rocky Flats project to initiate public meetings and provide for real dialogue. Building on this start, Rocky Flats community relations have grown phenomenally, currently averaging over one public forum per week. The effort has been very successful in building understanding and credibility within the local community. Community relations for environmental restoration is mandated by law and, for good management, is a necessary part of DOE's future. Properly utilized, it can augment an ongoing environmental program and help it succeed.

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NEPA/CERCLA Integration at Rocky Flats

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 163-164) (September 1991)

Integration of two laws: the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Environmental Policy Act (NEPA), was mandated by the U.S. Department of Energy (DOE) with DOE Order 5400.4 in October, 1989. NEPA documentation is required for all federal actions, to "thereby consider the impacts of such actions prior to the actions taking place." On the other hand, CERCLA actions taken by the U.S. Environmental Protection Agency (EPA) at non-federal and federal sites do not normally take NEPA into consideration, although federal sites are not exempted from NEPA. EPA claims that CERCLA is functionally equivalent to NEPA, and therefore that NEPA documentation is not required. Although EPA maintains the functional equivalence of the two laws, and formerly resisted recognition of NEPA, even in Inter-Agency Agreements, the DOE Rocky Flats Office has been integrating the two laws in its documents to avoid duplication of information and effort.

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J. Tischler, B. Huenefeld, and G.H. Irrgang

The Long Climb to Remediation

Civil Engineering 61(4):68-71 (1991)

For 40 years, mustard gas, napalm, and pesticides were manufactured just 10 miles from downtown Denver at the Rocky Mountain Arsenal. Much of the chemical wastewaters flowed to the same destination, creating a potent and unusual mixture of water, organics and dissolved solids. Now, after more than a decade of studies and pilot programs, a downfired liquid incinerator has been tapped to destroy the resilient waste.

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General Electric Company, Pinellas Plant, Largo, FL

Pinellas Plant Site Specific Plan: Environmental Health and Safety Programs

NDPP-OSP-0052; 124 pp. (September 1991)

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

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Compliance with ASME NQA-1 and QAMS-005/80 Quality Requirements Under the Environmental Restoration Program at the Idaho National Engineering Laboratory

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 729-732) (September 1991)

A number of approaches towards reconciliation of the U.S. Department of Energy's (DOE's) and U.S. Environmental Protection Agency's (EPA's) quality assurance (QA) requirements for environmental investigation have been advanced in recent years within the DOE and DOE contractor organizations. The DOE has adopted the American Society of Mechanical Engineers document NQA-1, "Quality Assurance Program Requirements for Nuclear Facilities," as the preferred standard for all projects conducted at its nuclear facilities. The EPA requires, through direct requests in consent agreements or by other means, consideration of its QAMS-005/80 guidelines, "Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans," for all environmental data gathering and monitoring investigations that are under its purview. It is suggested that one approach to integrating the DOE and EPA standards exists that is, by its nature, less prone to the problems and the costs associated with the introduction of new and complex requirements documents. That approach involves a re-examination and reaffirmation of the basic intent of ASME NQA-1 and QAMS-005/80 standards and establishes flexible, ASME NQA-1-based structures of program management and supporting procedures. Multiple investigations may then be pursued in compliance with detailed secondary-planning documents, which may be prepared in compliance with QAMS-005/80 and/or other applicable EPA guidelines to meet the specific needs of individual contract tasks and applicable consent orders. This approach, since it makes the best possible use of existing QA programs, supporting and technical procedures, and management and training systems, has proved to be both practical and flexible.

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EG and G Idaho Environmental Protection Implementation Plan (1991)

EGG-2585(91); 22 pp. (November 1991)

This report describes the EG&G Idaho, Inc. strategy for implementation of the Department of Energy (DOE) Order 5400.1, a DOE-Headquarters directive establishing environmental protection program requirements, authorities, and responsibilities. Preparation of this Environmental Protection Implementation Plan is a requirement of DOE Order 5400.1. Additionally, this report is intended to supplement the Department of Energy Field Office, Idaho Environmental Protection Implementation Plan by detailing EG&G Idaho Environmental Protection Program activities. This report describes the current status of the EG&G Idaho program, and the strategies for enhancing, as necessary, the current program to meet the requirements of DOE Order 5400.1. Aspects of the Environmental Protection Program included in this report are the assignment of responsibilities to specific EG&G Idaho organizations, a schedule for completion of enhancements, if necessary, and requirements for documentation and reporting.

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Environmental Restoration Project Configuration Control

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 723-726) (September 1991)

This paper provides an overview of the Westinghouse Idaho Nuclear Company, Inc. (WINCO) implementation of configuration control requirements for a major system acquisition in environmental restoration. WINCO's approach to environmental restoration is taken under the guidance of U.S. Department of Energy Order 4700.1, "Project Management System." The two major features of this control configuration approach relate to (1) the product and (2) the maintenance of the baseline for many sites that are in different phases of remediation at the same time. In the past, a project typically has produced a product. DOE Order 4700.1 premises that some product is going to be constructed. This premise drives the design of the product, its testing, control of the product, and the process by which it is manufactured. However, an environmental restoration project does not produce a typical product. In an environmental restoration project, what is produced (and what configuration control management exercises) is (a) the development of clean dirt, (b) the documentation to support clean dirt, and (c) the track record of each of the sites. This paper describes this "environmental restoration project" approach to product and baseline maintenance. The environmental restoration project approach is unique, in that there are four baselines rather than three: cost, schedule, scope, and technical (the track record product) baselines. This four-baseline approach is essential to configuration control management because of the lack of a unique product from each site. The philosophy behind the four-part configuration makes the technical baseline the identifiable product.

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Life Cycle Planning to Forecast Budget Requirements and Maintain Effective Cost Controls

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 135-138) (September 1991)

Projecting budgets for environmental restoration to comply with regulatory agency standards requires long-term planning, scheduling, and forecasting. The Westinghouse Idaho Nuclear Company, Inc. (WINCO) Environmental Restoration Program is responsible for 14 operable units at the Idaho Chemical Processing Plant, located in the Idaho National Engineering Laboratory. To respond to U.S. Department of Energy (DOE) requirements, WINCO has established a baseline document and has developed activities for each of the 83

environmental release sites in the operable units. The baseline document is primarily based on the activities for operable unit scoping and investigation that are identified in the Federal Facility Agreement and Consent Order, commonly called the Interagency Agreement. The schedule for some sites also reflects requirements of the fiscal year 1991 Consent Order Compliance Agreement. WINCO has planned activities at the sites through the completion of the Record of Decision. The baseline document provides the project's management with a defensible basis for projecting and controlling cost. Cost and schedule are normally impacted by modifications to the scope of work, changes in DOE or regulatory orders and guidance, or identification of additional environmental release sites. WINCO will evaluate these impacts and revise the baseline to reflect the changes. Project management will use the baseline document to evaluate potential cost impacts. When resources are limited, the baseline will help management to select the optimal technical strategy and to minimize impacts to the cost and schedule of other projects.

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Remediation Strategies for Perched Water Bodies Underlying the Idaho Chemical Processing Plant at the Idaho National Engineering Laboratory

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 433-437) (September 1991)

Analysis of water samples collected from perched water underlying the Idaho Chemical Processing Plant (ICPP) at the Idaho National Engineering Laboratory (INEL) indicates the presence of low levels of radionuclides. The perching layers are formed by dense basalts and/or sediment interbeds with sufficient clay to form an aquitard. The distribution of contaminants and depth to water levels observed in the perched-water well monitoring network suggest that perched water occurs as discrete bodies of water, but these are not necessarily interconnected across a large area. Present data suggest that the perching occurs as discrete "pools" and that the presence of contamination is a function of vertical contaminant transport from above. The remediation of this perched water will be dependent upon the types of contaminants, the hydrogeologic conditions, the physical setting, and the size of the perched water body. Remediation strategies under consideration include the use of wells for the extraction of contaminated water and the installation of horizontal wells. A preliminary conceptual model of the perched water has been developed and is being refined as additional hydrogeologic and contaminant data are acquired. Contaminant transport hypotheses have been formulated, and tests of these hypotheses are planned that will assist with the refinement of the conceptual model. The testing of these transport hypotheses and the development of the conceptual model will provide the basis for evaluating the available options for remediation of the perched water and for selecting the most effective strategy or strategies for the implementation of remedial action.

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Pad A Treatability Study Long-Range Project Plan

EGG-WTD-9776; 107 pp. (June 1991)

This plan addresses the work to be accomplished by the Pad A Treatability Study Project. The purpose of this project is to investigate potential treatment and separation technologies, identify the best technologies, and to demonstrate by both lab- and pilot-scale demonstration the most applicable remedial technologies for treating plutonium-contaminated salts at the Pad A site located at the Subsurface Disposal Area at the Radioactive Waste Management Complex at the Idaho National Engineering Laboratory. The conduct of this project will be supported by other Department of Energy laboratories, universities, and private industries, who will provide support for near-term demonstrations of treatment and

separation technologies. The purpose of this long-range planning document is to present the detailed plan for the implementation of the Pad A Treatability Study Project.

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Successful Integration of the CERCLA and NEPA Compliance Processes in the Weldon Spring Site Remedial Action Project: A Case Study

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 615-620) (September 1991)

Special problems are posed for Department of Energy environmental restoration projects by the need to satisfy the environmental compliance documentation requirements of both the National Environmental Policy Act (NEPA) and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The Weldon Spring Site Remedial Action Project (WSSRAP) employed a two-part process for the production of CERCLA documents that would also satisfy NEPA. The first part involved determining the proper level of documentation and integrating the information requirements of both laws. The second part involved managing the DOE headquarter's review, approval, and issuance activities. The first full application of this two-step process was completed in 1990 for two interrelated actions: (1) removal of the bulk waste from the Weldon Spring Quarry (an operable unit requiring a remedial investigation/feasibility study); and (2) construction of a water treatment plant for the Weldon Spring Chemical Plant (a non-time critical removal requiring an engineering evaluation/cost analysis).

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Taking Interim Actions: Integrating CERCLA and NEPA to Move Ahead with Site Cleanup

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 623-626) (September 1991)

The cleanup of contaminated sites can be expedited by using interim response actions in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). Interim actions include both (1) removal actions that are conducted to respond to a release or a threat of release, such as a leaking pit; and (2) interim or focused remedial actions that are conducted to address a separate operable unit of the site, such as a discrete source area or a specific environmental medium like surface water or ground water. A major portion of some Superfund sites can be cleaned up entirely as removal actions. These sites are remediated by the U.S. Environmental Protection Agency in accordance with CERCLA and NCP only. For CERCLA sites being remediated by the U.S. Department of Energy (DOE), such actions must also comply with the National Environmental Policy Act (NEPA), because the DOE has established a policy for integrating CERCLA and NEPA requirements. A strategy for the integrated documentation and implementation of interim actions has been applied successfully at the Weldon Spring Site, and major cleanup projects are currently underway there. This paper discusses some of the issues associated with integrating CERCLA and NEPA for interim actions and summarizes those actions that have been identified for the Weldon Spring Site. Advantages of an integrated interim-action program include: (a) discrete cleanup activities can begin without delay from the schedule for comprehensive project decisions; (b) the preparation of compliance documents for interim actions addresses issues ranging from presentation

and format to applicable relevant and appropriate requirements (ARARs) and regular interagency coordination; and (c) an interim action program demonstrates to the public the project's commitment to cleanup.

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Application of Classic Engineering Techniques (Value Engineering and Observation Method) at the Weldon Spring Quarry

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 733-738) (September 1991)

In July of 1987. the Weldon Spring quarry was listed on the Environmental Protection Agency's National Priority List as the highest priority federal facility site. The Weldon Spring Remedial Action Project applied the principles and techniques of value engineering (VE) and the observational method to remedial planning efforts at the quarry. VE sessions resulted in modifications of the scenarios developed during the remedial investigation/feasibility study (RI/FS) process, in preparation for conceptual design activities for the removal of waste from the quarry. The observational method, a technique used to manage uncertainties, was used to guide both environmental and engineering planning to ensure that the waste removal activities will be carried out in a safe and environmentally responsible manner.

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Engineering Evaluation/Cost Analysis for the Proposed Management of 15 Nonprocess Buildings (15 Series) at the Weldon Spring Site Chemical Plant, Weldon Spring, Missouri

DOE/EA-0549; 216 pp. (November 1991)

The U.S. Department of Energy, under its Surplus Facilities Management Program, is responsible for cleanup activities at the Weldon Spring Site, located near Weldon Spring, Missouri. The site consists of two noncontiguous areas: (1) a raffinate pits and chemical plant area and (2) a quarry. This engineering evaluation/cost analysis (EE/CA) report has been prepared to support a proposed removal action to manage 15 nonprocess buildings, identified as the 15 Series buildings, at the chemical plant on the Weldon Spring Site. These buildings have been nonoperational for more than 20 years, and the deterioration that has occurred during this time has resulted in a potential threat to site workers, the general public, and the environment. The engineering evaluation/cost analysis documentation of this proposed action is consistent with guidance from the U.S. Environmental Protection Agency (EPA) that addresses removal actions at sites subject to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986. Actions at the Weldon Spring Site are subject to CERCLA requirements because the site is on the EPA's National Priorities List. The objectives of this report are to (1) identify alternatives for management of the nonprocess buildings; (2) document the selection of response activities that will mitigate the potential threat to workers, the public, and the environment associated with these buildings; and (3) address environmental impact associated with the proposed action.

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Environmental Protection Implementation Plan, November 9, 1991 - November 9, 1992

DOE/NV-351; 51 pp. (November 1991)

DOE Order 5400.1, "General Environmental Protection Program," established environmental protection program requirements, authorities, and responsibilities to assure that Department of Energy (DOE) operations are in compliance with

applicable federal, state, and local environmental protection laws and regulations, executive orders, and internal department policies. Chapter 3 of DOE Order 5400.1 requires that each field organization prepare a plan for implementing the requirements of this order by no later than November 9, 1989, and update the plan annually. The Department of Energy/Field Office, Nevada (DOE/NV) has prepared this second annual update of its Environmental Protection Implementation Plan (EPIP). The Order and corresponding guidances also require estimated budgetary resources necessary for implementation of the Order to be identified in the EPIP. To satisfy this requirement, the estimated costs to effectuate necessary changes in existing programs or processes and to institute new programs or processes for compliance with the Order are provided in the following sections of this plan. The DOE/NV Assistant Manager for Operations, in consultation with other organizations responsible for line management of plan implementation, is responsible for annual plan revisions.

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Sandia National Laboratories Chemical Waste Landfill: Innovative Strategies Towards Characterization and Remediation

SAND-92-0426C; CONF-920307; Waste Management '92, R.G. Post (ed.), Proceedings of a Conference, Tucson, AZ, March 1-5, 1992; (16 pp.) (1992)

The Chemical Waste Landfill (CWL) was used by Sandia National Laboratories (SNL), Albuquerque, New Mexico, for disposal of hazardous chemicals from the years 1962 to 1985. Prompted by the detection of low levels of trichlorethylene (TCE) in groundwater samples from an aquifer approximately 146 meters below the ground surface, a RCRA Site Investigation (RSI) and remediation of organic contaminants will be performed at the CWL prior to closure of this landfill. The RSI is focused on optimal characterization of the VOC contamination and dense non-aqueous phase liquid (DNAPL) contamination at this site, which will be possible through the application of innovative strategies for characterization and promising new technologies. This paper provides a discussion of the conceptual models of contaminant transport at the CWL and an overview of the investigative strategy, which is focused on characterizing the transport of VOCs and DNAPLs. Each stage of the RSI has been developed to gather information that will reduce the uncertainty in the design of each subsequent phase of the investigation. Three stages are described: (1) source-characterization stage, (2) unsaturated-zone characterization stage, and (3) saturated-zone characterization stage. The unsaturated-zone characterization must provide all data necessary to make decisions concerning the necessity of a saturated zone characterization phase.

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CERCLA Integration with Site Operations: The Fernald Experience

FMPC-2229; CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 605-614) (September 1991)

The Fernald Environmental Management Project (FEMP), formerly the Feed Materials Production Center, was a key facility in the U.S. Department of Energy's nuclear materials production program. The facility, located northwest of Cincinnati, Ohio, produced uranium metal and uranium compounds for use in production reactors and at other defense facilities. The FEMP was built by the U.S. Atomic Energy Commission and began operations in the early 1950's. The FEMP employed a variety of chemical and metallurgical processes to support the production of high-purity uranium metal. These production processes generated a significant quantity of low-level radioactive and hazardous

wastes. Meanwhile, an increased national emphasis on environmental protection and restoration resulted in a change in the regulatory requirements for waste management; thus there was a major transition in the FEMP site mission. The production of uranium products at the site was suspended in July 1989. FEMP production capabilities are being transferred to private industry through a vendor qualification program. Environmental compliance and site cleanup are now FEMP's primary focus. FEMP environmental issues such as the stored inventories of process residues, materials, and equipment are being addressed under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Since FEMP continued process operations after 1980, it is not only a Superfund site under CERCLA, but also is subject to the Resource Conservation and Recovery Act (RCRA). Regulatory authorities applicable to FEMP include the Toxic Substance Control Act (TCSA), asbestos abatement regulations, and other environmental health and safety regulations. FEMP is one of the first DOE facilities to make the transition from an active production mission guided by DOE Defense Programs (DP) to an environmental mission guided by DOE Environmental Restoration and Waste Management (EM). Westinghouse Environmental Management Company of Ohio (WEMCO) is integrating all site activities to carry out the cleanup. Site activities are broken down into three categories: (1) CERCLA driven, restoration work required under CERCLA; (2) CERCLA covered, other regulatory requirements which must be integrated with CERCLA activities; and (3) CERCLA exempt, if any. WEMCO must negotiate the regulation of site activities with state and federal regulatory agencies. This paper discusses WEMCO's programmatic approach to integrating waste management, site utility and support services, health and safety programs, and Resource Conservation and Recovery Act programs with CERCLA requirements.

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Chaos and Remedial Investigations

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 777-781) (September 1991)

Current research into the nature of chaos indicates that even for systems that are well known and easily modeled, slight changes in the scale used to measure the input have unpredictable results in the model output. The conduct of a remedial investigation (RI) is dictated by well established rules of investigation and management, yet small changes in project orientation, regulatory environment, or site conditions have unpredictable consequences for the project in terms of costs, schedule, and value of data. Several examples from the groundwater investigation at the Fernald Environmental Management Project illustrate the chaotic effects of "changes of scale" in both technical and management situations. The number (density) of sampling locations and the frequency of sampling are two scales which changed over the course of the investigation. The Production Area at Fernald was added to the RI in 1989, a regulatory change which introduced the complication of drilling additional sampling wells in a small area with obstacles such as underground piping and electrical lines. Two chaotic effects were related to the long-term monitoring program at Fernald, which is crucial for determining natural baseline conditions and the effectiveness of the remediation. The water level measurements from groundwater wells were conducted monthly instead of quarterly and extended indefinitely (not just for one year). This became necessary because the original period was during a year of record drought in Ohio. The expanded monitoring revealed a larger contamination plume in the aquifer during wetter periods, with increases in uranium contamination in wells intended to show background levels. The management decision to divide the site into five operable units also had chaotic results in terms of data presentation and reviewing and commenting on reports generated. Given that chaos is present in all aspects of a RI, the key to managing chaos is to first recognize that work is being conducted on some measurable scale and to recognize when that scale changes. Success depends on developing specific units of measure for a number of activities, in addition to cost and schedule, and tracking them regularly on a finer

scale than the one used for reporting. An example of such tracking in this project was the measurement of drilling progress in the Production Area on a scale of number of borings per day.

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Project Quality Assurance Plan for Research and Development Services Provided by Oak Ridge National Laboratory in Support of the Westinghouse Materials Company of Ohio Operable Unit 1 Stabilization Development and Treatability Studies Program

ORNL/TM-11803; 46 pp. (May 1991)

This Project Quality Assurance Plan (PQAP) sets forth the quality assurance (QA) requirements that are applied to those elements of the Westinghouse Materials Company of Ohio (WMCO) Operable Unit 1 Support at Oak Ridge National Laboratory (ORNL) project that involve research and development (R&D) performed at ORNL. This is in compliance with the applicable criteria of 10 CFR Part 50, Appendix B, ANSI/ASME NQA-1, as specified by Department of Energy (DOE) Oak Ridge Operations (ORO) Order 5700.6B. For this application, NQA-1 is the core QA Program requirements document. QA policy, normally found in the requirements document, is contained herein. The requirements of this PQAP apply to project activities that affect the quality and reliability/credibility of research, development, and investigative data and documentation. These activities include the functions of attaining quality objectives and assuring that an appropriate QA program scope is established. The scope of activities affecting quality includes organization; personnel training and qualifications; design control; procurement; material handling and storage; operating procedures; testing, surveillance, and auditing; R&D investigative activities and documentation; deficiencies; corrective actions; and QA record keeping.

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Remedial Investigation/Feasibility Study Risk Assessments at a Superfund Mixed Waste Site

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 877-882) (September 1991)

This paper presents lessons learned during the U.S. Environmental Protection Agency and U.S. Department of Energy review of remedial investigation/feasibility study (RI/FS) risk assessments for the Fernald Environmental Management Project (FEMP). The review found that various sensitive issues are difficult to resolve, and have the potential to slow down the approval of the RI/FS documents. Some of the major sensitive topics are: (1) background contaminant concentrations; (2) fate and transport model parameters; (3) sensitive subpopulations; (4) future land use; (5) institutional controls; (6) radiation slope factors; (7) additive toxic effects; and (8) the basis for FEMP's remediation goals. This paper presents these topics along with the current status of their resolution.

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Contract Administration Involving the Remedial Investigation and Feasibility Study at the Feed Materials Production Center

ER-B-91-18; 23 pp. (August 28, 1991)

Advanced Sciences, Incorporated (ASI) has been performing a Remedial Investigation and Feasibility Study at the Feed Materials Production Center (FMPC) at Fernald, Ohio, under an 8 (a) contract with the U.S. Small Business Administration. The FMPC is a government-owned facility operated by Westinghouse Materials Company of Ohio under a management and operating contract. The objective of this audit was to evaluate the award and administration of the ASI contract.

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Implementation of 29 CFR 1910.120 at a Multiple-Contractor Operated Facility

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 643-648) (September 1991)

At the Fernald Environmental Management Project (FEMP), the application of regulation 29 CFR 1910.120, Hazardous Waste Operations and Emergency Response, has been extremely complicated. A standard of the Occupational Safety and Health Administration (OSHA), 29 CFR 1910.120, has complex requirements. Meeting these requirements has cost FEMP a significant expenditure of resources. This paper provides a discussion of both the specific requirements of the OSHA standard and some of the implementation strategies and difficulties that FEMP encountered in meeting these requirements. The paper also presents a detailed discussion of the scope of 29 CFR 1910.120. The FEMP, formally the Feed Materials Production Center, at Fernald, Ohio, is a former Department of Energy production facility whose mission dramatically changed when it became an environmental restoration site. Accompanying this change was the inclusion of the site on the National Priorities List. With the initiation of its environmental restoration activities, FEMP has realized the full extent of the application of 29 CFR 1910.120 to these activities. FEMP is a 425 ha facility employing over 1500 contractor and government personnel, representing several hundred separate companies. This helps explain the complexity of the application of these OSHA-mandated requirements at FEMP. Compliance with the standard initially resulted in the stoppage of several projects and the delay of others, at considerable cost to the Department of Energy. 29 CFR 1910.120 has taken, and continues to take, considerable time and effort to implement at FEMP. In reviewing the implementation of the OSHA standard at FEMP, this paper discusses the following topics separately: (1) description and scope of 29 CFR 1910.120, (2) site program, (3) site-specific safety and health plan, (4) site control, (5) training, (6) medical surveillance, (7) handling of drums and other containers, and (8) other requirements. The paper does not discuss specific directives levied against operations at treatment, storage, and disposal facilities, since, in general, these directives are a subset of the broader requirements of 29 CFR 1910.120. Nor does the paper address the emergency response requirements of the standard, since the preexisting operations at FEMP exceed its requirements.

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Integration of Removal Actions into the Operations at a DOE Facility

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 811-815) (September 1991)

The implementation of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) removal actions at a DOE facility can be a complex and complicated process. This paper examines the application of CERCLA removal actions at the Fernald Environmental Management Project (FEMP). Specific discussion focuses on: the regulatory background, the framework utilized to conduct removal actions, and examples of successful implementation. A flowchart illustrates the approach currently used for removal actions at the FEMP. Case histories of two specific, successful, time-critical removal actions (the reduction of airborne radioactive emissions from Waste Pit 6 and the removal of liquid waste from a decant sump tank) are described to assist other sites in noting potential problem areas encountered during the planning, preparation, and implementation phases of removal actions.

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J.A. Mora and Wilson, U.S. Department of Energy, Albuquerque Field Office, Albuquerque, NM; MG Ecology and Environment, Inc., Albuquerque, NM

A Tale of Negotiations: CERCLA Interagency Agreement at the Mound Plant

CONF-9010166; Waste Management and Environmental Restoration, Proceedings of the 1990 DOE Model Conference, Oak Ridge, TN, October 29-November 2, 1990, 343 pp.; (8 pp.) (1990)

The purpose of this paper is to explain some of the important provisions of the Mound agreement, and to explore lessons learned from the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Interagency Agreement (IAG) negotiations. Six specific IAG provisions are discussed. These provisions represent key elements in an attempt to merge what may seem like incongruous goals: the need to conduct a thorough CERCLA cleanup under the direction of another federal agency, and the desire to protect the public's money. The provisions discussed are: (1) integration of CERCLA and Resource Conservation and Recovery Act requirements; (2) the Environmental Protection Agency's (EPA's) covenant not to sue or assess administrative penalties against Department of Energy contractors for any of their actions which may have given rise to the releases covered by the agreement; (3) inclusion of a streamlined statement of work; (4) the procedure whereby investigative work already completed at the Mound Site which was not conducted utilizing EPA-approved methods may be accepted for future reports; (5) the short list of primary documents; and (6) use of a yearly schedule for work activities.

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Portsmouth Gaseous Diffusion Plant, Piketon, OH; Science Applications International Corporation, Dublin, OH

Quality Assurance Program Plan for the Environmental Restoration Program

POEF/ER/Sub-89/4541; 29 pp. (March 30, 1992)

The United States Department of Energy (DOE) has initiated the Environmental Restoration Program (ERP) at the Portsmouth Gaseous Diffusion Plant (PORTS) in an effort to manage, control and remediate existing hazardous, toxic and radioactive wastes generated at PORTS. This ERP Quality Assurance Program Plan (QAPP) is responsive to the PORTS Environmental Safety and Health Division Quality Assurance Program Plan (QAPP) and the Environmental Restoration Division (ERD) QAPP. This QAPP establishes the policies, requirements and responsibilities by which an appropriate level of QA shall be implemented within the PORTS-ERP. All PORTS-ERP activities shall be conducted in accordance with the requirements of this document and/or of a project-specific document which is derivative of this document.

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Portsmouth Gaseous Diffusion Plant, Piketon, OH; Geraghty and Miller, Inc., Environmental Services Division, Dublin, OH

Well 6B Remediation - X-608B Well Field Interim Measures Plan

POEF/ER/Sub-88/4523; 49 pp. (July 1991)

On March 1, 1989, during routine maintenance on the Well 6B pump, approximately 264 milliliters of mercury was spilled into the water column of Well 6B, X-608 Wellfield. In addition, eight gallons of mineral oil were spilled and parts of the pump were lost down the well. This report discusses attempts to remediate the well and recommendations for future work.

543

G.A. Plante, Portsmouth Gaseous Diffusion Plant, Piketon, OH

Post-Closure Plan for the X-616 Surface Impoundments

POEF/ER/Sub-88/4525; 121 pp. (November 25, 1991)

The Portsmouth Gaseous Diffusion Plant (PORTS) is owned by the U.S. Department of Energy and is managed by Martin Marietta Energy Systems, Inc. The PORTS facility enriches uranium for national defense applications and commercial nuclear reactors and has been in operation since

1954. To support production, the PORTS facility uses large quantities of water for process cooling. The X-616 Surface Impoundments were constructed to hold the trivalent-chromium sludge produced by the X-616 Liquid Effluent Control Facility. This report discusses the plan for post-closure groundwater monitoring.

544
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Savannah River Field Office - Financial Assistance Award - Intent to Award a Noncompetitive Grant

Federal Register 56(170):43590 (September 3, 1991)

The U.S. Department of Energy (DOE), Savannah River Field Office announces that it plans to award a grant to the South Carolina Department of Health and Environmental Control (SCDHEC) for the oversight and implementation of the Federal Facility Agreement (FFA). The grant will provide funding to SCDHEC prior to finalization of the FFA. The term of the grant is one year, with a funding level of $1,244,690 for the period. Pursuant to the DOE Assistance Regulations, 10 CFR 600.7(B)(2)(i)(C), the Director of the Office of Environmental Restoration and Waste Management at DOE Headquarters has determined that a noncompetitive award is appropriate, since the applicant is a unit of government and the activity to be supported is related to performance of their function within the subject jurisdiction. The proposed grant will enable the State of South Carolina to set up and maintain a program at the Savannah River Site (SRS) that will be conducted under the requirements of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Activities will include (1) review and comment on relevant primary and secondary documents generated under the FFA for the SRS; (2) participation in associated public meetings and/or hearings and other community relations activities pursuant to CERCLA requirements; and (3) certification of DOE sampling and analytical results at CERCLA sites.

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W.D. Hoffman, Westinghouse Savannah River Company, Aiken, SC

CERCLA Document Flow: Compressing the Schedule, Saving Costs, and Expediting Review at the Savannah River Site

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 621-622) (September 1991)

This paper conveys the logic of the CERCLA document flow, including work plans, characterization studies, risk assessments, remedial investigations, feasibility studies, proposed plans, and records of decision. The paper shows how schedules at the Savannah River Site are being formulated to accomplish work by using an observational approach. In this way, carefully planned tasks can be initiated early and carried out in parallel with each other. The paper shares specific proactive experience in working with the Environmental Protection Agency to expedite projects, begin removal actions, take interim actions, speed document flow, and eliminate unnecessary documents from the review cycle.

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R. Shuman, E. Jennrich, P. Andersen, D. Nix, and J. Cook, Rogers and Associates Engineering Corporation, Salt Lake City, UT; Geo Trans, Inc., Sterling, VA; Westinghouse Savannah River Company, Aiken, SC

Balancing CERCLA Risk and DOE Radiological Performance Assessment Methodologies and Practices

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 277-281) (September 1991)

Westinghouse Savannah River Company (WSRC) is engaged in an aggressive program to build new waste disposal facilities and to remediate

contaminated areas at the Savannah River Site (SRS). The waste disposal facilities are being developed in accordance with U.S. Department of Energy (DOE) Order 5820.2A, which requires radiological performance assessments. Site remediation is being conducted according to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended, which requires assessments of the impacts of hazardous substances on human health and the environment. Assessments under Order 5820.2A and CERCLA are conducted to achieve the same objective: adequate protection of individuals, populations, and the environment. The guidance, methodologies, and practices used for these two assessments, however, are different. The assessment of groundwater contamination at the F- and H-Area Seepage Basins is the first CERCLA assessment at SRS. This assessment, composed of a baseline risk assessment of current site conditions and assessments of several remedial action alternatives, sets precedence for future SRS assessments and will influence CERCLA assessments at all other DOE sites within U.S. Environmental Protection Agency (EPA) Region IV. WSRC's approach is to apply the extensive body of DOE radiological performance assessments, models, codes, and approaches to the entire CERCLA assessment. This has required negotiation with EPA on issues such as institutional control, exposure scenarios, exposure pathways, time period of analysis, and acceptable models and assumptions. It is crucial that the approach being followed under CERCLA is as consistent as possible with the approach used to develop new facilities under Order 5820.2A.

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G.F. Stejskal, Westinghouse Savannah River Company, Aiken, SC

Meeting Record for FFA Working Meeting of November 15, 1991

WSRC-MS-92-126; 61 pp. (January 3, 1992)

This document provides a meeting record of the Federal Facility Agreement (FFA) working meeting. The purpose of the meeting was to discuss progress on old issues and further required actions regarding environmental impacts of the Savannah River Facility.

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A.V. Palumbo, P.A. Boerman, S.E. Herbes, D.C. White, G.W. Strandberg, T.L. Donaldson, A.J. Lucero, H.L. Jennings, T.J. Phelps, and D.C. White, Oak Ridge National Laboratory, Environmental Sciences Division, Oak Ridge, TN; Oak Ridge National Laboratory, Chemical Technology Division, Oak Ridge, TN; University of Tennessee, Institute for Applied Microbiology, Knoxville, TN

A Co-Metabolic Approach to Groundwater Remediation

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 95-100) (September 1991)

Oak Ridge National Laboratory (ORNL) and the University of Tennessee (UT) are demonstrating the use of methanotrophs in bioreactors for remediation of contaminated groundwater at Savannah River Site (SRS). The demonstration is part of the U.S. Department of Energy's Integrated Demonstration (Cleanup of Organics in Soils and Groundwater at Non-Arid Sites). ORNL is conducting batch experiments, is operating a number of bench-scale bioreactors, has designed pretreatment systems, and has modified a field-scale bioreactor. UT is operating bench-scale bioreactors to determine the stability of a trichlorethylene-degrading methanotrophic consortia during shifts in operating conditions (e.g. pH, nutrient inputs, and contaminant mixtures). The ORNL and UT activities will provide a base of knowledge for the successful treatment of contaminated groundwater at the SRS, K-25, and other DOE sites.

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Comprehensive Strategy for Corrective Actions at the Savannah River Site General Separations Area

WSRC-MS-91-053; CONF-910270; Waste Management '91: Working Towards a Cleaner Environment - High-Level Waste, Low-Level Waste, Mixed Waste and Environmental Restoration, R.G. Post (ed.), Proceedings of a Conference, Tucson, AZ, February 24-28, 1991; (12 pp.) (1991)

The Savannah River Site (SRS), operated by the Westinghouse Savannah River Company for the United States Department of Energy, contains a number of waste-disposal units that are currently in various stages of corrective action investigations, closures, and postclosure corrective actions. Many of these sites are located within a 40 sq km area called the General Separations Area (GSA). The SRS has proposed to the regulatory agencies, the United States Environmental Protection Agency (EPA) and the South Carolina Department of Health and Environmental Control (SCDHEC), that groundwater investigations and corrective actions in this area be conducted under a comprehensive plan. The proposed plan would address the continuous nature of the hydrogeologic regime below the GSA and the potential for multiple sources of contamination. This paper describes the proposed approach.

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Costs and Schedule for a 58 Acre RCRA Interim Status Mixed Waste Closure at the Savannah River Plant

CONF-880839; Closure and Decommissioning - Session 6, Proceedings of the Tenth Annual Department of Energy Low-Level Waste Management Conference, Denver, Colorado, August 30-September 1, 1988, 99 pp.; (pp. 28-32) (December 1988)

The South Carolina Department of Health and Environmental Control approved an interim-status closure of a 58-acre mixed waste site. Hazardous wastes with the greatest potential for ground water impact are lead and cadmium. Venture Guidance Appraisal estimates that the total cost to complete the project will be $55.5 million. Estimated time to complete the project is three years. Major work elements of the closure include: (1) precompaction of existing site to minimize subsidence, (2) backfill and compaction to bring to subgrade, (3) construction of a three foot clay cap with a permeability of 1 X 10(E-7) cm/sec, (4) construction of a 2 ft vegetative layer, and (5) development of a cap drainage-and-erosion-control system.

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Performance Assessments of Closure Cap Alternatives at the Savannah River Plant

CONF-880839; Closure and Decommissioning - Session 6, Proceedings of the Tenth Annual Department of Energy Low-Level Waste Management Conference, Denver, Colorado, August 30-September 1, 1988, 99 pp.; (pp. 61-71) (December 1988)

Several large waste sites at the Savannah River Plant will be closed within the next few years, including two sets of seepage basins and a mixed-waste disposal facility. Technical support for the closure caps for these facilities included water balance calculations for a series of cap designs using the Hydrologic Evaluation of Landfill Performance (HELP) code, together with time-dependent dose calculations using the Rogers and Associates, PATHRAE code. The results of the HELP code showed that a cap constructed with clay having a hydraulic conductivity of 10(E-7) cm/sec and good drainage will be 97.6% effective in preventing infiltration through the cap. PATHRAE results show that with the reduced infiltration, all exposures will be at acceptable levels after a 100-year institutional control period.

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Work Plan, Health and Safety Plan, and Quality Assurance Project Plan for Hazardous Waste Removal at the CTF K-1654B Underground Collection Tank

ORNL-6697; 61 pp. (October 1991)

The Central Training Facility (CTF), located on Bear Creek Road approximately two miles south of the K-25 Site in Oak Ridge, Tennessee, is utilized for training Martin Marietta Energy Systems, Inc. security personnel. At the request of the CTF staff, this plan has been developed for the removal of the waste contents in the facility's 500-gallon septic tank and associated distribution box. The septic tank and distribution box were historically located beneath the K-1654B trailer and adjacent to the K-1654A Indoor Firing Range. Recently, however, the K-1654B trailer was removed to accommodate the objectives of this work plan as well as future construction activities planned at CTF. The purpose of this plan is to develop and assign responsibilities, establish personnel protection requirements and mandatory safety procedures, and provide for contingencies that may arise while operations are being conducted at the CTF K-1654B underground collection tank site. This document addresses the requirements of 29 CFR 1910.120, Final Rule, with respect to aspects of health and safety applicable to an underground collection tank waste removal.

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Environmental Restoration: Oak Ridge National Laboratory Perspective

CONF-910277; WATTec '91, Proceedings of the 18th Annual Technical Conference and Exhibition, Knoxville, TN, February 22, 1991; (24 pp.) (1991)

Oak Ridge National Laboratory (ORNL), located in Oak Ridge, Tennessee, is a multipurpose research facility managed by Martin Marietta Energy Systems, Inc. (Energy Systems) for the U.S. Department of Energy (DOE), Oak Ridge Operations. The operation of ORNL has resulted in a legacy of contaminated and potentially contaminated facilities, research areas, and waste management areas that may require remediation. The most recent inventory of remediation sites has identified approximately 400 individual sites that will require investigation and possibly remediation. The Remedial Action Program (RAP) was established at ORNL in 1985 to conduct the investigations, studies, and remediation necessary to prevent unacceptable risks to the environment and to the public from this legacy of contaminated sites. In 1989 a central Environmental Restoration Program (ERP) was established that consolidates the previous RAPs at all five sites managed by Energy Systems for DOE. This paper describes how a program was developed to solve the large and diverse problems associated with environmental restoration at ORNL.

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Environmental Restoration Program Management Control Plan

ES/ER/TM-19; 33 pp. (September 1991)

This Management Control Plan has been prepared to define the Energy Systems approach to managing its participation in the U.S. Department of Energy's (DOE's) Environmental Restoration (ER) Program in a manner consistent with DOE/ORO-931: Management Plan for the DOE Field Office, Oak Ridge, Decontamination and Decommissioning Program; and with the Energy Systems Environmental Restoration Contract Management Plan (CMP). This management control plan discusses the systems, procedures, methodology, and controls to be used by the program management team to attain these objectives.

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S.M. Robinson, S.M. DePaoli, and A.B. Walker, Oak Ridge National Laboratory, Oak Ridge, TN

Federal Facility Agreement Contingency, Upgrade, and Replacement Plans for the ORNL Active Low-Level Radioactive Waste Tank System

ORNL/TM-11795; 67 pp. (June 1991)

The Superfund Amendment and Reauthorization Act (SARA) of the Comprehensive Environmental Response, Compensation, and Liability Act

(CERCLA) required the Department of Energy (DOE) to execute a Federal Facilities Agreement (FFA) with the Environmental Protection Agency (EPA) within six months of final listing of the Oak Ridge Reservation (ORR) on the National Priorities List (NPL). This report summarizes the contingency, upgrade, and replacement plans that are being implemented at Oak Ridge National Laboratory (ORNL) as a result of the FFA. The liquid low-level waste (LLLW) system at ORNL is comprised of extensive underground piping and collection/treatment/storage tanks. In this report, contingency plans are defined as identification of, and planning for, alternate management of LLLW, while replacement and upgrade projects are defined as projects that install systems to meet the full secondary containment and leak testing requirements of the FFA. This report describes the objectives of the program, the existing LLLW system, the generated LLLW, and the contingency and upgrade/replacement plans. The alternative methods considered for compliance with the FFA are discussed, and the selected plans are summarized by tank system and by generating divisions. The proposed FFA budget and schedules are also summarized.

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Design and Construction of the Interim Waste Management Facility - SWSA 6

CONF-9010166; Waste Management and Environmental Restoration, Proceedings of the 1990 DOE Model Conference, Oak Ridge, TN, October 29-November 2, 1990, 343 pp.; (11 pp.) (1990)

The Interim Waste Management Facility (IWMF) is planned to provide disposal capacity for solid low-level radioactive waste (LLW) generated at Oak Ridge National Laboratory (ORNL). The LLW generation rate is approximately 30,000 cu ft per year and consists of a variety of technological wastes, primarily contaminated with short-half life radionuclides. IWMF construction was initiated in May 1990 and operation is expected to begin by September of 1991, and continue through 1996. The performance requirements for the IWMF are established in Department of Energy Order 5820.2a, Radioactive Waste Management. The IWMF design is based on the concept initially utilized in the Tumulus Disposal Demonstration, which has been underway at ORNL since 1986. The tumulus disposal technology involves several elements including: (1) sealing of LLW in structurally stable steel reinforced concrete disposal vaults; (2) stacking of the disposal vaults on grade-level steel reinforced concrete disposal pads; (3) collection and monitoring of storm water and infiltrating water which contacts the disposal vaults; (4) placement of low-permeability multi-layer caps over the waste stack; and (5) monitoring of near surface and groundwater.

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Functional Requirements for the Support Facilities to Plug and Abandon Wells at SWSA 6, Oak Ridge National Laboratory, Oak Ridge, Tennessee

ORNL/M-1814; 18 pp. (July 1991)

Throughout the operational history of Solid Waste Storage Area 6 (SWSA 6) at Oak Ridge National Laboratory (ORNL), numerous wells have been drilled for a variety of research and monitoring purposes. The plugging and abandonment (P&A) of unneeded wells and boreholes is an integral part of the maintenance and closure process for waste area groupings at ORNL. Wells requiring abandonment in and near SWSA 6 are currently being identified by an ORNL interorganizational group. The ORNL report "Corrective Action Plan in Response to Tiger Team Assessment" (report ORNL-6657, 1990) states that a number of wells will be plugged because they will be covered by the capping of the waste areas. Still more will be plugged to reduce the potential for surface water and groundwater communication, leaving only the wells necessary for detecting the presence or movement of contamination. There is a need for

facilities to support the removal of unused wells and boreholes located in SWSA 6. The purpose of this project is to construct facilities that will support personnel and equipment employed to plug and abandon the inactive wells. Additionally, the purpose of this project is to upgrade selected roads and facilities in SWSA 6 necessary to commence closure activities.

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Oak Ridge National Laboratory, Oak Ridge, TN

Remedial Investigation Plan for Waste Area Grouping 1 at Oak Ridge National Laboratory, Oak Ridge, Tennessee: Responses to Regulator Comments

ES/ER-6/D2; 297 pp. (May 1991)

This document, ES/ER-6&D2, is a companion document to ORNL/RAP/Sub-87/99053/4&R1, Remedial Investigation Plan for Oak Ridge National Laboratory Waste Area Grouping (WAG) 1, dated August 1989. This document lists comments received from the Environmental Protection Agency (EPA), Region 4 and the Tennessee Department of Health and Environment (TDHE), and responses to each of these comments. As requested by EPA, a revised Remedial Investigation (RI) Plan for Waste Area Grouping 1 will not be submitted. The document is divided into two Sections and an Appendix. Section I contains responses to comments issued on May 22, 1990, by EPA's Region 4 program office responsible for implementing the Comprehensive Environmental Response, Compensation, and Liability Act. Section 2 contains responses to comments issued on April 7, 1989, by EPA's program office responsible for implementing the Resource Conservation and Recovery Act; these comments include issues raised by the TDHE. The Appendix contains the attachments referenced in a number of the responses.

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Remedial Investigation Work Plan - Oak Ridge National Laboratory - Waste Area Groupings 11 and 13 - Appendix C: Data Quality Objectives

DOE/OR-941/D1 (App. C); LWA/90-015 (App. C); 14 pp. (December 1990)

This document is part of the Phase I Remedial Investigation (RI) Plans for Waste Area Groupings (WAGs) 11 and 13 at Oak Ridge National Laboratory, Tennessee. A WAG is a grouping of Solid Waste Management Units (SWMUs) that are geographically close or technically related. These site-specific plans describe the Phase I RI work that is planned as the initial steps in the remediation at WAGs 11 and 13. The objective of Phase I of the RI is to gather enough data to develop a baseline risk assessment for the remedial activities that will take place. A baseline risk assessment determines the risk to human health and the environment if no remedial actions take place. The Phase I data will also provide a basis for Phase II of the RI and for feasibility studies at the site, which will develop remedial alternatives, or which will provide a decision document justifying that no further action is required. Appendix A, the quality assurance project plan; Appendix B, the health and safety plan; Appendix C, the data quality objectives; and Appendix D, the field standard operating procedures are published under separate covers. Since the quality assurance, health and safety, data quality objectives and fieldwork procedures for the Phase I RIs at both WAG 11 and WAG 13 are identical, the appendices are the same for both RI plans.

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Lee Wan & Associates, Inc., Oak Ridge, TN

Remedial Investigation Work Plan - Oak Ridge National Laboratory - Waste Area Grouping 13

DOE/OR-943/D1 (Rev. 0); LWA/90-017 (Rev. 0); 186 pp. (December 1990)

This document presents the Phase I Remedial Investigation (RI) Plan for Waste Area Grouping (WAG) 13 at Oak Ridge National Laboratory, Tennessee, known as the Environmental Research Areas. A WAG is a grouping of Solid Waste Management Units (SWMUs) that are geographically close or technically related. This

site-specific plan describes the Phase I RI work that is planned as the initial steps in the remediation at WAG 13. The objective of Phase I of the RI is to gather enough data to develop a baseline risk assessment for the remedial activities that will take place at WAG 13. A baseline risk assessment determines the risk to human health and the environment if no remedial actions take place. The Phase I data will also provide a basis for Phase II of the RI and for feasibility studies at the site, which will develop remedial alternatives, or which will provide a decision document justifying that no further action is required at WAG 13. WAG 13 lies in a level floodplain along the Clinch River near Jones Island and covers about 2 hectares. The area was used for research on the effects of nuclear fallout on the environment. Based on prior investigations, this site was categorized as a SWMU requiring further investigation and remediation. Following Sections 1 and 2, the introduction and objectives of the plan, the site's current condition is described in detail in Section 3 of this work plan. Section 4 describes the baseline technical methodology of the Phase I RI and presents the baseline risk assessment for WAG 13. Section 5 is a characterization of potential pathways and receptors for contaminants from WAG 13. Section 6 offers information on the work breakdown structure, project schedule, data base management, and documentation of the Phase I RI. Section 7 describes the field investigation techniques and procedures; Section 8 gives the quality assurance objectives for the data; Section 9 is a description of analytical parameters and procedures; Section 10 is about the data reduction, validation, and reporting standards; Section 11 concerns internal quality control; Section 12 specifies routine procedures to assess data accuracy and completeness; Section 13 is the field investigation plan; Section 14 describes preventive maintenance; and Section 15 is the analysis of the RI results, including the preliminary characterization summary report for WAG 13. Appendix A, the quality assurance project plan; Appendix B, the health and safety plan; Appendix C, the data quality objectives; and Appendix D, the field standard operating procedures, are published under separate covers.

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H.L. Boston, T.L. Ashwood, D.M. Borders, V. Chidambariah, D.J. Downing, T.A. Fontaine, R.H. Ketelle, S.Y. Lee, D.E. Miller, G.K. Moore, G.W. Suter, M.F. Tardiff, J.A. Watts, and D.S. Wickliff, Oak Ridge National Laboratory, Oak Ridge, TN

Field Sampling and Analysis Plan for the Remedial Investigation of Waste Area Grouping 2 at Oak Ridge National Laboratory, Oak Ridge, Tennessee

ORNL/ER-58; 235 pp. (February 1992)

This field sampling and analysis (S&A) plan has been developed as part of the Department of Energy's (DOE's) remedial investigation (RI) of Waste Area Grouping (WAG) 2 at Oak Ridge National Laboratory (ORNL) located in Oak Ridge, Tennessee. WAG 2 consists of White Oak Creek (WOC) and its tributaries downstream of the ORNL main plant area, White Oak Lake (WOL), White Oak Creek embayment (WOCE) on the Clinch River, and the associated floodplain and subsurface environment (Figure 1.1). The WOC system is the surface drainage for the major ORNL WAGs and has been exposed to a diversity of contaminants from operations and waste-disposal activities in the WOC watershed. WAG 2 acts as a conduit through which hydrologic fluxes carry contaminants from upgradient areas to the Clinch River. Water, sediment, soil, and biota in WAG 2 are contaminated and continue to receive contaminants from upgradient WAGs. This document describes the following: (1) an overview of the RI plan, background information for the WAG 2 system, and objectives of the S&A plan; (2) the scope and implementation of the first 2 years of effort of the S&A plan and recent information about contaminants of concern, organization of S&A activities, interactions with other programs, and quality assurance specific to the S&A activities; (3) details of the field sampling plans for sediment, surface water, groundwater, and biota, respectively; and (4) the sample-tracking and records-management plan.

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Oak Ridge National Laboratory, Oak Ridge, TN Bechtel National, Inc., Oak Ridge, TN

Closure Plan for Solid Waste Storage Area 6: Volume 1, Closure Plan

RNL/RAP/Sub-87/99053/9&V1/R1; 239 pp. (September 1988)

This Closure Plan for Solid Waste Storage Area 6 (SWSA 6), a disposal area for low-level radioactive wastes and hazardous materials at the Oak Ridge National Laboratory (ORNL), describes how portions of SWSA 6 will be closed under Resource Conservation and Recovery Act (RCRA) Interim Status per 40 CFR 265 Subpart G (TN Rule 1200-1-11-.05(7)). An overview is provided of activities necessary for the final closure and corrective measures for all of SWSA 6. Results of surface waters and groundwater sampling are provided.

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Applicable or Relevant and Appropriate Requirements (ARARs) for Remedial Action at the Oak Ridge Reservation - A Compendium of Major Environmental Laws

ES/ER/TM-1; 51 pp. (July 1991)

Section 121 of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) specifies that remedial actions for cleanup of hazardous substances must comply with applicable or relevant and appropriate requirements (ARARs) or standards under federal and state environmental laws. The U.S. Department of Energy (DOE) Oak Ridge Reservation (ORR) was listed by the U.S. Environmental Protection Agency (EPA) on the National Priorities List on November 21, 1989, effective December 21, 1989. As a result of this listing, DOE, EPA, and the Tennessee Department of Environment and Conservation have drafted a Federal Facility Agreement (FFA) for the environmental restoration of ORR. Section XXI(F) of the FFA calls for the preparation of a draft listing of all ARARs as mandated by CERCLA Section 121. This report supplies a preliminary list of available federal and state ARARs that might be considered for remedial response at ORR. A description of the terms "applicable" and "relevant and appropriate" is provided, as well as definitions of chemical-, location-, and action-specific ARARs. ARARs promulgated by the federal government and by the state of Tennessee are listed in tables. In addition, the major provisions of the Resource Conservation and Recovery Act, Safe Drinking Water Act, Clean Water Act, Clean Air Act, and other acts, as they apply to hazardous waste cleanup, are discussed.

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Oak Ridge Reservation Site Management Plan for the Environmental Restoration Program

DOE/OR-1001; ORNL/M-1710; 158 pp. (September 1991)

This site management plan for the Environmental Restoration Program implements the Oak Ridge Reservation (ORR) Federal Facility Agreement. The U.S. Department of Energy, the U.S. Environmental Protection Agency, and the Tennessee Department of Environment and Conservation entered into this agreement for the purpose of coordinating remediation activities undertaken on the ORR to comply with the Comprehensive Environmental Response, Compensation, and Liability Act as amended by the Superfund Amendments, the Resource Conservation and Recovery Act, and the National Environmental Policy Act.

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Oak Ridge National Laboratory, Oak Ridge, TN

Implementation of the Natural Resource Damage Assessment Rule - Workshop Summary - Interim Notification Policy: Environmental Restoration Program

ES/ER/TM-24; 43 pp. (November 1991)

Regulations have been promulgated by the Department of Interior (DOI) which provide an administrative process whereby natural resource

trustees may establish the type and extent of injury and evaluate the damages to natural resources. These regulations provide an optional mechanism for Natural Resource Damage Assessments (NRDAs), with four major components. A workshop was held to develop recommendations for the Department of Energy (DOE) regarding implementation of the DOI NRDA regulations at the Oak Ridge Reservation (ORR). The attendants were divided into three working groups to consider (1) administrative/legal requirements, (2) ecological assessments, and (3) the NRDA/economic evaluation process. This report supplies an overview of the DOI NRDA regulations as well as summaries of the consensus of each of the three working groups.

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U.S. Department of Energy, Oak Ridge Field Office, Oak Ridge, TN

EPA, State, and DOE Sign Federal Facility Agreement for Oak Ridge Cleanup

DOE News (911122):1-2 (November 22, 1991)

The U.S. Department of Energy (DOE) Oak Ridge Field Office has announced the signing of an agreement with the U.S. Environmental Protection Agency and the Tennessee Department of Environment and Conservation that will establish procedures and schedules for developing and implementing appropriate cleanup actions related to DOE activities at the Oak Ridge Reservation, to protect public health, welfare, and the environment. The Federal Facility Agreement (FFA) identifies each agency's responsibility for implementing the various regulatory requirements for cleanup under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments, the Resource Conservation and Recovery Act (RCRA), the National Environmental Policy Act (NEPA), and Tennessee state law. This FFA encompasses remedial actions that will be required because of historical and current activities at DOE's Oak Ridge Y-12 Plant, Oak Ridge National Laboratory, Oak Ridge K-25 Site, and Oak Ridge Associated Universities. Also included in the scope of the agreement are off-site cleanup actions required as a result of contamination outside the DOE Oak Ridge Reservation. The agreement provides a means to verify that DOE has completed all investigations, studies, remedial designs, and remedial actions required by state and federal laws.

567
U.S. Department of Energy, Oak Ridge Field Office, Oak Ridge, TN; Science Applications International Corporation, Oak Ridge, TN

Environmental Restoration and Waste Management Site-Specific Plan for the Oak Ridge Reservation

DOE/OR-968; 216 pp. (September 1991)

The United States Department of Energy (DOE) is committed to achieving and maintaining environmental regulatory compliance at its waste sites and facilities, while responding to public concerns and emphasizing waste minimization. DOE publishes the Environmental Restoration and Waste Management Five-Year Plan (FYP) annually to document its progress towards these goals. The purpose of this Site-Specific Plan (SSP) is to describe the activities, planned and completed, undertaken to implement these FYP goals at the DOE Field Office-Oak Ridge installations and programs; specifically, for the Oak Ridge Reservation, Oak Ridge Associated Universities, and Hazardous Waste Remedial Action Program. Activities described in this SSP address hazardous, radioactive, mixed, and sanitary wastes, along with treatment, storage, and disposal of current production waste and legacy waste from past operations. The SSP is presented in sections emphasizing corrective activities, environmental restoration, waste management, technology development, and transportation; and includes descriptions of activities, resources, and milestones by installation or program.

568
R.K. White, D.W. Swindle, A. Redfearn, and A.D. King, Oak Ridge National Laboratory, Oak Ridge, TN

The Use of Institutional Controls at Department of Energy Oak Ridge Field Office Environmental Restoration Sites

ES/ER/TM-28; 18 pp. (January 1992)

This report summarizes some of the major issues related to the use of institutional controls at hazardous waste sites under the auspices of the Department of Energy Field Office, Oak Ridge/Environmental Restoration (DOE-OR/ER) Division. In particular, the report addresses the impacts that assumptions regarding institutional controls have on the results and interpretation of the risk assessment, both in the Remedial Investigation (RI) and the Feasibility Study (FS). Environmental restoration activities at DOE-OR/ER sites are primarily driven by CERCLA. Therefore, the report focuses on the approaches and assumptions relating to institutional controls under CERCLA. Also, the report briefly outlines approaches adopted under other authorities (such as RCRA) and under radiation regulatory authorities (such as NRC regulations/guidance, DOE orders, and EPA standards) in order to contrast these approaches to those adopted under CERCLA. In order to demonstrate the implications of the use of institutional controls at DOE facilities, this report summarizes the approaches and results of the recent baseline risk assessment for Solid Waste Storage Area 6 at Oak Ridge National Laboratory. The report concludes with possible options on the use of institutional controls at DOE-OR/ER sites.

569

A.E. Walzer and T.K. Cothron, Martin Marietta Energy Systems, Inc., Environmental Restoration Division, Oak Ridge, TN; Martin Marietta Energy Systems, Inc., Environmental Compliance, Oak Ridge, TN

Strategic Planning of an Integrated Program for State Oversight Agreements

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 85-90) (September 1991)

Among the many agreements faced by federal facilities are State Oversight Agreements, known as Agreements in Principle in many states, between the Department of Energy (DOE) and the state. A State Oversight Agreement funds the state to conduct independent environmental monitoring and oversight of environmental restoration activities at federal facilities. This DOE-funded state monitoring and oversight requires plans, studies, inventories, models, and reports from DOE, its management, and its operating contractors. States which have signed such agreements include Tennessee, Kentucky, Washington, Idaho, Colorado, California, and Florida. The State Oversight Agreement originated in Colorado as a result of environmental concerns at the Rocky Flats Plant. The Five-Year State Oversight Agreements for Tennessee and Kentucky became effective on May 13, 1991. DOE will fund Tennessee nearly $21 million and will fund Kentucky nearly $7 million. Implementation of the comprehensive and integrated agreements in Tennessee and Kentucky is particularly complex. The DOE Oak Ridge Reservation (ORR) in Tennessee houses three installations with distinctly different missions, while Kentucky houses the Paducah Gaseous Diffusion Plant. The strategic planning required for coordinating and integrating an oversight program of this magnitude is discussed in this paper. This discussion includes the organizational structure and interfaces which define and coordinate the program's elements among the three ORR plants and Paducah, and the effective negotiation of the oversight program's scope and schedules with the two states. A program management plan containing implementation and procedural guidelines is described. The management control system for detailed tracking of activities and costs is outlined. A comparison of the oversight agreements for Tennessee, Kentucky, Colorado, and Idaho is made.

570

D.W. Swindle and J.S. Watson, Martin Marietta Energy Systems, Inc., Environmental Restoration Division, Oak Ridge, TN

Achieving Technical Consistency and Meeting Technology Development Needs in the Oak Ridge Environmental Restoration Program

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the

21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 69-74) (September 1991)

In fiscal year 1990, environmental restoration activities for the Oak Ridge Reservation (ORR), which includes the Y-12 Plant, the K-25 Site, and Oak Ridge National Laboratory, and those programs in progress at the Portsmouth Gaseous Diffusion Plant, and the Paducah Gaseous Diffusion Plant were consolidated into a single program operated by Martin Marietta Energy Systems, Inc. (MMES) for the U.S. Department of Energy (DOE). The primary objectives of this consolidation are (1) to ensure that the environmental restoration activities, which were conducted independently at each of these five sites, are now being consistently managed; and (2) that key technical needs at all the sites are consistently resolved. The ORR was designated as a National Priorities List site on December 21, 1989. Schedules and work commitments for restoration of contaminated sites at the ORR have been negotiated as part of a Federal Facility Agreement. Consent Orders and Consent Decrees that affect the Portsmouth and Paducah sites have been handed down as well, so there is an immediate, urgent need for achieving technical consistency among the restoration activities at all five sites. This paper describes the Oak Ridge Environmental Restoration Program activities, which are authorized by the DOE Field Office in Oak Ridge, and the MMES activities that promote technical consistency throughout the program. The paper also discusses requirements for technology development that are specific to the unique contamination problems and geological settings of the Oak Ridge, Portsmouth, and Paducah sites. It compares and contrasts these technology needs with those at other DOE sites.

571

M. Leslie and B.L. Kimmel, CDM Federal Programs Corporation, Oak Ridge, TN; Oak Ridge National Laboratory, Oak Ridge, TN

Regulatory Compliance Issues Related to the White Oak Creek Embayment Time-Critical Removal Action

CONF-9110168; Proceedings of the 1991 DOE Model Conference, Oak Ridge, TN, October 14-17, 1991; (11 pp.) (1991)

In September 1990, Martin Marietta Energy Systems (Energy Systems) discovered high levels of cesium-137 in surface sediments near the mouth of White Oak Creek Embayment (WOCE). White Oak Creek (WOC) receives surface water drainage from Oak Ridge National Laboratory. Since this discovery, the Department of Energy (DOE) and Energy Systems have pursued actions designed to stabilize the contaminated WOCE sediments, under provisions of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and the implementing regulations in the National Contingency Plan (40 CFR Part 300), as a time-critical removal action. By definition, a time-critical removal is an action where on-site activities are initiated within six months of the determination that a removal action is appropriate. Time-critical removal actions allow comparatively rapid mobilization to protect human health and the environment without going through the lengthy and extensive CERCLA Remedial Investigation/Feasibility Study/Record of Decision process. Many aspects of the project have exceeded regulatory requirements, despite the fact that there is no apparent authority on conducting removal actions at Federal facilities.

572

Oak Ridge Y-12 Plant, Oak Ridge, TN; Science Applications International Corporation, Oak Ridge, TN

Well Plugging and Abandonment Program, Y-12 Plant, Oak Ridge, Tennessee

Y/TS-801; 102 pp. (December 1991)

This report is a synopsis of the progress of the well plugging and abandonment program at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee, from January 1991 to September 1991. A total of nine wells and borings were plugged and abandoned during the period of time covered in this report. Rehabilitation was attempted unsuccessfully on two of these wells. A tenth well was successfully rehabilitated and returned to scheduled monitoring. Of the nine wells plugged and abandoned, five were coreholes which had outlived their usefulness. Deviations from plugging and

abandonment procedures were sometimes required. Upon plugging and abandonment of these nine wells and borings, some minor discrepancies were discovered between reported and actual construction details. All were negligible differences except for the appearance of casing in Well 1087 below a depth of 12 ft.

573
J.E. Stone and S.H. Welch, Martin Marietta Energy Systems, Inc., Oak Ridge, TN; EG&G Idaho, Inc., Idaho Falls, ID

RCRA Closure of Eight Land-Based Units at the Y-12 Plant

CONF-880839; Closure and Decommissioning - Session 6, Proceedings of the Tenth Annual Department of Energy Low-Level Waste Management Conference, Denver, Colorado, August 30-September 1, 1988, 99 pp.; (pp. 1-27) (December 1988)

Eight land-based hazardous waste management units at the Oak Ridge Y-12 Plant are being closed under an integrated multi-year program. Closure plans for the units have been submitted and are in various stages of revision and regulatory review. These units will be closed by various combinations of methods, including liquid removal and treatment, sludge stabilization, contaminated sludge and/or soil removal, and capping. The closure of these sites will be funded by a new Department of Energy budget category, the Environmental Restoration Budget Category (ERBC), which is intended to provide greater flexibility in the response to closure and remedial activities. A major project, Closure and Post-Closure Activities (CAPCA), has been identified for ERBC funding to close and remediate the land units in accordance with RCRA requirements. Establishing the scope of this program has required the development of risk assessments and the preparation of an integrated schedule.

574
F.R. Van Ryn, Martin Marietta Energy Systems, Inc., Hazardous Waste Remedial Action Program, Oak Ridge, TN

Interim Action Proposed Plan: Mercury Tank Remediation at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee

Y/ER-18; 23 pp. (June 1991)

This proposed plan addresses the remediation of tanks which contain mercury-contaminated sediment at the Oak Ridge Y-12 Plant. The contaminated sediment has accumulated in the bottom of the tanks as a result of mercury-contaminated ground water pumped from the fan-room sumps in the basements of Buildings 9201-4 and 9201-5. Water pumped from these buildings passes through these tanks prior to discharging into Upper East Fork Poplar Creek. As the contaminated water flows through Upper East Fork Poplar Creek and East Fork Poplar Creek in the city of Oak Ridge, the potential exists for absorption of mercury by aquatic organisms. The purpose of this remediation effort is to reduce the risks associated with mercury in surface waters. Three alternatives for remediating the tanks were evaluated using the nine Comprehensive Environmental Response, Compensation, and Liability Act evaluation criteria. These alternatives were (1) take no action, (2) abandon the tanks in place, or (3) remove and dispose of contaminated sediment. Alternative 3 is recommended as the preferred alternative for remediating the tanks.

575
R.R. Turner, M.A. Bogle, R.B. Clapp, K.C. Dearstone, R.B. Dreier, T.O. Early, S.E. Herbes, J.M. Loar, P.D. Parr, and G.R. Southworth, Oak Ridge Y-12 Plant, Oak Ridge, TN; Oak Ridge National Laboratory, Oak Ridge, TN; H&R Technical Associates, Inc., Oak Ridge, TN; Science Applications International Corporation, Oak Ridge, TN

Remedial Investigation Work Plan for Bear Creek (Y02-S600) at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee

Y/ER/Sub-90/99928/2; 475 pp. (July 1991)

As part of its response to the Resource Conservation and Recovery Act (RCRA), the U.S. Department of Energy had agreed to further investigate contamination of Bear Creek and its

floodplain on the Oak Ridge Reservation. The contamination is thought to be the result of releases of hazardous waste or hazardous constituents from the Y-12 Plant solid waste management units (SWMU) located in the Bear Creek watershed. The proposed Bear Creek RCRA Facility Investigation has been modified to incorporate the requirements of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) into a Remedial Investigation (RI) Plan for Bear Creek. This document is the RI Plan for Bear Creek and its flood-of-record floodplain. The following assumptions were made in the preparation of this RI Plan: (1) that source-area ground-water monitoring will be conducted as a part of the comprehensive ground-water monitoring plan for the Bear Creek hydrogeologic regime; and (2) that postclosure activities associated with each SWMU do not explicitly include a comprehensive assessment of surface water, sediment, and floodplain soil contamination in Bear Creek and its tributaries. The RI Plan is thus intended to provide a more comprehensive evaluation of Bear Creek and its floodplain than that provided by the investigative monitoring and risk assessment activities associated with the ten individual SWMUs. RI activities will be carefully coordinated with other monitoring and assessment activities to avoid redundancy and to maximize the utility of data gathered during the investigation.

576
Oak Ridge Y-12 Plant, Oak Ridge, TN; Geraghty and Miller, Inc., Oak Ridge, TN

Draft Postclosure Permit Application for Bear Creek Hydrogeologic Regime at the Oak Ridge Y-12 Burial Grounds Hazardous Waste Disposal Unit

Y/ER/Sub-91/ALV96/3 (Draft); 320 pp. (September 1991)

This report describes closure plans and ground water information for the Y-12 Bear Creek burial grounds hazardous-waste disposal unit (HWDU). Wastes disposed in the HWDU include mop waters, ethylenediaminetetraacetic (EDTA) acids, oils and coolants, asbestos, solvents, salts, materials contaminated with radioisotopes, heavy metals, and debris.

577
Oak Ridge Y-12 Plant, Oak Ridge, TN

Revised RCRA Closure Plan for the Interim Drum Yard (S-030) at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee

Y/ER-19; 26 pp. (August 1991)

The Oak Ridge Y-12 Plant Interim Drum Yard (S-030) is an outdoor storage area for containerized hazardous waste. The yard is constructed of gravel on native soil and has no liner or containment system. Drums of waste are stored on wooden pallets. A list of wastes that are or have been stored at this facility is given. This report also discusses inventory removal, disposal, and decontamination.

578
U.S. Department of Energy, Oak Ridge Field Office, Oak Ridge, TN

DOE to Hold Public Meeting on Proposal to Reduce Mercury Releases from Y-12 Plant

DOE News (910716):1-2 (July 16, 1991)

The U.S. Department of Energy (DOE) Oak Ridge Field Office, and Martin Marietta Energy Systems, Inc., propose to reduce the amount of mercury-contaminated sediment and elemental mercury entering the storm sewer system from three tanks at the Y-12 Plant. The mercury contamination is the result of past uses of mercury at the Y-12 Plant, and are not the result of current releases. Three alternatives have been considered: (1) no action; (2) abandon tanks in place and reroute basement sump water from two buildings where mercury was formerly used; and (3) remove mercury-laden sediments from the tanks and improve the sediment-removal efficiency of the two other operational tanks. The third alternative is preferred by DOE in order to most effectively reduce mercury releases from the Y-12 Plant. This interim action complies with applicable Federal and State requirements, and is cost-effective. This cleanup plan allows DOE to reduce the amount of mercury entering the storm sewer system until a final cleanup plan can be completed at a later date.

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M.C. Brown, C. Edwards, and A.A. Beers, Westinghouse Hanford Company, Richland, WA; Washington State Department of Ecology, Olympia, WA

Efforts to Earn Public Support and Confidence in Hanford Site Cleanup Work

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 47-49) (September 1991)

Public involvement is needed for Hanford Site cleanup to succeed. If people do not know about, understand, and support cleanup, it will be more difficult and expensive. The Tri-Party Agreement calls for public involvement in decisions about cleanup options and schedules. This paper defines what public involvement means and how the Washington State Department of Ecology, U.S. Environmental Protection Agency, and the U.S. Department of Energy have conducted it. Experience and survey research have shown ways to improve performance. Efforts continue to open decision making earlier in the decision process, to share information that is clear and understandable, and to open channels of communication. This paper describes some of the highlights and lessons learned in public involvement in Hanford Site remediation.

580
R.F. Cote, Westinghouse Hanford Company, Richland, WA

Environmental Restoration Remedial Action Quality Assurance Requirements Document

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 727-728) (September 1991)

The Environmental Restoration Remedial Action Quality Assurance Requirements Document (QARD), DOE/RL 90-28, defines the quality assurance program requirements for the U.S. Department of Energy (DOE)/Richland Field Office's (RL's) Environmental Restoration Remedial Action (ERRA) Program at the Hanford Site. This paper describes the quality assurance (QA) objectives outlined in DOE/RL 90-28. The Hanford Site ERRA Program implements the significant commitments made by the DOE in the Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement), which DOE entered into with the Washington State Department of Ecology (Ecology) and the U.S. Environmental Protection Agency (EPA). From this Tri-Party Agreement arises the Hanford Site's new mission of environmental restoration, which requires the Richland Field Office and its contractors to implement and comply with multiple quality assurance program requirements specified in the agreement. The QARD combines and consolidates multiple or overlapping requirements, where they exist for similar activities, to avoid confusion and the misinterpretation of requirements by ERRA participants. The QARD integrates and tailors requirements for the 18 basic, supplementary, and non-mandatory appendices of the American Society of Mechanical Engineers QA program requirements manuals: ASME NQA-1 (ASME 1989a), and the other Consensus Standards - NQA-2 (ASME 1989b) and NQA-3 (ASME 1989c) - with (1) the appropriate QA provisions from certain articles of the Tri-Party Agreement; (2) EPA requirements and source documents; (3) DOE Orders and DOE-RL Orders; and (4) Ecology regulations. To integrate these diverse QA needs, the requirements within the QARD are source-coded to identify from which documents the requirements were derived.

581
M.C. Hughes, R.K. Wahlen, and R.A. Winship, Westinghouse Hanford Company, Richland, WA

Surplus Facilities and Resource Conservation and Recovery Act Closure Program Plan - Fiscal Year 1992

WHC-EP-0231-4; 148 pp. (October 1991)

The Surplus Facilities and Resource Conservation and Recovery Act Closure program is responsible to the U.S. Department of Energy Field Office,

Richland (DOE-RL) for the safe, cost-effective surveillance, maintenance, and decommissioning of surplus facilities at the Hanford Site. The Surplus Facilities and Resource Conservation and Recovery Act Closure program is also responsible to DOE-RL for the program management of specific Resource Conservation and Recovery Act (RCRA) closures at the Hanford Site. This program plan addresses only the surplus facilities. The criteria used to evaluate each factor relative to decommissioning are based on the guidelines presented by the DOE-RL Environmental Restoration Division. These guidelines are consistent with the Westinghouse Hanford Company's commitment to decommission Hanford Site retired facilities in the safest and most cost-effective way achievable. This document outlines the plan for managing these facilities until disposal.

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R.R. LaBarge and D.R. Dahl, Pacific Northwest Laboratory, Richland, WA

Development of a Hybrid Quality Assurance Plan for Resource Conservation and Recovery Act (RCRA) Ground-Water Monitoring Projects

PNL-SA-18876;CONF-891053;Environmental Monitoring, Restoration and Assessment: What Have We Learned?, R.H. Gray (ed.), Proceedings of the 28th Hanford Life Sciences Symposium, Richland, WA, October 16-19, 1989, 340 pp.; (pp. 257-260) (1989)

Quality assurance (QA) programs attempt to enhance the traceability, responsibility, and legal defensibility of project results and assure clients and regulators that work is performed according to established guidelines. Pacific Northwest Laboratory's (PNL's) QA program is based on the nationally recognized American National Standards Institute/American Society of Mechanical Engineers Standard NQA-1-1986. Because this standard was developed for the design, construction, and operation of nuclear facilities, the authors had to adapt and supplement their QA program with elements from QA programs developed by the U.S. Environmental Protection Agency. To provide documentation and traceability of all work related to Resource Conservation and Recovery Act ground water monitoring and to ensure that reproducible results are attained, PNL's hybrid QA plans address activities from initial planning through well installation, and from sample collection and transportation through sample analysis and data evaluation.

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L.E. Michael, Westinghouse Hanford Company, Richland, WA

Environmental Restoration Remedial Action Program Records Management Plan

WHC-EP-0430; 46 pp. (July 1991)

The U.S. Department of Energy-Richland Operations Office (DOE-RL) Environmental Restoration Field Office Management Plan (FOMP) describes the plans, organization, and control systems to be used for management of the Hanford Site environmental restoration remedial action program. The FOMP, in conjunction with the Environmental Restoration Remedial Action Quality Assurance Requirements document, provides all the environmental restoration remedial action program requirements governing environmental restoration work on the Hanford Site. The FOMP requires a records management plan be written. The Westinghouse Hanford Company Environmental Restoration Remedial Action (ERRA) Program Office has developed this ERRA Records Management Plan to fulfill the requirements of the FOMP. This records management plan will enable the program office to identify, control, and maintain the quality assurance, decisional, or regulatory prescribed records generated and used in support of the ERRA Program.

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J.M. Nickels, Westinghouse Hanford Company, Richland, WA

Quality Assurance Project Plan for Facility Effluent Monitoring Plan Activities - Environmental Assurance

WHC-EP-0446; 79 pp. (June 1991)

This Quality Assurance Project Plan addresses the quality assurance requirements for the facility monitoring plans of the overall site-wide environmental monitoring plan. The Quality Assurance Project Plan specifically applies to the sampling and analysis activities and continuous monitoring performed for all of the facility effluent monitoring plan activities conducted by Westinghouse Hanford Company. It is generic in approach and will be implemented in conjunction with the specific requirements of individual Facility Effluent Monitoring Plans. This document is intended to be the guidance document for preparing facility effluent monitoring plans, their determinations and their management plans. The implementing procedures, plans, and instructions are appropriate for the control of effluent monitoring plans requiring compliance with U.S. Department of Energy, U.S. Environmental Protection Agency, state, and local requirements. This Quality Assurance Project Plan contains a matrix of organizational responsibilities, procedural resources from facility or site manuals used in the facility effluent monitoring plans, and a list of the analytes of interest and analytical methods for each facility preparing a facility effluent monitoring plan.

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J.M. Nickels and D.R. Pratt, Westinghouse Hanford Company, Richland, WA

Management Plan for Facility Effluent Monitoring Plan Activities - Environmental Assurance

WHC-EP-0491; 11 pp. (August 1991)

The United States Department of Energy-Richland Operations Office Environmental Protection Implementation Plan, DOE/RL 89-19 (1989), requires the Hanford Site to prepare an environmental monitoring plan (EMP) by November 9, 1991. The Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance, DOE/EH-0173T (1991), provides additional guidance and requires implementation of the EMP within 36 months of the effective date of the rule. DOE Order 5400.1, the General Environmental Protection Program, requires each U.S. Department of Energy (DOE) site, facility, or activity that uses, generates, releases, or manages significant quantities of hazardous materials to prepare an EMP. This EMP is to identify and discuss two major activities: (1) effluent monitoring and (2) environmental surveillance. At the Hanford Site, the site-wide EMP will consist of the following elements: (a) A conceptual plan addressing effluent monitoring and environmental surveillance; (b) Pacific Northwest Laboratory (PNL) site-wide environmental surveillance program; (c) Westinghouse Hanford Company (Westinghouse Hanford) effluent monitoring program consisting of the near-field operations environmental monitoring activities and abstracts of each facility effluent monitoring plan (FEMP). This management plan addresses the third of these three elements of the EMP, the FEMPs.

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Pacific Northwest Laboratory, Environmental Management Operations, Richland, WA

Evaluation of the Hanford RI/FS Cost Projections - Appendixes, Volume 2 of 2

EMO-1033 (Vol. 2); 225 pp. (June 1991)

The U.S. Department of Energy-Richland Operations (DOE-RL) asked the Environmental Management Operations (EMO) to review the cost estimates and implementation process for the Hanford Remedial Investigation/Feasibility Study (RI/FS) Program as defined by the Hanford RCRA/CERCLA Past Practices Cost Models. The purpose of the review was to determine if there were opportunities to reduce the RI/FS costs at Hanford, with a focus on the approach being taken at Hanford to implement and complete the RI/FS process. This volume contains 4 appendices for the evaluation of the Hanford RI/FS Cost Projections.

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Pacific Northwest Laboratory, Environmental Management Operations, Richland, WA

Evaluation of the Hanford RI/FS Cost Projections - Appendixes, Volume 1 of 2

EMO-1033 (Vol. 1); 63 pp. (June 1991)

The U.S. Department of Energy-Richland Operations (DOE-RL) asked the Environmental Management Operations (EMO) to review the cost estimates and implementation process for the Hanford Remedial Investigation/Feasibility Study (RI/FS) Program as defined by the Hanford RCRA/CERCLA Past Particles Cost Model. The purpose of the review was to determine if there were opportunities to reduce the RI/FS costs at Hanford, with a focus on the approach being taken at Hanford to implement and complete the RI/FS process. Three specific tasks comprised the review. The first focused on the cost model assumptions to assess whether the assumptions, and resulting estimates were representative of the cost of performing work at Hanford. The second involved a detailed review of the regulatory pressure and other driving forces that define the scope and approach to be taken at Hanford. The purpose of the review was to develop recommendations on changes what would help streamline the past-practices process and reduce the cost and schedule. The third (Task 1C) provided a review of the scope and approach planned for two operable units (OUs), 100-HR-1 and 100-HR-3, as contained in their detailed draft RI/FS work plans. These work plans were reviewed for appropriate application of, and conformance to, the regulations and other requirements examined in the first two tasks.

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Future Use and Cleanup Strategy Alternatives: The Hanford Approach

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 43-45) (September 1991)

Nuclear weapons material production is no longer the mission of the Hanford Site, a 560 square mile area in southeastern Washington's Columbia Basin. Environmental remediation, including removal of radioactive and hazardous contaminants, waste management and disposal, decommissioning of old facilities, and restoration of land and groundwater, has become the site's major mission. The mission is conducted within the framework of the Tri-Party Agreement between the U.S. Department of Energy, the U.S. Environmental Protection Agency, and the State of Washington. There is broad public interest in cleanup and the future of the Hanford Site. A facilitated process to develop alternative future use and cleanup scenarios is about to begin. The process will introduce some traditional tools of land use planning alongside environmental regulations and cleanup technologies in order to develop an integrated vision. Many interests, including local governments, Indian Tribes, state and federal agencies, business, agriculture, labor, environmental, and recreational groups will be involved. It is hoped that a widely shared vision of the site's future will both guide and sustain support for cleanup and restoration.

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Privatization Provisions of H.R. 2100

Congressional Record 137(170):H10283 (November 18, 1991)

Representative Sid Morrison of Washington State addresses the U.S. House of Representatives, voicing his opposition to provisions of a conference report on HR 2100, the National Defense Authorizations Act for fiscal year 1992-93. Mr. Morrison is concerned over a section of the report regarding the privatization of U.S. Department of Energy waste management and environmental restoration programs. Specifically, he emphasizes the problem of job security and the disruption of families of workers currently employed at the Hanford Reservation in Washington state.

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W. Sanderson and K. Niles, Oregon Department of Energy, Office of the Director,

Salem, OR; Oregon Department of Energy, Nuclear Safety and Energy Facilities Division, Salem, OR

Effective Outreach is Good Public Policy

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 37-38) (September 1991)

Effective public outreach is good public policy. Effective outreach is defined as a proactive attitude, not a function. The attitude must be infused throughout the organization by enlightened management and role models. Effective outreach can be especially difficult if issues involve complex science and human emotions, including a general distrust of science and scientists and of government secrecy. The U.S. Department of Energy (DOE) must win and keep public confidence if cleanup of the Hanford Site and other nuclear defense facilities is to succeed. Candor, clarity, and timeliness in public information and involvement are essential to DOE success in environmental restoration.

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J.W. Schmidt, Westinghouse Hanford Company, Richland, WA

Operational Environmental Monitoring Program Quality Assurance Project Plan

WHC-EP-0538; 46 pp. (January 1992)

This Quality Assurance Project Plan is prepared to cover the environmental monitoring performed by Westinghouse Hanford Company as it implements the Operational Environmental Monitoring Program (OEMP). This plan applied to all sampling and monitoring activities performed by Westinghouse Hanford in implementing the OEMP at the Hanford Site. This Quality Assurance Project Plan is required by U.S. Department of Energy (DOE) Order 5400.1 (DOE 1999a) as a part of the Environmental Monitoring Plan (EMP) (DOE-RL 1991) and is used to show: (1) environmental measurement and sampling locations that determine ambient environmental levels from facility operations; (2) procedures and equipment needed to perform the measurement and sampling; (3) frequency and analyses required for each measurement and sampling location; (4) minimum detection level and accuracy; (5) quality assurance components; and (5) investigation and alarm levels.

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B.S. Sprouse, Westinghouse Hanford Company, Richland, WA

Development of an Administrative Record System and Information Repository System on the Hanford Site, Benton County, Richland, Washington

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 173-178) (September 1991)

This paper describes the development of an administrative record (AR) file system for the Hanford Site in Richland, Washington. An AR provides a concise record of events, studies, data, and other pertinent information documenting the decision process upon which each removal or remedial action is based. The AR, as established in Section 113 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) has two purposes: (1) to support the decision process, the judicial review of any issue concerning the adequacy of a response action is limited to the AR; and (2) the AR is a vehicle for public participation in the selection of response action, giving adequate notice and an opportunity to participate in this selection to all interested parties. The paper focuses on (a) the background of the AR system and its implementation at the Hanford Site; (b) the types of documents to be included in an AR file; (c) the management system used to develop and implement the AR system; (d) the unique characteristics of the AR system; and (e) the role of the information repositories.

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Hanford Site Past Practice Investigation Strategy

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 773-776) (September 1991)

The U.S. Department of Energy (DOE), U.S. Environmental Protection Agency (EPA), and the Washington State Department of Ecology (Ecology) have negotiated a strategy for performing Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and Resource Conservation and Recovery Act (RCRA) past practice investigations at the Hanford Site in a more streamlined, action-oriented manner. This strategy employs new concepts for (1) accelerating decision-making by maximizing use of existing data, consistent with data quality objectives, and (2) undertaking expedited response actions (ERAs) or interim remedial measures (IRMs), as appropriate, to either remove threats to human health, welfare, and the environment or to reduce risk by reducing the toxicity, mobility, or volume of the contaminants. Since the overall goal of the program is cleanup, much more emphasis will be placed on initiating and completing waste site cleanups through interim measures. While investigations and studies are important in meeting long-range goals, there is now agreement by the parties that a significant portion of near-term funding resources should be dedicated to remedial work, when sufficient information exists to plan and implement interim remedial measures. The initial stages of Hanford cleanup will optimize the use of interim cleanup actions when justified and practicable. Existing data will be evaluated as the initial basis for decision-making. If the data are found to be insufficient, additional essential data will be collected to support the IRM in a limited field investigation (LFI). Only data needed to formulate a conceptual model (source to pathway to receptor) and qualitative risk assessment would be obtained. The data quality objectives of the LFI will be established based on the use of the data in choosing IRMs. The data may not need to be of the same quality needed to support final records of decision (RODs), since the IRM itself would yield valuable information for supporting the final ROD. As IRMs are completed, the later stages of the program would involve more thorough assessment of cumulative risks and environmental effects. The objective is to achieve a real cleanup in a cost-effective manner in cases where it is obviously necessary to bring health and environmental risks to acceptable levels in the shortest possible time.

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HEIS: An Integrated Information System for Environmental Restoration and Monitoring at Hanford

CONF-911107; Proceedings of the American Nuclear Society Winter Meeting, San Francisco, CA, November 10-15, 1991; (5 pp.) (November 1991)

The U.S. Department of Energy's Hanford Site has about 1500 waste sites that contain a complex mixture of chemical and radioactive contaminants. After many years of environmental monitoring to assess the impact of Hanford operations on the environment, Hanford's mission is shifting to environmental restoration. The Hanford Environmental Information System (HEIS) is being developed to provide advanced tools to support environmental restoration and routine site-wide monitoring, and to aid scientists in understanding and conducting the restoration efforts. This paper describes some of the highlights and distinctive features of the HEIS.

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Public Comments and Responses to the 1989 Hanford Cleanup Five-Year Plan

DOE/RL-91-14; 189 pp. (June 1991)

In April 1990, the U.S. Department of Energy (DOE) issued a site-specific Five-Year Plan (DOE-RL 1989a) on Hanford's cleanup for public review and comment. The plan guides Hanford in carrying out DOE's national plan for

environmental restoration and waste management. During the 90-day public comment period, DOE held nine public meetings to answer questions and gather comments on the plan. This report is in three main sections. The first presents consolidated public comments and responses. These were compiled from both verbal comments from public meetings and written comments. The second section contains comments not responded to in this plan. Those comments were outside this plan's scope, were related to how public comments were gathered, or were intended for and directed to DOE-Headquarters. In the appendices are the written comment letters received and a short glossary and list of special terms used. The source of comments is shown in parentheses after the comment. The individual who made the comment, the city of the public meeting, or the organization name is generally used. When several sources gave the same comment, a source was not listed.

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U.S. Department of Energy, Richland Field Office, Richland, WA

Environmental Restoration and Waste Management Site-Specific Plan for Richland Operations Office

DOE/RL-91-25; 380 pp. (September 1991)

This document was prepared to implement and support the U.S. Department of Energy-Headquarters (DOE-HQ) national plan. The national plan, entitled Environmental Restoration and Waste Management Five-Year Plan (hereinafter referred to as the DOE-HQ Five-Year Plan), is the cornerstone of the U.S. Department of Energy (DOE) long-term strategy in environmental restoration and waste management. The DOE-HQ Five-Year Plan addresses overall philosophy and environmental and waste-related activities under the responsibilities of the DOE Office of Environmental Restoration and Waste Management. The plan also reaffirms DOE-HQ goals (1) to bring its nuclear sites into environmental compliance, in cooperation with its regulators and the public; and (2) to clean up and restore the environment by 2019 (the commitment for the Hanford Site is for one year sooner, or 2018). This document is part of the site-specific plan for the U.S. Department of Energy-Richland Operations Office (DOE-RL). It is the first revision of the original plan, which was dated December 1989. This document is a companion document to the Overview of the Hanford Cleanup Five-Year Plan and to the Hanford Site Environmental Restoration and Waste Management Five-Year Plan Activity Data Sheets. Although there are three documents that make up the complete DOE-RL site specific plan, this volume of detailed information was prepared so it could be used as a "stand-alone" document.

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U.S. Department of Energy, Richland Field Office, Richland, WA

Standard Review Plan for the Review of Environmental Restoration Remedial Action Quality Assurance Program Plans

DOE/RL-91-36; 224 pp. (September 1991)

This plan establishes both the scope of the review and the acceptance criteria to be utilized for the review of Quality Assurance Program Plans (QAPPs), developed in accordance with the requirements of DOE/RL-90-28. DOE/RL-90-28, the Environmental Restoration/Remedial Action Quality Assurance Requirements Document, defines all quality assurance requirements governing activities that affect the quality of the Environmental Restoration/Remedial Action program at the Hanford, Washington Site. The purpose of this document is to identify the scope of the review by the Department of Energy (DOE) Field Office, Richland staff, and to establish the acceptance criteria (Parts 1, 2, and 3) that the DOE Field Office, Richland staff will utilize to evaluate the participant QAPPs. Use of the standard review plan will (1) help ensure that participant QAPPs contain the information required by DOE/RL-90-28; (2) aid program participant and DOE Field Office, Richland staff is ensuring that the information describing the participant's QAPP is complete; (3) help persons regarding DOE/RL-90-28 to locate information; and (4) contribute to decreasing the time needed for the review process. In addition, the Standard Review Plan ensures the quality and uniformity of

the staff reviews and presents a well-defined base from which to evaluate compliance of participant quality programs against DOE/RL-90-28.

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Decommissioning of the 105-F and 105-H Fuel Storage Basins in the 100 Area at the Hanford Site

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 179-183) (September 1991)

An Environmental Impact Statement (EIS) was prepared to examine several alternatives for decommissioning the surplus production reactors at the Hanford Site. The EIS assumes that the fuel storage basins at the production reactors are free of reactor fuel elements before the final decommissioning begins. The 105-F and 105-H fuel storage basins are filled with debris and dirt that may cover spent fuel elements that were inadvertently left behind. This paper describes a project that will locate and remove any of these fuel elements, and will leave the facilities in a condition suitable to the decommissioning alternative selected by the EIS Record of Decision. There is a fuel storage basin at each of the surplus production reactor facilities. This basin served as a collection, storage, and transfer facility for the irradiated fuel elements discharged from the reactor. Each basin was approximately 24 meters wide by 30.5 meters long by 6 meters deep, and contained 6 meters of water as a coolant and shielding for the irradiated fuel. The fuel was stored in stainless steel baskets in aisles separated by 1-meter high concrete walls. Over the years, considerable sediment collected on the bottom of the basins. The sediment contains transuranics, fission products, and activated coolant materials. Each basin contains an estimated 50,000 kg of sediment. To begin stabilization of the basins, the water level was lowered to 0.6 meter. At this point, some of the fuel storage baskets were removed from the 105-H and 105-F basins. The wooden decking covering each of the basins was dropped into the basins. Monorail systems above each aisle of the basins were cut from the ceilings and dropped into the basins. Miscellaneous objects removed from the buildings were also placed in the basins, and the basins were backfilled. The backfill in the 105-F basin (approximately 3420 cu m) was obtained from the local surface and is essentially aeolian sand. The backfill in the 105-H basin (approximately 4400 cu m) was obtained from a nearby barrow pit and is mostly cobble, interspersed with rock up to 15 centimeters in diameter. Neither backfill was compacted. In 1990, a definitive design for remediation of the two basins was completed. During fiscal years 1991 and 1992, the soil and water in the two basins will be sampled and analyzed to define material removal, packaging, and disposal methods. The fill will be characterized for radionuclides and chemicals. An air handling and exhaust system will be installed in the work area. Water in the 105-H basin will be pumped out before backfill removal begins. A 150-horsepower vacuum will be used as the primary backfill removal system for the 105-F basin; small loader tractors and a belt conveyor system will be used along with the vacuum at the 105-H basin. Remotely operated equipment may be used for the removal of high dose rate items. Radiation and metal detectors will be mounted on the vacuum and conveyor systems. Material that is highly contaminated (greater than 100 mR/hr) will be placed in steel containers and sent to the 200 Area for disposal. Low-level radioactive and uncontaminated fill will be disposed of at approved locations. Fuel elements will be placed in certified shipping casks for transfer to 100-K Area basins. Hazardous waste will be removed for disposal at a Resource Conservation and Recovery Act-compliant facility. Mixed waste will be segregated from the other wastes to reduce waste volume. As the fill removal process nears the bottom of the basins, a layer of soil approximately 1 meter thick will be used for shielding. From that depth downward, only small areas at a time will be excavated. As the basin is cleared, the walls and floors will be either coated with a fixative for in-place decommissioning or stabilized for dismantlement, according to the selection of a remedial alternative in the Record of Decision.

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Management of Petroleum Underground Storage Tanks at the Hanford Site

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 817-821) (September 1991)

This report presents the timetables, responsible organizations, and methods required to comply with the newly promulgated Washington Administrative Code (WAC) 173-360 Underground Storage Tank (UST) Regulations which became effective December 29, 1990. This report only addresses UST systems that contain nonradioactive material. A total of 84 tanks at the Hanford Site are currently regulated under the State of Washington's WAC 173-360. In addition, 32 regulated tanks have been removed as a result of the federally mandated program and the newly implemented state regulations. The majority of the USTs at Hanford are operated by Westinghouse Hanford; however, one is operated by Kaiser Engineers Hanford (KEH) and one by Pacific Northwest Laboratories (PNL).

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Remedial Investigation Phase 2 Supplemental Work Plan for the Hanford Site 1100-EM-1 Operable Unit

DOE/RL-90-37 (Rev. 1); 127 pp. (September 1991)

The 1100 Area of the Hanford Site was designated a National Priorities List (NPL) site in July 1989. This NPL site was divided into four operable units, and the first equipment maintenance operable unit, 1100-EM-1, was assigned the highest priority. This summary focuses on major issues related to contaminant sources, meteorology, surface hydrology, geology, pedology, hydrogeology, and ecology. The 110-EM-1 Phase 1 Remedial Investigation (RI) report recommended further investigation at six waste management units assigned to or within the operable unit: (1) 1100-1 (Battery Acid Pit), an unlined dry sump, or french drain, used for the disposal of waste acid from vehicle batteries; (2) 1100-2 (Paint and Solvent Pit), a former sand and gravel pit subsequently used for the disposal of construction debris and, reportedly, waste paints, thinner, and solvents; (3) 1100-4 (Antifreeze Tank Site), the site of a former underground storage tank used for the disposal of waste vehicle antifreeze; (4) UN-1100-6 (Discolored Soil Site), the location of an apparent disposal event onto the ground surface involving a container of organic waste liquids; (5) Horn Rapids Landfill, a solid waste facility used primarily for the disposal of office and construction waste and the burning of classified documents; and (6) Ephemeral Pool, the location of the 1100 Area parking-lot-runoff accumulation during infrequent, high-intensity precipitation events. This remedial investigation supplemental work plan details the efforts for final characterization of the 1100-EM-1 Operable Unit that will provide data to be used for the evaluation of remedial operations in the Phase 3 1100-EM-1 feasibility study.

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U.S. Department of Energy, Richland Field Office, Richland, WA

Phase 1 and 2 Feasibility Study Report for the Hanford Site 1100-EM-1 Operable Unit

DOE/RL-90-32 (Rev. 1); 108 pp. (August 1991)

This draft of the Phase I and II Feasibility Study is based on data and conclusions from the Phase I Remedial Investigation Report for the Hanford Site 1100-EM-1 Operable Unit. No contamination of air or surface water occurs at the 1100-EM-1 Operable Unit, and contamination of groundwater will be addressed in the Phase III Feasibility Study. Chemicals of concern in soils are established to be bis(2-ethylhexyl)phthalate (BEHP) at the Discolored Soil Site, and polychlorinated biphenyls (PCBs) at the Horn Rapids Landfill. These data are summarized in Table 2-1. The following major conclusions from the Phase I Remedial

Investigation report are the basis for this Phase I and II Feasibility Study: Risks to humans are minimal, and risks to the environment are below levels of concern for any mechanism of transport considered.

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D.R. Brown, K.K. Daellenbach, P.L. Hendrickson, D.C. Kavanaugh, R.W. Reilly, D.L. Shankle, S.A. Smith, S.A. Weakley, T.A. Williams, and T.F. Grant, Pacific Northwest Laboratory, Richland, WA; Battelle Human Affairs Research Center, Seattle, WA

Analysis and Decision Document in Support of Acquisition of Steam Supply for the Hanford 200 Area

PNL-7991; 147 pp. (February 1992)

The U.S. Department of Energy (DOE) is now evaluating its facility requirements in support of its cleanup mission at Hanford. One of the early findings is that the 200-Area steam plants, constructed in 1943, will not meet future space heating and process needs. Because the 200 Area will serve as the primary area for waste treatment and long-term storage, a reliable steam supply is a critical element of Hanford operations. This Analysis and Decision Document (ADD) is a preliminary review of the steam supply options available to the DOE. The ADD contains a comprehensive evaluation of the two major acquisition options: line-term versus privatization. It addresses the life-cycle costs associated with each alternative, as well as factors such as contracting requirements and the impact of market, safety, security, and regulatory issues. Specifically, this ADD documents current and future steam requirements for the 200 Area, describes alternatives available to DOE for meeting these requirements, and compares the alternatives across a number of decision criteria, including life-cycle cost. DOE has currently limited the ADD evaluation alternatives to replacing central steam plants rather than expanding the study to include alternative heat sources, such as a distributed network of boilers or heat pumps. Thirteen project alternatives were analyzed in the ADD. One of the alternatives was the rehabilitation of the existing 200-East coal-fired facility. The other twelve alternatives are combinations of: (1) coal- or gas-fueled plants, (2) steam-only or cogeneration facilities, (3) primary or secondary cogeneration of electricity, and (4) public or private ownership.

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Facility Effluent Monitoring Plan Determinations for the 200 Area Facilities

WHC-EP-0440 (Vol. 1); 433 pp. (November 1991)

The following facility effluent monitoring plan determinations document the evaluations conducted for the Westinghouse Hanford Company 200 Area facilities (chemical processing, waste management, 222-S Laboratory, and laundry) on the Hanford Site in south-central Washington State. These evaluations determined the need for facility effluent monitoring plans for the 200 Area facilities. The facility effluent monitoring plan determinations have been prepared in accordance with "A Guide for Preparing Hanford Site Facility Effluent Monitoring Plans," WHC-EP-0438 (WHC 1991). The Plutonium/Uranium Extraction Plant and UO3 facility effluent monitoring plan determinations were prepared by Los Alamos Technical Associates, Richland, Washington. The Plutonium Finishing Plant, Transuranic Waste Storage and Assay Facility, T Plant, Tank Farms, Low Level Burial Grounds, and 222-S Laboratory determinations were prepared by Science Applications International Corporation of Richland, Washington. The B Plant Facility Effluent Monitoring Plan Determination was prepared by ERCE Environmental Services of Richland, Washington.

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U.S. Department of Energy, Richland Field Office, Richland, WA

Request for Interim Approval to Operate 218-E-12B Trench 94 as a Chemical Waste Landfill for Disposal of Polychlorinated Biphenyl Wastes in Submarine Reactor Compartments

DOE/RL-90-12; 59 pp. (February 1990)

This request from the U.S. Department of Energy, Richland Operations Office (DOE-RL), to the U.S. Environmental Protection Agency (EPA), Region 10, seeks interim approval for DOE to operate a chemical waste landfill for the disposal of polychlorinated biphenyl (PCB) wastes. This request applies only to disposal of these wastes in the Trench 94 of the 218-E-12B burial ground in the 200 East Area of the Hanford Site. Interim approval is requested for a period not to exceed five years. The request covers only the disposal of small quantities of solid PCB wastes contained in decommissioned submarine reactor compartments (SRCs). Trench 94 is used for the final disposal of U.S. Navy SRCs; currently, there are eight SRCs in the trench. At the time of their disposal to the trench, the Navy was unaware that there are large amounts of PCBs in the sound-damping felt that is part of the interior hulls of six of the SRCs. After the Navy discovered this fact in 1989, it committed to the Washington State Department of Ecology to remove the PCB-containing felt from the six SRCs by mid-1990. The felt was removed from the two other SRCs before they were placed in Trench 94. While reviewing the SRCs for other hazardous, potentially regulated materials, the Navy identified (1) small amounts of PCBs in some solid components and (2) lead in the reactor shielding; the disposal of the small quantities of other hazardous materials that the Navy found in the SRCs is not regulated. Other than the PCBs in the sound-damping felt, there are less than 3 pounds of PCBs in the solid components of the SRCs. Since hazardous materials on the Hanford Site are regulated by EPA, DOE is making this request so that the small amounts of PCBs and lead in the SRCs can remain in place after their disposal to Trench 94. Disposal of the wastes will be conducted in accordance with the Memorandum of Agreement between DOE-RL and EPA. During the five-year interim period covered by this request, DOE-RL will seek final approval for operation of Trench 94 as a chemical waste landfill and will seek a final dangerous waste permit from the Washington State Department of Ecology for the disposal of the lead in the SRCs. This request demonstrates how Trench 94 will be operated to comply with the Toxic Substances Control Act (TSCA) and the TSCA regulations at 40 CFR 761. Chapter 2 provides a general background and history of Trench 94 as it relates to the operation of a chemical waste landfill. Chapter 3 provides information on site characteristics. Chapter 4 is a description of the wastes received at Trench 94. Chapter 5 is an operation plan for Trench 94, as required under 40 CFR 761.75(b)(8)(ii). Chapter 6 addresses the risk associated with operating Trench 94 for the five-year interim approval period. Chapter 7 demonstrates how operation of the chemical waste landfill during the interim period will comply with specific requirements of 40 CFR 761.75; it also describes how DOE-RL is seeking waivers for some of the requirements during the interim period. Requests for the waivers are made in Chapter 8. These requests indicate that operation of Trench 94 during the interim approval period, without a liner and leachate collection system and with the existing site ground-water monitoring program, will not present an unreasonable risk to human health and the environment.

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200-UP-2 Operable Unit Technical Baseline Report

WHC-EP-0400; 133 pp. (February 1991)

This report is prepared in support of the development of a Remedial Investigation/Feasibility Study (RI/FS) Work Plan for the 200-UP-2 Operable Unit. It provides a technical baseline of the 200-UP-2 Operable Unit, gives the results from an environmental investigation undertaken by the Technical Baseline Section of the Environmental Engineering Group, Westinghouse Hanford Company. The 200-UP-2 Operable Unit Technical Baseline Report is based on review and evaluation of numerous Hanford Site reports, drawings, and photographs, and is supplemented with Hanford Site inspections and employee interviews. No field investigations or sampling were conducted. Each waste site in the 200-UP-2 Operable Unit is described separately. Close relationships between waste units, such as overflow from one to another, are also discussed. The 200-UP-2 Operable Unit consists of liquid-waste disposal sites in the vicinity of, and

related to, U Plant operations in the 200 West Area of the Hanford Site. The "U Plant" refers to the 221-U Process Canyon Building, a chemical separations facility constructed during World War Two. It also includes the Uranium Oxide Plant, which was constructed at the same time and, like the 221-U Process Canyon Building, was later converted for other missions. Waste sites in the 200-UP-2 Operable Unit are associated with the U Plant Uranium Metal Recovery Program mission that occurred between 1952 and 1958 and the Uranium Oxide 3 Plant's ongoing uranium oxide mission. The waste sites include one or more cribs, reverse wells, french drains, septic tanks and drain fields, trenches, catch tanks, settling tanks, diversion boxes, waste vaults, and the lines and encasements that connect them.

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U.S. Department of Energy, Richland Field Office, Richland, WA

2101-M Pond Closure Plan - Revision 1

DOE/RL-88-41 (Rev. 1); 776 pp. (March 1991)

This document describes activities for the closure of a surface impoundment, the 2101-M Pond, operated by the U.S. Department of Energy-Richland Operations Office (DOE-RL) and the Westinghouse Hanford Company (Westinghouse Hanford). Although the U.S. Government holds legal title to this facility, DOE-RL is considered the legal owner of the facility under existing U.S. Environmental Protection Agency (EPA) interpretive regulations (EPA 1986f) for the purposes of defining Resource Conservation and Recovery Act of 1976 (RCRA) facilities. The 2101-M Pond will be closed in accordance with the requirements of the Hanford Federal Facility Agreement and Consent Order.

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Facility Effluent Monitoring Plan for the 2724-W Protective Equipment Decontamination Facility

WHC-EP-0471; 51 pp. (November 1991)

A facility effluent monitoring plan is required by the U.S. Department of Energy in DOE Order 5400.1, for any operations that involve hazardous materials and radioactive substances that could impact employee or public safety or the environment. This document is prepared using the specific guidelines identified in "A Guide for Preparing Hanford Site Facility Effluent Monitoring Plans," WHC-EP-0438. This facility effluent monitoring plan assesses effluent monitoring systems and evaluates whether they are adequate to ensure the public health and safety as specified in applicable federal, state, and local requirements. This facility effluent monitoring plan is the first annual report. It shall ensure long-range integrity of the effluent monitoring systems by requiring an update whenever a new process or operation introduces new hazardous materials or significant radioactive materials. This document must be reviewed annually even if there are no operational changes, and it must be updated at a minimum of every three years.

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Facility Effluent Monitoring Plan Determinations for the 300 Area Facilities - Environmental Assurance

WHC-EP-0441; 123 pp. (August 1991)

Facility effluent monitoring plan determinations were conducted for the Westinghouse Hanford Company 300 Area facilities on the Hanford Site. These determinations have been prepared in accordance with "A Guide For Preparing Hanford Site Facility Effluent Monitoring Plans." Sixteen Westinghouse Hanford Company facilities in the 300 Area were evaluated: 303 (A, B, C, E, F, G, J and K), 303 M, 306 E, 308, 309, 313, 333, 334 A, and the 340 Waste Handling Facility. The 303, 306, 313, 333, and 334 facilities Facility Effluent Monitoring Plan determinations were prepared by Columbia Energy and Environmental Services of Richland, Washington. The 340 Central Waste Complex determination was prepared by Bovay Northwest, Incorporated. The 308 and 309 facility

determinations were prepared by Westinghouse Hanford Company. Of the 16 facilities evaluated, 3 will require preparation of a facility effluent monitoring plan: (1) the 313 N Fuels Fabrication Support Building, (2) the 333 N Fuels Fabrication Building, and (3) the 340 Waste Handling Facility.

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Floodplains Wetland Involvement for the Proposed Remedial Investigation of the 300-FF-5 Operable Unit of the Hanford Site, Richland, WA

Federal Register 56(76):16081 (April 19, 1991)

Under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980, as amended, U.S. Department of Energy proposes to perform the Remedial Investigation/Feasibility Study (RI/FS) of the 300-FF-5 groundwater operable unit on the Hanford Site, Richland, Washington. The RI/FS will consist of compilation of existing data and on-site studies to characterize the impact of waste disposal activities in the 300-FF-1, 300-FF-2, and 300-FF-3 operable units on the groundwater system. The information will be used to determine appropriate remediation activities for the operable unit. The specific activities, which may occur within the 100-year floodplain, include geophysical surveys, hydrostratigraphy studies, surface-water and sediment investigations, and biota investigations. None of these tasks requires major construction activities. The hydrostratigraphy studies may require the drilling of wells in the floodplain, depending on the results of earlier tasks in the RI/FS. Disturbances to the floodplain and wetlands adjacent to the Columbia River will be limited primarily to pedestrian traffic necessary to collect samples, monitor water levels, and perform surveys with non-intrusive instruments. Following completion of the characterization, remedial action strategies and alternatives will be prepared for the removal and remediation of the contamination from the operable unit.

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Waste Management Plan for the Oak Ridge National Laboratory Remedial Investigation/Feasibility Study

ORNL/RAP/Sub-87/99053/10; 144 pp. (April 1988)

In accordance with the requirements of the Remedial Investigation/Feasibility Study (RI/FS) Project Quality Assurance Plan, this waste management plan establishes clear lines of responsibility and authority, documentation requirements, and operational guidance for the collection, identification, segregation, classification, packaging, certification, and storage/disposal of wastes. These subjects are discussed in the subsequent sections of this document.

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Remedial Investigation of a Superfund Site

CONF-900802; Proceedings of the American Chemical Society National Meeting, Washington, DC, August 26-31, 1990, 43 pp.; (19 pp.) (1990)

Over the past 2 years, the authors prepared the baseline public health assessment for the Lawrence Livermore National Laboratory (LLNL) Livermore, California Site, a Superfund Site. To accomplish this assessment they (1) monitored environmental media on and near the LLNL site (e.g., air, water, and soil) for contamination; (2) screened this monitoring data to identify the chemicals of potential concern; and (3) developed pathway-exposure factors (PEFs), and in some cases, cancer-potency factors (CPFs) for the chemicals of concern so that unremediated concentrations predicted in environmental media on the basis of the monitored data could be translated into estimated total potential risk to hypothetically exposed individuals on-site and

off-site. The methodologies that were used to complete this assessment and the results of their application are described.

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Hydrostratigraphic Analysis of the Pilot Remediation Test Area

UCRL-CR-108063; 165 pp. (August 1991)

Aquifer heterogeneity at the Pilot Remediation Test Area, Lawrence Livermore National Laboratory (LLNL), Livermore, California, was characterized using a three-step approach. Characteristic hydraulic conductivity (K) ranges were defined for LLNL aquifer sediments based on analysis of geologic, hydraulic, and geophysical data from LLNL monitoring wells. Using these K ranges, detailed sedimentologic core descriptions, facies analysis, and previous geologic and hydrogeologic studies, hydrogeologic facies assemblages were established. Preliminary hydrostratigraphic interpretations (hydraulic conductivity cross-sections) were constructed, then revised and refined through the use of hydraulic drawdown maps of three stratigraphic intervals within the study area's aquifer system.

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Logs of Wells and Boreholes Drilled During Hydrogeologic Studies at Lawrence Livermore National Laboratory Site 300, June 30, 1988 - December 31, 1990

UCID-21536 (Add. 1); 614 pp. (1990)

This addendum 1 to the Logs of Wells and Boreholes Drilled During Hydrogeologic Studies at Lawrence Livermore National Laboratory (LLNL) Site 300 (June 1, 1982-June 30, 1988) presents hydrogeologic well logs for monitor wells and boreholes drilled between June 30, 1988 and December 31, 1990 at Lawrence Livermore National Laboratory (LLNL) Site 300. In addition, a composite log is included of wells W-827-04 and W-827-05 (well W-827-05 was completed early in January 1991). Both of these wells have significantly contributed to interpretation of the geology and hydrogeology of Site 300. Also included are several logs of boreholes and wells drilled as part of the Building 833 Complex remedial investigation. To date, a total of 430 monitor wells and 215 exploratory boreholes have been drilled as part of studies made to determine the horizontal and vertical distribution of volatile organic compounds, high-explosive compounds, and tritium in soil, rock, and ground water at Site 300. The summary section, entitled "Site 300 Geology," provides a context for the well and borehole logs. As new monitor wells and boreholes are drilled as part of investigations at Site 300, addendums to the well log book will be published. A commercially available mainframe computer program, LOGGER, developed by Rockware, Inc., and modified at LLNL, has been used since late 1985 to generate these logs. This program has since been rewritten for personal computer compatibility and the computer-aided design (CAD) system. The CAD system produces hydrogeologic cross sections and fence diagrams, utilizing the digitized form of these logs.

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D.A. Cirrincione and D.B. Costain, EG&G Rocky Flats, Inc., Golden, CO

Rocky Flats Plant Site Environmental Report - January-December 1990

RFP-ENV-90; 233 pp. (1990)

This report provides information to the public about the impact of the Rocky Flats Plant on the environment and public health. The report contains a compliance summary, a description of environmental monitoring programs, and radiation dose estimates for the surrounding population for the period January 1 through December 31, 1990. An environmental surveillance program has been ongoing at the Rocky Flats Plant since the 1950s. Early programs focused on radiological impacts to the environment. The current program examines potential impacts to air, surface water, groundwater, and soils from radiological and

nonradiological sources. Environmental operations at Rocky Flats Plant are under the jurisdiction of several local, state, and federal agencies, most notably the Colorado Department of Health, the U.S. Environmental Protection Agency, and the U.S. Department of Energy. A variety of reports are prepared at different intervals for these and other agencies, in addition to the annual environmental report.

615
U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, DC

Superfund Record of Decision (EPA Region 8): Rocky Flats Plant (DOE), Northern Jefferson County, CO - First Remedial Action, January 1990 - Final report

PB-91-921487/XAB; EPA/ROD/R08-90/043; 428 pp. (January 5, 1990)

The 6550-acre Rocky Flats Plant Site is a federal facility which serves as a nuclear-weapons research, development, and production complex in Jefferson County, Colorado. Surrounding land use is primarily rural-presidential, although there are some industrial properties nearby. The site overlies an alluvial/colluvial aquifer, and a small wetlands area is present. Since 1951, on-site operations have included the manufacture of nuclear-weapons components from plutonium, uranium, beryllium, and stainless steel. There are twelve sites designated as solid waste management units which comprise the 881 Hillside area. In 1987, U.S. Environmental Protection Agency (EPA) identified VOC-contaminated ground water in the 881 Hillside area. The Record of Decision (ROD) addresses management of migration and cleanup of ground water in the 881 Hillside area. The primary contaminants of concern affecting the ground water are volatile organic compounds, metals including chromium, and radioactive materials.

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R.T. Ogg and J.T. Crone, EG&G Rocky Flats, Inc., Golden, CO

RCRA Closures at Rocky Flats Plant: A Programmatic Perspective and Case Study

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 75-80) (September 1991)

The Rocky Flats Plant (RFP), managed and operated by EG&G Rocky Flats, Inc., is located approximately sixteen miles northwest of Denver along the eastern edge of the southern Rocky Mountain Region. The RFP consists of approximately 6550 acres of federal land. An Interagency Agreement (IAG) about hazardous waste sites at the RFP was signed by the U.S. Department of Energy (DOE), the U.S. Environmental Protection Agency (EPA), and the Colorado Department of Health on January 22, 1991. The IAG integrates unique mechanisms for remediation at RFP, which include utilizing Resource Conservation and Recovery Act (RCRA) and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) technical and regulatory processes. Under the IAG, sixteen operable units (OUs) at RFP were defined for characterization and remediation. Of the sixteen OUs, six are classified as interim status RCRA closure units: (1) Solar Evaporation Ponds - OU4; (2) Present Landfill - OU7; (3) Original Process Waste Lines - OU9; (4) Other Outside Closures - OU10; (5) Waste Spray Field - OU11; and (6) Inside Building Closures - OU15. The IAG will function as a technical and regulatory mechanism for managing remediation and complying with all aspects of the interim status RCRA closure units at RFP. In accordance with the IAG, all the interim status RCRA closure units except OU15 (Inside Building Closures) will be addressed in two phases. Phase I addresses sources of contamination and soil remediation and Phase II addresses ground and surface water, air, the environment, and biota. This paper describes the six interim status RCRA closure OUs. It also reports on a case study of the RCRA Facility Investigation/Remedial Investigation (RFI/RI) at OU7, which includes the Present Landfill and the Inactive Hazardous Waste Storage Area. The final draft of the Phase I RFI/RI Work Plan has been submitted for review to the three agencies that are

parties to the IAG. Work at OU7 is scheduled to begin in August 1992.

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J.H. Lee, G.P. Martins, and J.R. Weldner, EG&G Idaho, Inc., Idaho Falls, ID

Characterization Studies on: (A) Contaminated Batch of Rocky Flats Soil (B) Uncontaminated Batch of INEL Soil

EGG-WTD-9749; 50 pp. (June 1991)

Transuranic waste (TRU)-contaminated soil samples collected near Rocky Flats 903 Pad and uncontaminated INEL soil collected from the Lost River Spreading Area A, adjacent to the Radioactive Waste Management Complex, were characterized in the analytical facilities of the Department of Metallurgical and Materials Engineering, Colorado School of Mines. The soils were characterized in terms of chemical, physical, and mineralogical properties that were judged to be important for separating hazardous materials from the soil matrix. These properties include particle size distribution, density measurements, determination of micro-morphology, micro-chemical analysis, cation exchange capacity, and mineralogical and chemical analysis. The results indicate that the two soils are distinctly different from one another, but share some features. Rocky Flats soils contain (by weight) about 47% quartz, 38% clay minerals, 13% feldspars, and minor constituents. INEL soil contains (by weight) about 37% quartz, 48% clay minerals, 10% calcite, and minor constituents. The cation exchange capacities of each soil are low and are approximately the same when ashed. The radioactivity, relative to unclassified soil, as a function of particle size suggests that TRU metals are concentrated by a factor of approximately 20% in the less-than-300-mum particle-size fraction.

618
U.S. Department of Energy, Office of Environmental Audit, Washington, DC

Environmental Audit of the Grand Junction Projects Office

DOE/EH-0207P; 302 pp. (August 1991)

The Grand Junction Projects Office (GJPO) is located in Mesa County, Colorado, immediately south and west of the Grand Junction city limits. The U.S. Atomic Energy Commission established the Colorado Raw Materials Office at the present-day Grand Junction Projects Office in 1947, to aid in the development of a viable domestic uranium industry. Activities at the site included sampling uranium concentrate; pilot-plant milling research, including testing and processing of uranium ores; and operation of a uranium mill pilot plant from 1954 to 1958. The last shipment of uranium concentrate was sent from GJPO in January, 1975. Since that time, the site has been utilized to support various Department of Energy programs, such as the former National Uranium Resource Evaluation Program, the Uranium Mill Tailings Remedial Action Project, the Surplus Facilities Management Program, and the Technical Measurements Center. All known contamination at GJPO is believed to be the result of past uranium milling, analyses, and storage activities. Hazards associated with the wastes impounded at GJPO include surface and ground-water contamination and potential radon and gamma-radiation exposure. This report documents the results of the Baseline Environmental Audit conducted at Grand Junction Projects Office. The Grand Junction Baseline Environmental Audit was conducted from May 28 to June 12, 1991, by the Office of Environmental Audit (EH-24). This audit evaluated environmental programs and activities at GJPO, as well as GJPO activities at the state-owned temporary repository.

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D.W. Brown, C.A. Biedermann, V.E. Molesch, M.W. Parker, and G.C. Smith, General Electric Company, Pinellas Plant, Largo, FL

Pinellas Plant Site Environmental Report for Calendar Year 1990 - Environmental Health and Safety Programs: Revision A

NDPP-OSP-0053 (Rev. A); 120 pp. (August 9, 1991)

The purposes of this report are: (1) to present a summary of the environmental data collected in calendar year 1990 at the Pinellas Plant; (2) to characterize site environmental management performance; (3) to report compliance with

applicable environmental standards and requirements; and (4) to highlight significant programs and efforts. This report is required by U.S. Department of Energy (DOE) Orders 5400.1 and 5484.1. Information presented in this report is based on the Environmental Monitoring Program conducted at the Pinellas Plant in calendar year 1990. This monitoring program is designed to detect possible releases of radioactive and nonradioactive material to the air, surface water, groundwater and soil during plant operations. In addition, monitoring is done to detect effects of pollution on the plant site from external sources. More than 70 on- and off-site locations are used in the monitoring program.

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R.M. Lugar, EG&G Idaho, Inc., Idaho Falls, ID

Health and Safety Plan for Operations Performed for the Environmental Restoration Program - Task: Vapor Vacuum Extraction

EGG-WM-9732; 140 pp. (July 1991)

This document constitutes the generic health and safety plan for the Environmental Restoration Program (ERP). It addresses the health and safety requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA); Occupational Safety and Health Administration (OSHA) 29 CFR 1910.120 standard; and EG&G Idaho, Inc. This plan is a guide to individuals who must complete a health and safety plan for a task performed for the ERP. It contains a task-specific addendum that, when completed, specifically addresses task specific health and safety issues. This health and safety plan reduces the time it takes to write a task specific health and safety plan by providing discussions of requirements, guidance on where specific information is located, and specific topics in the addendum that must be discussed at a task level. This format encourages a complete task specific health and safety plan and a standard for all health and safety plans written for ERP. This plan also incorporates the "Health and Safety Plan for Operations Performed for the Environmental Restoration Program" (EGG-WM-8771, Rev. 1), with an addendum completed for vapor vacuum extraction (VVE). The VVE project includes sampling and analysis of gas concentrations in monitors and open wells, measurement of pressures in monitoring wells, measurement of extraction-well gas and system operational parameters in support of characterizing the volatile organic compounds contamination beneath the subsurface disposal area of the Radioactive Waste Management Complex, calibrating the organic transport model and prevailing engineering data for a final remedial action.

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S.J. Wegner and L.J. Campbell, U.S. Geological Survey, Idaho Falls, ID; Idaho Department of Water Resources, Boise, ID

Radionuclides, Chemical Constituents, and Organic Compounds in Water from Designated Wells and Springs from the Southern Boundary of the Idaho National Engineering Laboratory to the Hagerman Area, Idaho, 1989

DOE/ID-22098; 53 pp. (June 1991)

The U.S. Geological Survey and the Idaho Department of Water Resources, in response to a request from the U.S. Department of Energy, have completed the initial phase of a long-term project to monitor the quality of water in the Snake River Plain aquifer, from the southern boundary of the Idaho National Engineering Laboratory to the Hagerman area, Idaho. Fifty-five water samples were collected and analyzed for manmade pollutants and naturally occurring contaminants. The samples were collected from 26 irrigation wells, 13 domestic wells, 5 springs, 4 stock wells, 3 dairy wells, 2 observation wells, 1 commercial well, and 1 public-supply well. Six quality assurance samples also were collected and analyzed. All water samples were analyzed for selected radionuclides, chemical constituents, and organic compounds. The maximum contaminant level established by the U.S. Environmental Protection Agency for gross alpha-particle radioactivity was exceeded in one sample; the maximum contaminant level for mercury also was exceeded in one sample. Both of these sampling locations are downgradient from many of the sampling locations in which gross-alpha radioactivity and mercury

concentrations were less than maximum-contaminant levels. Concentrations of diazinon and malathion exceeded the reporting level in two water samples. One water sample and its quality assurance replicate contained reportable concentrations of DDT.

622
Westinghouse Idaho Nuclear Company, Inc., Idaho Falls, ID

ICPP Environmental Monitoring Report, CY 1989

WINCO-1085; 69 pp. (January 1991)

Summarized in this report are the data collected through Environmental Monitoring programs conducted at the Idaho Chemical Processing Plant (ICPP) by the Environmental Assurance (EA) Section of the Environmental Compliance and SIS Operations (EC/SIS) Department. Published in response to U.S. Department of Energy (DOE) Order 5484.1, Chapter 3, this report covers the period from December 20, 1988 through December 19, 1989. The ICPP is responsible for complying with all applicable Federal, State, Local and DOE Rules, Regulations and Orders. Radiological effluent and emissions are regulated by the DOE in accordance with the Derived Concentration Guides (DCGs) as presented in DOE Order 5,400.05, and the State of Idaho Maximum Permissible Concentrations (MPCs). The Environmental Protection Agency (EPA) regulates all nonradiological waste resulting from the ICPP operations including all airborne, liquid, and solid waste. The EA Section completed a Quality Assurance (QA) Plan for Environmental Monitoring activities during the third quarter of 1986. QA activities have resulted in the ICPP's implementation of the Environmental Protection Agency rules and guidelines pertaining to the collection, analyses, and reporting of environmentally related samples. Where no approved methods for analyses existed for radionuclides, currently used methods were submitted for EPA approval.

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R.G. Baca, J.C. Walton, A.S. Rood, and M.D. Otis, EG&G Idaho, Inc., Idaho Falls, ID; Idaho National Engineering Laboratory, Idaho Falls, ID

Organic Contaminant Release from a Mixed Waste Disposal Site: A Computer Simulation Study of Transport through the Vadose Zone and Site Remediation

CONF-880839; Site Performance Assessment - Session 2, Proceedings of the Tenth Annual Department of Energy Low-Level Waste Management Conference, Denver, Colorado, August 30-September 1, 1988, 161 pp.; (pp. 113-125) (December 1988)

Migration of organic contaminants from mixed-waste disposal sites is emerging as a increasingly significant environmental problem. Organic contaminants, particularly in the vapor phase, can pose a health hazard to workers in the vicinity of the disposal site and can cause contamination of the underlying aquifer. Volatile organic chemicals such as carbon tetrachloride, chloroform, and trichloroethylene are frequently encountered at waste sites. These chlorinated hydrocarbons are relatively common chemicals and are widely used as industrial solvents. Problems with organic vapors have been noted at waste disposal sites at a number of U.S. Department of Energy (DOE) facilities. At the Idaho National Engineering Laboratory, for example, problems with organic vapors (Laney, et al., 1988) have occurred at the Radioactive Waste Management Complex (RWMC). Analyses of soil-gas samples and ground water samples indicate that organic vapors are being emitted from disposal pits in the Subsurface Disposal Area (SDA) of the RWMC. The primary source of the organic vapor has been determined to be organic wastes that were disposed at the site in the mid-1960's. To address the organic problems at the RWMC, a multi-task activity was initiated. The first task involved a records search to determine the quantities and distribution of organic wastes. The second task consisted of a detailed soil-gas survey to identify the specific disposal areas that are producing the organic vapors.

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D. Counce-Brown, Martin Marietta Energy

Systems, Inc., Oak Ridge, TN; Paducah Gaseous Diffusion Plant, Paducah, KY

Paducah Gaseous Diffusion Plant Environmental Report for 1990

ES/ESH-18/V3; 294 pp. (September 1991)

This two-part report, the Paducah Gaseous Diffusion Plant Site Environmental Report for 1990, is published annually. It reflects the results of a comprehensive, year-round program to monitor the impact of operations at Paducah Gaseous Diffusion Plant (PGDP) on the area's ground water and surface waters, soil, air quality, vegetation, and wildlife. In addition, an assessment of the effect of PGDP effluents on the resident human population is made. PGDP's overall goal for environmental management is to protect the environment and PGDP's neighbors and to maintain full compliance with all current regulations. The current environmental strategy is to identify any deficiencies and to develop a system to resolve them. The long-range goal of environmental management is to minimize the source of pollutants, to reduce the formation of waste, and to minimize hazardous waste by substitution of materials.

625

Allied-Signal Aerospace Company, Kansas City Division, Kansas City, MO

Annual Site Environmental Report for Calendar Year 1990, United States Department of Energy, Kansas City Plant, Kansas City, Missouri

KCP-613-4578; 198 pp. (May 1991)

The purpose of this report is to present a summary of the environmental data for the Kansas City Plant, characterize site environmental management performance, provide compliance status with applicable environmental standards and requirements, and highlight significant achievements, programs, and efforts which go beyond regulatory requirements. This report is required by the U.S. Department of Energy (DOE) Order 5400.1 (General Environmental Protection Program). Information presented in this report is based on an environmental monitoring program conducted at the Allied-Signal Inc., Kansas City Division in 1990. This monitoring program is designed to measure non-radiological releases to the air, water (surface and ground), and soil during historical/routine operations and to detect any accidental non-radioactive releases. Over 123 monitoring wells (some with multiple completions), ten sampling points at the uv/ozone system, three air stations, and sampling results from four outfalls, nine surface water sites, and one sanitary discharge are used in the monitoring program. No radioactive materials are machined or processed at this plant.

626

P.D. Grimm, U.S. Department of Energy, Office of Environmental Restoration and Waste Management, Washington, DC

Floodplain Involvement Notification for Environmental Restoration Activities at the Department of Energy Kansas City Plant Located in Kansas City, MO

Federal Register 56(203):52539-41 (October 21, 1991)

Federal regulations 10 CFR Part 1022 require U.S. Department of Energy to evaluate actions it may take in a floodplain to ensure protection of the floodplain in decision-making. As soon as practicable after a determination that a floodplain may be involved, the regulations require that public notice be published in the Federal Register, including a description of the proposed action and its location. DOE proposes several corrective actions related to the Environmental Restoration Program at the DOE Kansas City Plant (KCP), which is located on a floodplain. Many of the beneficial characteristics of floodplains have been lost through construction of buildings, parking lots, and flood-control levees. The proposed actions include: (1) a series of site investigations through the Research Conservation and Recovery Act (RCRA) Facility Investigation process to determine the presence or absence of contamination, the vertical and horizontal extent of contamination, and risks to human health and the environment; (2) interim measure groundwater treatment that consists of pumping and treating contaminated groundwater to contain and

remediate the contaminated groundwater plumes; (3) interim measure actions at the Department 27 Outside site to remove shallow soil polychlorinated biphenyl (PCB) contamination; (4) remediation of deep PCB contaminated soil from the Abandoned Indian Creek Outfall site; and (5) future interim and final remedial actions that will be required under the RCRA 3008(h) Administrative Order on Consent. All of these activities could involve the disturbance of floodplain areas at the Blue River or Indian Creek, but no wetlands are expected to be disturbed by these actions. The alternatives considered will, to the extent possible, avoid or mitigate impacts to the floodplain.

627
Missouri Department of Natural Resources, Division of Geology and Land Survey, Rolla, MO

Shallow Groundwater Investigations at Weldon Spring, Missouri - Final Report for Fiscal Years 1988-1990

DOE/OR/21755-T3; 126 pp. (June 1991)

The Missouri Department of Natural Resources, Division of Geology and Land Survey (MDNR-DGLS) conducted investigations of the upper aquifer in the vicinity of the abandoned Weldon Spring Chemical Plant in southwest St. Charles County, Missouri. The objective of the investigation was to better define the relationships between precipitation, surface runoff, groundwater recharge and shallow groundwater discharge within the study area, thereby assisting the U.S. Department of Energy in designing an appropriate groundwater monitoring plan for the Weldon Spring Site Remedial Action Project. The results of the investigations indicate that the upper aquifer has been affected by karst development, but that well-developed karst does not exist on or around the site. Dye traces conducted during the study have shown that surface water which leaves the site enters the subsurface in losing streams around the site and travels rapidly to one or more local springs. Upper aquifer recharge areas, constructed from dye trace and potentiometric data, generally follow surface-water drainage patterns on the south side of the site, but cross surface-water drainage divides north of the site. Nine springs may receive recharge from site runoff, depending upon the amount of runoff. In addition to these springs, one perennial spring and two intermittent springs to the southwest of the site may receive recharge from site infiltration.

628
MK-Ferguson Company, St. Charles, MO

Annual Site Environmental Report for Calendar Year 1990 - Weldon Spring Site Remedial Action Project, Weldon Spring, Missouri: Revision 1

DOE/OR/21548-193; 381 pp. (September 1991)

This report presents the results of a comprehensive, year-round program to monitor the impact of the Weldon Spring Site (WSS) on the surrounding region's ground water, surface water, and air quality through multiple pathways as well as to monitor for potential exposure to receptor human populations. Information is also presented on the environmental monitoring quality assurance program, waste management activities, audits and reviews, and special environmental studies. The data reported have been collected from a growing complex of monitoring stations and a routine sampling program supplemented by the following: (1) an air monitoring network of 22 stations located within and on the perimeters of the two operable remedial units of the site, and at critical receptor locations around the WSS; (2) six National Pollutant Discharge Elimination System locations and over 25 surface water sampling locations; (3) twenty-two locations for measuring external gamma radiation; (4) over 100 groundwater monitoring wells and piezometers; (5) dozens of soil and ground surface scanning locations for potential direct contact exposure; and (6) an on-site meteorological station. Comprehensive environmental monitoring data for 1990 show that emissions of radiological contamination from the WSS continue to decrease, and contaminant migration pathways and environmental variability are better understood.

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MK-Ferguson Company, St. Charles, MO;

Jacobs Engineering Group, Inc., St. Charles, MO

Quarry Detection Monitoring Wells Completion Report WP-166

DOE/OR/21548-224; 51 pp. (September 1991)

The purpose of this report is to document the activities undertaken during implementation of Work Package 166, Quarry Detection Monitoring Wells, for the Weldon Spring Site Remedial Action Project, Weldon Spring, Missouri. The subcontract specifications should be consulted for specific details regarding this work effort. Analytical parameters for soil samples collected for all but one borehole were analyzed for uranium, thorium, cyanide, nitroaromatics, and all Hazardous Substance List parameters, including volatiles, semivolatiles, pesticides, polychlorinated biphenyls (PCBs) and metals. No soil samples were collected at other boreholes as per specifications. With two exceptions, uranium results for all boreholes sampled were at background levels. Nitroaromatics and cyanide were not detected in any of the samples collected. Volatile and semivolatile organics were not detected in the soil samples collected from the boreholes, with the exception of common lab contaminants such as methylene chloride, toluene, acetone, and phthalates. All metals results were either within their natural background ranges or below the detection limit of the instrument. PCB's were not detected within any of the boreholes. Pesticides detected (aldrin and methoxychlor) at one borehole near the surface may be attributed to previous spraying of pesticides on the highway right-of-way. In conclusion, the analytical results show that only uranium was detected in significant quantities; all other results were below the detection limit, very near the detection limit, or within natural background ranges.

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MK-Ferguson Company, St. Charles, MO; Jacobs Engineering Group, Inc., St. Charles, MO

Quarry Residuals RI/FS Scoping Document

DOE/OR/21548-194; 57 pp. (October 1991)

This document is intended to serve as a planning tool for the implementation of the Quarry Residual Remedial Investigation/Feasibility Study (RI/FS) process and to provide direct input to revising and updating the 1988 Work Plan for the Weldon Spring Site Remedial Action Project Remedial Investigation/Feasibility Study-Environmental Impact Statement. The scoping process is intended to outline the tasks necessary to develop and implement activities in compliance with the Comprehensive Environmental Response, Compensation and Liability Act and National Environmental Policy Act. In addition to scoping the entire process, this document will serve as the primary tool for planning and accomplishing all activities to be developed in the Quarry Residual RI/FS Work Plan. Subsequent tasks are difficult to plan at this time.

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U.S. Department of Energy, Office of Environmental Audit, Washington, DC

Environmental Audit, Weldon Spring Site Remedial Action Project

DOE/EH-0195; 217 pp. (June 1991)

This report documents the results of the Environmental Baseline Audit of the U.S. Department of Energy (DOE) Weldon Spring Site Remedial Action Project (WSSRAP), located in St. Charles, Missouri. The purpose of the Environmental Baseline Audit is to provide the Secretary of Energy with concise information pertaining to the following issues: (1) compliance status with applicable environmental regulations (with the exception of National Environmental Policy Act requirements); (2) adherence to best-management and accepted industry practices; (3) DOE vulnerabilities and liabilities associated with compliance status, environmental conditions, and management practices; (4) root causes of compliance findings and best-management practice (BMP) findings; (5) adequacy of environmental management programs and organizations; and (6) noteworthy practices. This information will assist DOE in determining patterns and trends in environmental compliance, BMPs, and root causes, and will provide the information necessary for line management to take appropriate corrective actions.

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U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, DC

Superfund Record of Decision (EPA Region 7): Weldon Spring Quarry/Plant/Pits (USDOE), Weldon Spring, MO (Second Remedial Action) - September 1990

EPA/ROD/R07-90/043; 118 pp. (September 28, 1990)

The 226-acre Weldon Spring Quarry/Plant/Pits (U.S. Department of Energy) site is a former ordnance works and chemical plant near the city of Weldon Spring in St. Charles County, Missouri. The site is divided into two noncontiguous areas: a 217-acre chemical plant area, comprised of various buildings, ponds and four raffinate pits; and a 9-acre quarry, which forms a valley wall at the edge of the Missouri River floodplain. Since the early 1940s, the site has been used by various government agencies for chemical and ordnance processing. Chemical and radioactive waste were disposed in the quarry. From 1941 to 1946, the site was an Army ordnance works used for the production of trinitrotoluene (TNT) and dinitrotoluene (DNT) explosives. The selected interim remedial action for the site includes (1) excavating an estimated 95,000 cubic yards of chemically and radioactively contaminated bulk wastes from the quarry and temporarily storing the wastes on site in the chemical plant area, and (2) implementing site access restrictions. The estimated total cost for the remedial action is $11,000,000.

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MK-Ferguson Company, St. Charles, MO

Weldon Spring Quarry Construction Staging Area and Water Treatment Plant Site Remedial Action Characterization Report for the Weldon Spring Site Remedial Action Project, Weldon Spring, Missouri

DOE/OR/21548-200; 21 pp. (September 1991)

The quarry construction staging area (QCSA) and water treatment plant (WTP) are located in the areas that border the western edge of the Weldon Spring quarry (WSQ). These facilities were constructed to support bulk waste removal from the WSQ. This area was contaminated with U-238, Ra-226, and Th-230 and was remediated prior to construction in order to allow release of the area for use without radiological restrictions. This report documents the methods of characterization, the remediation activities, and the post-remedial action sampling methods and analytical results.

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L.R. Anspaugh, S.C. Black, C.F. Costa, D.R. Elle, E.H. Essington, R.O. Gilbert, D.A. Gonzalez, R.B. Hunter, R.D. McArthur, P.A. Medica, T.P. O'Farrell, S.E. Patton, E.M. Romney, J.H. Shinn, and C.B. Thompson, Lawrence Livermore National Laboratory, Environmental Sciences Division, Livermore, CA; U.S. Environmental Protection Agency, Environmental Monitoring Systems Laboratory, Las Vegas, NV; U.S. Department of Energy, Nevada Field Office, Las Vegas, NV; Los Alamos National Laboratory, Los Alamos, NM; Pacific Northwest Laboratory, Richland, WA; Reynolds Electrical & Engineering Company, Inc., Las Vegas, NV; Desert Research Institute, Las Vegas, NV; EG&G Energy Measurements, Inc., Santa Barbara, CA; University of California, Los Angeles, CA

Radiation-Related Monitoring and Environmental Research at the Nevada Test Site

PNL-SA-18876;CONF-891053;Environmental Monitoring, Restoration and Assessment: What Have We Learned?, R.H. Gray (ed.), Proceedings of the 28th Hanford Life Sciences Symposium, Richland, WA, October 16-19, 1989, 340 pp.; (pp. 159-167) (1989)

A radiation-related monitoring program was established at the Nevada Test Site (NTS) in 1951 to determine the levels and distribution of radionuclides release by nuclear weapons testing there. The primary methods of measurement used survey-meter-equipped, field-monitoring teams and placement of film badges and air-sampling devices

at fixed locations. In the mid-1950's, the results of the early monitoring program and of related research programs and more stringent radiation protection standards led to increased engineering efforts to reduce local fallout. Environmental activities at NTS increased with the passage of the National Environmental Policy Act and increased concern about the possible effects of radiation exposure. Now, there is an extensive environmental monitoring program at NTS to assess radiological conditions resulting from past tests and from continued testing. In populated areas nearby, there is a monitoring effort that relies on assistance from local communities. Other environmental efforts include reconstruction of radiation doses received by off-site residents during the 1950s and 1960s, the determination of the current radionuclide inventory and distribution in NTS surface soil, and studies of the movement of radionuclides in the desert ecosystem.

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J.J. Cullen, R.L. Jacobsen, and C.E. Russell, Desert Research Institute, Las Vegas, NV

Siting and Constructing Very Deep Monitoring Wells on the U.S. Department of Energy's Nevada Test Site

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 415-420) (September 1991)

Many aspects of the Nevada Test Site's (NTS's) hydrogeologic setting restrict the use of traditional methods for the siting and construction of ground-water characterization and monitoring wells. The size of the NTS precludes establishing high-density networks of characterization wells, like those typically used at smaller sites. The geologic complexity and variability of the NTS requires that the wells be critically situated. The site's hydrogeologic complexity requires that each well provide access to many aquifers. Depths to ground water on the NTS require the construction of wells averaging approximately 100 meters in depth. Wells meeting these criteria are uncommon in the ground water industry; therefore, techniques used by petroleum engineers are being employed to solve certain problems related to siting, design, and installation. One focus has been on developing completion strings that facilitate routine and efficient ground water sampling from multiple intervals in a single well. The method currently advocated employs a new design of a sliding side door sleeve that is actuated by an electrically operated, hydraulic shifting tool. Stemming of the wells is being accomplished with standard materials, such as cement-based grouts and sand. However, new stemming methods are being developed to accommodate the greater depths, to minimize problems of pH caused by the use of cements, to enhance the integrity of the interzone seals, and to improve the representativeness of radionuclide analyses performed on ground water samples. Bench-scale experiments have been used to investigate the properties of more than a dozen epoxy-aggregate grout mixtures, materials that are commonly used in underwater sealing applications. Additional experiments are being planned to determine optimal methods for mixing and using the materials in the field. One material appears to have met the stringent set of requirements for use in deep monitoring wells. Obtaining groundwater samples from multiple completions in a single well will require minimizing purging volumes through the construction of a special geophysical tool that employs packers to isolate the wellbore fluid in the vicinity of the sleeves from the fluid in the remainder of the well. To eliminate cross-contamination of water samples, a pumping system that incorporates a custom slim hole pump is being designed to lower the water levels in the wells prior to sleeve actuation.

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Environmental Surveillance and Research at the Nevada Test Site

PNL-SA-18876;CONF-891053;Environmental Monitoring, Restoration and Assessment: What Have We Learned?, R.H. Gray (ed.), Proceedings of the 28th Hanford Life Sciences Symposium, Richland, WA, October 16-19, 1989, 340 pp.; (pp. 153-158) (1989)

In 1951, at the same time that the first nuclear weapons were tested at the Nevada Test Site (NTS), an environmental surveillance and monitoring program was established off-site. The initial emphasis of this program was on tracking fallout clouds and measuring external radiation exposure rates. An environmental research program was also initiated. Establishment of comprehensive programs has facilitated the ability to address issues such as the inventory and distribution of radionuclides in surface soils, reconstruction of off-site population doses, and recognition of areas that require additional information. NTS has learned that a successful environmental monitoring program must be flexible and responsive to change, must address public as well as technical and regulatory concerns, and must continuously interpret results to ensure that all pathways are considered and that all programs are proactive in their approach.

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Environmental Monitoring Plan, Nevada Test Site and Support Facilities

DOE/NV-10630-28 (Vol. 2); 231 pp. (November 1991)

This Operational Area Monitoring Plan for environmental monitoring at the Nevada Test Site (NTS) and its support facilities was created for EG&G Energy Measurements, Inc. (EG&G/EM), which operates several off-site facilities in support of activities at the NTS. These off-site facilities include: (1) Amador Valley Operations (AVO), Pleasanton, California; (2) Kirtland Operations (KO), Kirtland Air Force base, Albuquerque, New Mexico (KAFB); (3) Las Vegas Area Operations (LVAO), Remote Sensing Laboratory (RSL), and North Las Vegas (NLV) Complex at Nellis Air Force Base (NAFB), North Las Vegas, Nevada; (4) Los Alamos Operations (LAO), Los Alamos, New Mexico; (5) Santa Barbara Operations (SBO), Goleta, California; (6) Special Technologies Laboratory (STL), Santa Barbara, California; (7) Washington Aerial Measurements Department (WAMD), Andrews Air Force Base, Maryland; and (8) Woburn Cathode Ray Tube Operations (WCO), Woburn, Massachusetts. Each of these facilities has an individual Operational Area Monitoring Plan, but they have been consolidated in this report to reduce redundancy.

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Studies of Fission Product Movement in Tuffaceous Media

LA-UR-91-2778; CONF-9110152; Chemistry and Migration Behavior of Actinides and Fission Products in the Geosphere, Proceedings of the Third Annual International Conference, Jerez de la Frontera, Spain, October 21-25, 1991; (10 pp.) (1991)

For approximately 25 years the United States has conducted underground nuclear tests at a site in the state of Nevada. These tests have left a variety of fission products at depths of 100 to 1000 meters below the land surface. The geologic media here consist primarily of tuffs and rhyolites. More than 150 tests were conducted at or below the water table. Studies are being made on locations of past tests to determine whether residual fission products move through the underground environment and, if so, by what mechanisms. The research involves consideration of leaching, sorption, hydraulic dispersion, fracture flow and colloid transport. The data obtained are relevant to ground water contamination and nuclear waste storage issues. This paper presents information obtained from research at several different locations within the study site. Specifically, the movement of radionuclides (including tritium, Kr-85, Sr-90, Ru-106, Sb-125, and Cs-137) in groundwater is described.

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U.S. Environmental Protection Agency, Environmental Monitoring Systems Laboratory, Las Vegas, NV

Offsite Environmental Monitoring Report: Radiation Monitoring Around United States Nuclear Test Areas

DOE/DP-00539-063; EPA/600/4-91/030; 189 pp. (1990)

This report describes the off-site radiation safety program conducted during 1990 by the Environmental Protection Agency (EPA) Environmental Monitoring Systems Laboratory, Las Vegas, Nevada. This laboratory operates an environmental radiation monitoring program in the region surrounding the Nevada Test Site (NTS) and at former test sites in Alaska, Colorado, Mississippi, Nevada, and New Mexico. The surveillance program is designed to measure levels and trends of radioactivity, if present, in the environment surrounding testing areas to ascertain whether current radiation levels and associated doses to the general public are in compliance with existing radiation protection standards. The surveillance program additionally has the responsibility to take action to protect the health and well-being of the public in the event of any accidental release of radioactive contaminants. Off-site levels of radiation and radioactivity are assessed by: (1) sampling milk, water, and air; (2) deploying thermoluminescent dosimeters (TLDs) and using pressurized ion chambers (PICs); and (3) biological monitoring of animals, food crops, and humans. Personnel with mobile monitoring equipment are placed in areas downwind from the test site prior to each nuclear weapons test to implement protective actions, provide immediate radiation monitoring, and obtain environmental samples rapidly after any occurrence of radioactivity release.

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A. Hwang, J.M. Phelan, T. Wolff, G. Yeager, and D. Dionne, Sandia National Laboratories, Albuquerque, NM

Environmental Monitoring Report, Tonopah Test Range, Tonopah, Nevada, 1990

SAND-91-0593; 59 pp. (May 1991)

There is no routine radioactive emission from Sandia National Laboratories, Tonopah Test Range. However, based on the types of test activities, such as air drops, gun firings, ground-launched rockets, air-launched rockets, and other explosive tests, possibilities exist that small amounts of depleted uranium (as part of weapon components) may be released to the air or to the ground because of unusual circumstances during testing. Four major monitoring programs were used in 1990 to assess the radiological impact of testing at Tonapah on the public. The Environmental Protection Agency (EPA) Air Surveillance Network found that the only gamma emitting radionuclide on the prefilters was beryllium-7, a naturally occurring spallation product formed by the interaction of cosmic radiation with atmospheric oxygen and nitrogen. The weighted average results were consistent with the area background concentrations. The EPA Thermoluminescent Dosimetry Network and Pressurized Ion Chamber reported normal results. In the EPA Long-Term Hydrological Monitoring Program, analytical results for tritium in well water were reported and were well below Department of Energy-derived concentration guides. In the Reynolds Electrical and Engineering Company Drinking Water Sampling Program, analytical results for H3, gross alpha, beta, and gamma scans, strontium-90, and plutonium-239 were within the EPA's primary drinking-water standards.

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S. Hwang, G. Yeager, T. Wolff, A.M. Parsons, and D. Dionne, Sandia National Laboratories, Albuquerque, NM

Environmental Monitoring Report, Sandia National Laboratories, Albuquerque, New Mexico, 1990

SAND-91-0592; 273 pp. (May 1991)

This 1990 report contains monitoring data from routine radiological and nonradiological environmental surveillance activities. Summaries of significant environmental compliance programs in progress, such as National Environmental Policy Act documentation, environmental permits, environmental restoration, and various waste management programs for Sandia National Laboratories (SNL) in Albuquerque are included. The maximum off-site dose impact was calculated to be 2 X 10(E-3) mrem. The total 50-mile population received a collective dose of 0.82 person-rem during 1990 from SNL, Albuquerque, operations. As in the previous year, the 1990 SNL operations had no adverse impact on the general public or on the environment. This report is

prepared for the U.S. Department of Energy in compliance with DOE Order 5400.1.

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W.R. Penrose, E.H. Polzer, E.H. Essington, D.M. Nelson, and K.A. Orlandini, Transducer Research, Inc., Naperville, IL; Los Alamos National Laboratory, Earth and Environmental Science Division, Los Alamos, NM; Argonne National Laboratory, Environment, Safety, and Health Department, Argonne, IL; Argonne National Laboratory, Environmental Research Division, Argonne, IL

Mobility of Plutonium and Americium Through a Shallow Aquifer in a Semiarid Region

Environmental Science and Technology 24(2):228-233 (February 1990)

Treated liquid wastes containing traces of plutonium and americium were released into Mortandad Canyon, within the site of Los Alamos National Laboratory, New Mexico. The wastes infiltrated a small aquifer within the canyon. Although laboratory studies predicted that the movement of actinides in subsurface environments would be limited to less than a few meters, both plutonium and americium are detectable in monitoring wells as far as 3390 m downgradient from the discharge. Between the first and last monitoring wells (1.8 and 3.4 km from the discharge), plutonium concentrations decreased exponentially from 1400 to 0.55 mBq/l. Americium concentrations ranged between 94 and 1240 mBq/l, but did not appear to vary in a systematic way with distance. Investigation of the properties of the mobile actinides indicates that the plutonium and part of the americium are tightly or irreversibly associated with colloidal matter between 25 and 450 nm in size. The colloidally bound actinides are removed only gradually from the groundwater. The fraction of the americium not associated with colloids exists in low molecular weight form (diameter, less than or equal to 2 nm) and appears to be a stable, anionic complex of unknown composition. The mobile forms of these actinides defeat the forces that normally act to retard their movement through groundwater systems.

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RCRA Facility Investigation for the Townsite of Los Alamos, New Mexico

LA-UR-91-4069; CONF-920251; Proceedings of the Hazardous Materials Control Research Institute Meeting, New Orleans, LA, February 26-28, 1992; (22 pp.) (1992)

During World War II, Los Alamos, New Mexico was established as an ideal location for the research and development required to design a nuclear fission bomb. Experiments carried out in the 1940's generated both radioactive and hazardous waste constituents on what is presently part of the Los Alamos townsite. Under the Resource Conservation and Recovery Act permit issued to Los Alamos National Laboratory in 1990, the Laboratory is scheduled for investigation of its solid waste management units (SWMUs). Most of the existing information on levels of radioactivity at the townsite is data from soil samples taken during the last site decontamination in 1976. Little information on the presence of hazardous constituents exists today. This paper addresses pathway analysis and a preliminary risk assessment for current residents of the Los Alamos townsite. The estimated dose levels, in mrem per year, show that the previously decontaminated SWMU areas on the Los Alamos townsite will not contribute a radiation dose of any concern to the current residents.

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V.A. Freeman, D.L. Porter, E. Morren, D. Harmer, and L. Phillips, International Technology Corporation, Itasca, IL; International Technology Corporation, Knoxville, TN; Brookhaven National Laboratory, Upton, NY; U.S. Department of Energy, Washington, DC

The Selective Absorption of Radionuclides from a Contaminated Holding Pond at Brookhaven National Laboratory

CONF-9010166; Waste Management and Environmental Restoration, Proceedings of the 1990 DOE Model Conference, Oak Ridge, TN, October 29-November 2, 1990, 343 pp.; (8 pp.) (1990)

Brookhaven National Laboratory (BNL) was carrying out a program for the cleanout and removal of obsolete tankage when one of the cleaned tanks experienced an unexpected increase in concentration of cesium-137. The increase occurred between the time of sampling for nuclide content and the time of discharge to the laboratory's wastewater treatment system. The unforeseen high levels of radioactivity in the water were detected at the treatment facility, and the flow was diverted to a lined holding pond. The water was greatly diluted by flow from the rest of the laboratory. A quantity of sand was also contaminated and was removed from the top of the filter bed. Two different contaminated wastes resulted from this event: water and filter sand.

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Methods for Drilling and Well Installation in Radiologically Contaminated Soils

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 901-906) (September 1991)

Methods and procedures for drilling and well installation in radiologically contaminated soils are described in this paper. The investigation was conducted at a former nuclear fuel reprocessing facility (West Valley Nuclear Fuel Services Company, Inc.) located in the Town of Ashford, New York. The fuel reprocessing plant and related facilities are underlain by a surficial, water-bearing glaciofluvial deposit of sand and gravel, which averages 7.6 meters or more in thickness. Beneath this sand and gravel deposit is a dense glacial till, composed primarily of clay and silt, exhibiting low permeability (i.e., in the 10(E-8) cm/sec range). As part of a well installation and monitoring program initiated at the site, two augered soil borings were drilled in separate areas in the vicinity of the main plant. Radiological contamination (primarily beta activity) was encountered in both borings, at an average depth of 8.2 meters below the ground surface, within the surficial sand and gravel layer. Based upon radiochemical analyses, it was apparent that most of the contamination resided in an insoluble state (adsorbed onto soil particles). However, significant activity (10(E-5) uCi/ml) still existed in a soluble form within the groundwater. The investigation that followed was concerned with two operations: (1) drilling and completion of monitoring wells within the two contaminated boreholes; and (2) characterizing surrounding areas by using an alternated exploratory approach. The drilling and well completion operation involved the development and implementation of procedures for the handling and control of radiologically contaminated soil and groundwater during drilling, sampling, and well installation. The intent was to define the thickness of the sand and gravel layer at both locations, as well as to provide long-term monitoring points that would satisfy the recommended criteria for monitoring well design. The alternated exploratory operation involved the installation of eight exploratory well points within the surrounding areas to further define the extent of subsurface contamination. While exact stratigraphic information was not acquired at these locales, the well point installation method (a) minimized waste generation and equipment contamination, (b) maximized worker safety, (c) was relatively fast and cost-effective when compared to other methods, and (d) provided valuable data about the nature and extent of subsurface contamination.

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H.A. Berry, EG&G Energy Measurements, Inc., Remote Sensing Laboratory, Las Vegas, NV

An Aerial Radiological Survey of the West Valley Demonstration Project and Surrounding Area, West Valley, New York - Date of Survey: August-September 1984

EGG-10617-1080; 25 pp. (September 1991)

An aerial radiological survey of the West Valley Demonstration Project and the surrounding area was conducted from mid-August through early September 1984 by EG&G Energy Measurements, Inc. for the U.S. Department of Energy (DOE). The radiological survey was part of the DOE Comprehensive Integrated Remote Sensing program, which provides remote sensing to support the needs of the various DOE facilities. The survey consisted of airborne measurements of both natural and man-made gamma radiation emanating from the terrestrial surface. These measurements allowed an estimate of the distribution of isotopic concentrations in the area surrounding the West Valley Project Site. Results are reported as isopleths superimposed on aerial photographs of the area. Gamma-ray energy spectra are also presented for the net man-made radionuclides.

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U.S. Department of Energy, Office of Environmental Audit, Washington, DC

Environmental Audit: West Valley Demonstration Project

DOE/EH-0236; 286 pp. (January 1992)

This report documents the results of the environmental audit of West Valley Demonstration Project (WVDP) located in West Valley, New York. The audit was conducted from July 29 through August 16, 1991, by the Office of Environmental Audit (EH-24). This audit evaluated environmental programs and activities at WVDP, as well as the overall environmental management system. The scope of the audit was comprehensive, addressing environmental media and Federal and local regulations, with the exception of the National Environmental Policy Act (NEPA). Also addressed were Department of Energy Orders, WVDP 1989 ES&H Assessment Action Plan, formalized facility or program operating procedures, and best management practices. The technical disciplines addressed by the audit were: (1) air; (2) surface water; (3) soils, sediment and biota; (4) groundwater; (5) waste management; (6) toxic and chemical materials; (7) radiation; (8) quality assurance; and (9) inactive waste sites. The audit included a review of environmental management programs within the West Valley Project Office, West Valley Nuclear Services, and subcontractor organizations. The effectiveness of environmental monitoring programs was a major component of the review conducted within each technical discipline.

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Ground-Water Flow and Transport Modeling of the NRC-Licensed Waste Disposal Facility, West Valley, New York

NUREG/CR-5794; 115 pp. (October 1991)

This report describes a simulation study of groundwater flow and radionuclide transport from disposal pits at the Nuclear Regulatory Commission-licensed waste disposal facility in West Valley, New York. A transient, precipitation-driven, flow model of the near-surface fractured till layer and underlaying unweathered till was developed and calibrated against observed inflow data into a recently constructed interceptor trench for the period March-May 1990. The results suggest that lateral flow through the upper, fractured till layer may be more significant than indicated by previous, steady state, flow-modeling studies. A conclusive assessment of the actual magnitude of lateral flow through the fractured till could not be made. A primary factor contributing to this uncertainty is the unknown contribution of vertical infiltration through the interceptor trench cap to the total trench inflow. The second part of the investigation involved simulation of the migration of Sr-90, Cs-137, and Pu-239 from one of the fuel hull disposal pits. A first order radionuclide leach rate with rate coefficient of 10(E-6)/day was assumed to describe radionuclide release into the disposal pit. The simulations indicated that for wastes buried below the fractured till zone, no significant migration would occur. However, under the assumed conditions, significant lateral migration could occur for radionuclides present in the upper, fractured till zone.

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Feed Materials Production Center Annual Environmental Report for Calendar Year 1990

FEMP-2245; 311 pp. (December 1991)

As restoration efforts to manage the low-level radioactive and hazardous wastes stored on-site continue, environmental monitoring (EM) continues to check yearly progress in reducing potential contamination to the surrounding environment. Environmental monitoring at Feed Materials Production Center (FMPC) primarily examines air and water as possible routes through which pollutants, particularly radionuclides, may leave the site. Levels of direct radiation originating primarily from the K-65 Silos are also measured. Concentrations of radionuclides detected off-site are converted to potential doses to nearby residents through mathematical models. These off-site concentrations are compared to environmental standards, and doses are compared to U.S. Department of Energy- and U.S. Environmental Protection Agency-regulated exposure limits. Other environmental activities at the site include routine on-site monitoring of liquid wastes according to the National Pollutant Discharge Elimination System permit and problem-identification and solution-development through the Remedial Investigation and Feasibility Study.

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C.S. Duke, L. Meyers-Schone, S.R. Glum, and W. Quaider, Advanced Sciences, Inc., Ross, OH

An Assessment of Baseline Ecological Risks at the Fernald Environmental Management Project, Fernald, Ohio

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 861-869) (September 1991)

The Fernald Environmental Management Project (FEMP), formerly the Feed Materials Production Center (FMPC), is a Department of Energy (DOE) facility located near Cincinnati, Ohio, which produced pure uranium metals from the early 1950s until 1989. DOE is currently conducting a Remedial Investigation/Feasibility Study (RI/FS) under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), in order to remediate environmental impacts at the site. DOE is also preparing an environmental impact statement under the National Environmental Protection Act (NEPA) to evaluate environmental impacts of proposed remedial actions. Both CERCLA and NEPA require evaluation of ecological risks of baseline conditions and proposed remedial actions. A preliminary assessment of ecological risks examined the potential effects of FEMP contaminants in one operable unit (OU) at the site: OU5, Environmental Media. Radionuclides of potential concern in OU5 soils include uranium, cesium, radium, strontium, technetium, and thorium. Chemicals detected in terrestrial organisms include aluminum, arsenic, barium, cadmium, lead, mercury, vanadium, and zinc, as well as radionuclides. Chemicals of potential concern in surface water include a variety of metals as well as uranium and technetium. Radionuclides in OU5 do not appear to pose a hazard to terrestrial organisms. Estimated radiation doses to aquatic organisms continually exposed to the maximum uranium concentrations observed in on-property drainages ranged from 40 to 4000 rad per year. However, off-property radionuclide concentrations are very low, and it is unlikely that organisms in streams adjacent to the FEMP are exposed to toxic levels. Maximum arsenic levels in vegetation collected from the FEMP are consistent with values reported in the literature to be toxic to certain plants. However, signs of stress have not been observed in vegetation on, or adjacent to, the FEMP. Similarly, arsenic levels in plants and animals collected from the FEMP could be toxic to terrestrial mammals under worst-case conditions, but toxicity has not been observed in the field. Current and planned sampling of soils will clarify whether nonradioactive constituents constitute a hazard to terrestrial organisms at the FEMP. The maximum concentrations of aluminum observed in OU5 surface waters are comparable to those

reported to cause chronic-to-acute effects in aquatic organisms. However, macroinvertebrate communities in streams adjacent to the FEMP do not exhibit any adverse effects of exposure to FEMP constituents. This preliminary assessment suggests that present ecological risks of the FEMP are low and likely to be associated primarily with nonradiological effects. However, long-term ecological risks could be substantial if containment systems fail or wastes are penetrated by plants or burrowing animals.

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Characterization of Vitrified and Non-Vitrified Fernald K-65 Soil

CONF-910430; Proceedings of the 93rd American Ceramic Society Annual Meeting and Exposition, Cincinnati, OH, April 28-May 2, 1991, 475 pp.; (p. 145) (1991)

Fernald K-65 Silo material contains uranium, its daughter products, and heavy metals (primarily lead). The radium yields high radon emissions. After vitrification, it no longer tested hazardous, a volume reduction of 65% was demonstrated, and radon emanation was over 30,000 times less than the non-vitrified material. Based on these results, vitrification of the K-65 material appears to be an attractive treatment option.

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S.Y. Lee and J.D. Marsh, Oak Ridge National Laboratory, Oak Ridge, TN

Characterization of Uranium Contaminated Soils from DOE Fernald Environmental Management Project Site: Results of Phase 1 Characterization

ORNL/TM-11980; 57 pp. (January 1992)

The Integrated Demonstration (ID) for remediation of uranium-contaminated soils has been established by the U.S. Department of Energy (DOE) Office of Technology Development. The Fernald (Feed Materials Production Center) Site was selected as the DOE facility for the field demonstration. The principle objective of this ID is to evaluate and compare the versatility, efficiency, and economics of various technologies that can be combined into systems for the removal of uranium from contaminated soils. Several leaching solutions were employed to determine their effectiveness in extracting uranium from the soil. The extractants and their means of preparation are presented in this report.

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Evaluation of a Contaminant Pathway and Mobility at a U.S. DOE Site Using Groundwater Chemical Data

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 841-846) (September 1991)

An evaluation of groundwater chemistry data confirms the presence of a groundwater recharge zone beneath Paddys Run, a small stream that flows along the western edge of the U.S. Department of Energy (DOE) Fernald Environmental Management Project (FEMP) in Fernald, Ohio. The hydrologic connection between Paddys Run and the underlying Great Miami Aquifer represents a pathway for potential groundwater contamination. Because uranium is a major constituent of waste presently stored at the FEMP, geochemical modeling was employed to assess the behavior of dissolved uranium in groundwater. Results indicate that uranium will be present as neutral and negative charged uranyl complexes. Some adsorption of uranium may occur; however, dissolved uranium will be relatively mobile in the aquifer. This study indicates the need to protect the Paddys Run channel from potential contamination during FEMP remedial activities.

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Ridge, TN; U.S. Department of Energy, Cincinnati Area Office, Cincinnati, OH

Environmental Soil Sampling Under Storage Tanks Utilizing Angled Auger Borings

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 895-900) (September 1991)

At the Fernald Environmental Management Project (FEMP), radium-bearing waste is stored in concrete structures known as the K-65 Silos. As part of the FEMP Remedial Investigation/Feasibility Study (RI/FS), the soils surrounding these silos are being evaluated to determine the presence and extent of radiological contaminants and Hazardous Substance List constituents that may have leaked from the silos. Five auger borings at angles of 4 to 12 degrees below horizontal were found to be the only feasible method for collecting samples from beneath the silos and an associated steel tank. Conventional auger drilling equipment was inadequate because torque requirements for low-angle borings are much greater than those needed for vertical borings; therefore, a horizontal boring machine was used to complete the five borings. Accurate vertical tracking of the location of the advancing boreholes was necessary to ensure that the silos were not breached and that the boreholes would not fully penetrate the glacial till beneath the silos, which overlies the Great Miami aquifer. A Horizontal Digitilt Uniaxiai Inclinometer (TM) was used to track the boreholes. Continuous soil sampling within the boreholes was accomplished with a Bearing Head Continuous Sample Tube System. The scope of the project changed to include the sampling of perched groundwater when water was encountered in the borings. Although four out of the five originally proposed boring lengths were not achieved, the project was a success in that it showed that the drilling, sampling, and borehole-tracking methods that were used for the low-angle borings all worked well.

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B.M. Farmer, D.G. Carfagno, W.D. Gloekler, J.F. Griffin, and C. Kinard, EG&G Mound Applied Technologies, Miamisburg, OH; Science Applications International Corporation, Oak Ridge, TN

Environmental Monitoring at Mound: 1990 Report

MLM-3703; 86 pp. (June 1991)

Mound is a government-owned facility operated by EG&G Mound Applied Technologies, Inc., for the U.S. Department of Energy (DOE). This integrated production, development, and research site performs work in support of DOE's weapon and energy related programs, with emphasis on explosive, nuclear, and energy technology. The purpose of this report is to inform the public about the impact of Mound's operations on the population and the environment. The report contains data from the Environmental Monitoring Program, through which Mound maintains continuous surveillance of radiological and nonradiological substances emitted from the facility.

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D. Counce-Brown, Martin Marietta Energy Systems, Inc., Oak Ridge, TN; Martin Marietta Energy Systems, Inc., Piketon, OH

Portsmouth Gaseous Diffusion Plant Environmental Report for 1990

ES/ESH-18/V4; 230 pp. (September 1991)

This calendar year 1990 annual report on environmental surveillance of the U.S. Department of Energy's Portsmouth Gaseous Diffusion Plant and its environment consists of two parts: Part 1, the summary, discussion, and conclusions; and Part 2, the data presentation. The objectives of this report are as follows: (1) report 1990 monitoring data (that may have been affected by operations on the plant site) for the installation and its environment; (2) provide reasonably detailed information about the plant site and plant operations; (3) provide detailed information on input and assumptions used in all calculations; (4) provide trend analyses (when appropriate) to indicate increases and decreases in environmental impact; and (5) provide general information on plant quality

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Bettis Atomic Power Laboratory, Pittsburgh, PA

1990 Effluent and Environmental Monitoring Report for the Bettis Atomic Power Laboratory

WAPD-RC/E(EE)-1562; 78 pp. (1990)

The results of the radiological and non-radiological environmental monitoring programs for 1990 at the Bettis Laboratory are presented. The results obtained from the monitoring programs demonstrate that the existing procedures ensured that any environmental releases during 1990 were in accordance with applicable federal and state regulations, except for one minor instance which was reported to federal and state regulators. In this incident the site's National Pollutant Discharge Elimination system (NPDES) water discharge permit limit for visible foam was exceeded for a short period of time. This instance is more fully discussed in the report. Evaluation of the environmental data indicates that operation of the laboratory continues to have no adverse effect on the quality of the environment. A conservative assessment of radiation exposure to the general public as a result of laboratory operations demonstrated that the dose received by any member of the public was well below the most restrictive dose limits given by the Environmental Protection Agency and the Department of Energy.

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E.L. Feimster, EG&G Energy Measurements, Inc., Remote Sensing Laboratory, Las Vegas, NV

Aerial Radiological Survey of the Central Savannah River Site, Aiken, South Carolina - Survey Date: February 1987

EGG-10617-1130; 57 pp. (September 1991)

An aerial radiological survey was conducted over a 194 sq km (75 sq mile) area encompassing the central portion of the Savannah River Site (SRS). The survey was flown during February 10-27, 1987. These radiological measurements were used as baseline data for the central area and for determining the extent of man-made radionuclide distribution. Previous SRS surveys included small portions of the area; the 1987 survey was covered during the site-wide survey conducted in 1979. Man-made radionuclides (including cobalt-60, cesium-137, protactinium-234m, and elevated levels of uranium-238 progeny) that were detected during the survey were typical of those produced by the reactor operations and the material-processing activities being conducted in the area. The natural terrestrial radiation levels were consistent with those measured during prior surveys of other SRS areas.

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J.A. Gellici, South Carolina Water Resources Commission, Geology-Hydrology Division, Columbia, SC

Hydrogeologic Investigation and Establishment of a Permanent Multi-Observational Well Network in Aiken, Allendale, and Barnwell Counties South Carolina - Phase 4

DOE/SR-15160-4; 74 pp. (March 1991)

The Lower Savannah River Project was initiated in 1986 for the purpose of understanding the hydrogeologic conditions adjacent to the Savannah River Site. Nineteen monitoring wells have been completed, 16 of which have been equipped with automatic water-level recorders. Microscopic core descriptions, sieve analyses, age dating, and other core analyses continue to be obtained. During Phase 4 (August 1989-August 1990), two deep monitoring wells were completed at site C-10. Paleontologic and palynological age dates, with lithologic data, were used to determine the stratigraphy at sites C-2, C-6, and C-10. Eleven formations and three members were identified at site C-10, and nine formations at sites C-2 and C-6. Two cluster sites, C-2 and C-6, are complete; no additional monitoring wells are scheduled to be drilled. Water-level differences are minor among the wells at site C-2, indicating regional hydraulic continuity among area aquifers. Significant water-level differences occur among wells at site C-6, suggesting four hydraulically isolated aquifers.

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U.S. Department of Energy, Washington, DC

Waste Management Activities for Groundwater Protection - Savannah River Plant, Aiken, South Carolina: Draft Environmental Impact Statement, Volume 1

DOE/EIS-0120D (Vol. 1); 634 pp. (April 1987)

The U.S. Department of Energy (DOE) prepared this environmental impact statement (EIS) to assess the environmental consequences of the implementation of modified waste management activities for hazardous, low-level radioactive, and mixed wastes for the protection of groundwater, human health, and the environment at its Savannah River Plant (SRP) in Aiken, South Carolina. The SRP is a major DOE installation that produces nuclear materials for national defense. Previously acceptable waste disposal practices have included the use of seepage basins for liquids, disposal pits and waste piles for solids, and solid waste burial grounds for low-level radioactive wastes. Groundwater contamination of some water-table aquifers has occurred at some sites because of these waste management practices. Detected contaminants include volatile organic compounds, heavy metals, radionuclides, and other miscellaneous chemicals. The proposed action considered in this EIS is the modification of SRP waste management activities. Considering all environmental factors and costs, a combination alternative strategy would be DOE's preferred action. This combination alternative strategy would include compliance through a combination of site dedication, elimination of some existing waste sites, and disposal/storage of wastes. The combination strategy includes: (1) project-specific actions of waste removal at selected existing waste sites, and remedial and closure actions as required; (2) above- and below-ground disposal and retrievable storage for new disposal and storage facilities; and (3) continuation of the discharge of disassembly-basin purge water to seepage basins, with continued studies on detritiation or other mitigation measures. In support of this inclusive study and its conclusions, Volume 1 of the EIS includes Chapters (1) a statement of need and purpose, (2) a complete site-by-site description and discussion of the proposed action and alternatives, (3) an in-depth characterization of the affected environment at SRP, (4) the environmental consequences of the various action strategies, (5) monitoring and study requirements at existing and proposed waste management sites, and (6) an overview of federal and state environmental requirements at SRP; and Appendices (A), geology and subsurface hydrology at SRP, and (B), existing waste sites at SRP. In addition, Volume 1 includes a list of the EIS preparers, a distribution list, a glossary, and an index. Volume 2 contains Appendices C through K and is recorded separately.

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U.S. Department of Energy, Washington, DC

Waste Management Activities for Groundwater Protection - Savannah River Plant, Aiken, South Carolina: Draft Environmental Impact Statement, Volume 2

DOE/EIS-0120D (Vol. 2); 509 pp. (April 1987)

The U.S. Department of Energy (DOE) prepared this environmental impact statement (EIS) to assess the environmental consequences of the implementation of modified waste management activities for hazardous, low-level radioactive, and mixed wastes for the protection of groundwater, human health, and the environment at its Savannah River Plant (SRP) in Aiken, South Carolina. The SRP is a major DOE installation that produces nuclear materials for national defense. Previously acceptable waste disposal practices have included the use of seepage basins for liquids, disposal pits and waste piles for solids, and solid waste burial grounds for low-level radioactive wastes. Groundwater contamination of some water-table aquifers has occurred at some sites because of these waste management practices. Detected contaminants include volatile organic compounds, heavy metals, radionuclides, and other miscellaneous chemicals. The proposed action considered in this EIS is the modification of SRP waste management activities. Considering all environmental factors and costs, a combination alternative strategy would be DOE's preferred action. This combination alternative strategy would include compliance through a combination of site dedication, elimination of some existing waste sites, and disposal/storage of wastes. The combination strategy includes project-specific

actions of waste removal at selected existing waste sites, and remedial and closure actions as required; above- and below-ground disposal and retrievable storage for new disposal and storage facilities; and continuation of the discharge of disassembly-basin purge water to seepage basins, with continued studies on detritiation or other mitigation measures. Volume 2 of the EIS consists of Appendices C through K, which support specific sections of the principal report given in Volume 1. These Appendices include (C) remedial, treatment, and closure techniques; (D) predisposal treatment technologies; (E) new disposal facility alternative; (F) assessment of actions at existing waste sites; (G) assessment of alternative disposal facilities; (H) transport and dose models; (I) health effects; (J) waste-management demonstration programs; and (K) scoping comments and responses.

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EG&G Energy Measurements, Inc., Remote Sensing Laboratory, Las Vegas, NV

Aerial Radiological Survey of the Savannah River Site TNX Facility and Surrounding Area, Aiken, South Carolina - Date of Survey: August 1986

EGG-10617-1131; 27 pp. (June 1991)

An aerial radiological survey was conducted over a 3.8 sq km (1.5 sq mile) area, centered on the Savannah River Site (SRS) TNX facility. The survey was flown on July 25, 1986, prior to the Steel Creek Corridor survey. Radiological measurements were used to determine the extent of man-made radionuclides in the TNX area. This survey area had been covered during previous site surveys of the Savannah River Floodplain. Higher than typical levels of thorium-232 daughters were detected in the survey area just west of the TNX facility. The natural terrestrial radiation levels were consistent with those measured during prior surveys of this and other SRS areas.

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Oak Ridge K-25 Site, Oak Ridge, TN

Site Descriptions of Environmental Restoration Units at the Oak Ridge K-25 Site, Oak Ridge, Tennessee

K/ER-47; 621 pp. (October 1991)

This report gives an overview of each of the 116 Solid Waste Management Units (SWMUs) under the purview of the Oak Ridge, Tennessee K-25 Environmental Restoration Program. This document outlines the history and current condition of each SWMU. Information was gathered from visits to the sites, research into plant records, interviews with personnel associated with the operation of each unit, and published reports as noted in the "References" section for each SWMU. This document treats each SWMU as an individual unit grouped into one of 14 hydrogeological areas at the K-25 Site rather than one of the 16 Operable Units established in May 1991. This document is intended to meet the requirements of state and federal regulatory bodies as well as provide a reference source on all SWMUs at the K-25 Site. This report will be periodically updated to reflect the changing status of environmental restoration units at the K-25 Site.

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J.S. Ashwood and T.L. Ashwood, Oak Ridge National Laboratory, Oak Ridge, TN

Active Sites Environmental Monitoring Program: Action levels

ORNL/M-1569; 28 pp. (October 1991)

The Active Sites Environmental Monitoring Program (ASEMP) was established at Oak Ridge National Laboratory to provide for early leak detection and to monitor performance of the active low-level waste disposal facilities in Solid Waste Storage Area (SWSA) 6 and the transuranic waste storage areas in SWSA 5 North. Early leak detection is accomplished by sampling runoff, groundwater, and perched water in burial trenches. Sample results are compared to action levels that represent background contamination by naturally occurring and fallout-derived radionuclides.

665
R.B. Clapp, D.M. Borders, M.F. Tardiff, and D.D. Huff, Oak Ridge National Laboratory, Environmental Sciences Division, Oak Ridge, TN

Evaluation of Proposed Designs for Streamflow Monitoring Structures at Waste Disposal Sites

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 589-595) (September 1991)

Design of small surface-water monitoring stations associated with waste sites requires an approach that balances several problems. The monitoring site must have a capacity for a wide range of flows, allow accurate measurements over the full performance range, minimize effects from the accumulation of contaminated sediment, and minimize costs of construction and operation. Selecting a station design that takes these factors into consideration can be done systematically through use of formal design analysis. This report summarizes the decision-making process for selection of the best flow measurement and control structure on a small tributary stream of White Oak Creek near the Oak Ridge National Laboratory. The mandatory objectives of the design were: (1) measured flows must be within 10% of true value for 95% of the expected flow range and within 25% of true value for flows up to the 25-year recurrence interval; and (2) the submergence ratio must not exceed conventional limits for the type of control structure (i.e., weir, flume, etc.). Several desired design objectives were identified and each was given a weight of one to ten, reflecting their relative importance. Several flow control methods were analyzed using mathematical techniques of flow-frequency analysis, volume-frequency analysis, and contaminant-flux frequency analysis. The design analysis system identified the hydraulic structure that best fit the performance criteria and site constraints. A complex critical-flow flume was judged to be the best design; however, the 4.5 foot H-flume scored sufficiently close that both were retained for continued evaluation. The cost of constructing each design will be estimated.

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P.Y. Goldberg, B.M. Horwedel, R.S. Loffman, A.E. Osborne-Lee, and M.R. Powell, Oak Ridge National Laboratory, Oak Ridge, TN

Environmental Surveillance Data Report for the Fourth Quarter of 1990

ORNL/M-1157; 129 pp. (January 1992)

The Environmental Surveillance and Protection Section within the Office of Environmental and Health Protection at the Oak Ridge National Laboratory (ORNL) is responsible for the development and implementation of an environmental program to: (1) ensure compliance with all federal, state, and Department of Energy (DOE) reporting requirements to quantitatively demonstrate prevention, control, and abatement of environmental pollution; (2) monitor the adequacy of containment and effluent controls; and (3) assess impacts of releases from ORNL facilities on the environment. Environmental monitoring, as defined by Draft Department of Energy Order 5400.6, consists of two major activities: effluent monitoring and environmental surveillance. Effluent monitoring is the collection and analysis of samples or measurements of liquid and gaseous effluents. Environmental surveillance is the collection and analysis of samples, or direct measurements, of air, water, soil, foodstuff, biota, and other media from DOE sites. Monthly or quarterly summaries are presented in this report for each media sampled. All data are rounded to two significant digits. The summary tables generally give the number of samples collected during the period and the maximum, minimum, average, and standard error of the mean values of parameters for which determinations were made.

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P.Y. Goldberg, A.E. Osborne-Lee, M.R. Powell, M.M. Stevens, and M.F. Tardiff, Oak Ridge National Laboratory, Oak Ridge, TN

Environmental Surveillance Data Report for the Third Quarter of 1990

ORNL/M-1156; 87 pp. (July 1991)

Each section of this report consists of a program description, results for the quarter, and an analysis of trends over the previous two years, depending upon the availability of data. The analyst who produced each section is identified in order to facilitate the reader in following up any questions

regarding the data or the analysis approach. The reader is directed to the trend subsections for more in-depth summaries of each data section. The four major environmental topics included are air, water, meteorological processes and biological monitoring.

668
J.A. Greene, Oak Ridge National Laboratory, Oak Ridge, TN

Final Report on the Waste Area Grouping Perimeter Groundwater Quality Monitoring Well Installation Program at Oak Ridge National Laboratory, Oak Ridge, Tennessee

ORNL/ER-46; 72 pp. (June 1991)

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

669
D.D. Huff and M.A. Faulkner, Oak Ridge National Laboratory, Environmental Sciences Division, Oak Ridge, TN

Guide to Groundwater Well Locations and Information at Oak Ridge National Laboratory

ORNL/TM-11713; 92 pp. (September 1991)

The need for a guide to groundwater monitoring wells at Oak Ridge National Laboratory (ORNL) has steadily increased over the past decade. This guide displays well locations in the context of waste area groupings (WAGs) and includes a simple tabulation of well location and depth for over 1400 wells. Although this information is not all-inclusive, it allows the reader to identify areas of interest and serves as a starting point for the development of maps and tabular data to meet a variety of needs. The scope of this guide is anticipated to expand in the future to include wells that have been plugged and abandoned, and to indicate general water chemistry features.

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Oak Ridge National Laboratory, Oak Ridge, TN

RCRA Facilities Assessment (RFA) - Oak Ridge National Laboratory

ORNL/RAP-12/V1; 457 pp. (March 1987)

U.S. Department of Energy (DOE) facilities are required to be in full compliance with all federal and state regulations. In response to this requirement, the Oak Ridge National Laboratory (ORNL) has established a Remedial Action Program (RAP) to provide comprehensive management of areas where past and current research, development, and waste-management activities have resulted in residual contamination of facilities or the environment. This report presents the RCRA Facility Assessment (RFA) needed to meet the requirements of the Resources Conservation Recovery Act (RCRA) Section 3004(u). Included in the RFA are: (1) a listing of all sites identified at ORNL that could be considered sources of releases or potential releases; (2) background information on each of these sites, including location, type, size, period of operation, current operational status, and information on observed or potential releases (as required in Section II.A.1 of the RCRA permit); (3) analytical results obtained from preliminary surveys conducted to verify the presence or absence of releases from some of the sites; and (4) ORNL's assessment of the need for further remedial attention.

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Oak Ridge National Laboratory, Oak Ridge, TN

RCRA Facilities Assessment (RFA) for Oak Ridge National Laboratory: Addendum of August 25, 1987

ORNL/RAP-12/V3; 97 pp. (August 1987)

The RCRA Facilities Assessment (RFA) report identified approximately 250 Solid Waste

Management Units (SWMUs) that were grouped into 20 Waste Area Groupings (WAGs) at Oak Ridge National Laboratory, Oak Ridge, Tennessee. Identification of each SWMU included information as to location, type, size, dates of operation, type of waste handled, and evidence of releases. Preliminary sampling studies were performed around each WAG to determine if there was evidence of releases beyond its perimeter. Analytical results from the surveys and historical information were the basis for recommendations concerning further actions for each WAG. Remedial investigations (RIs) were recommended for WAGs 1-10 and 17; for WAGs 14, 16, 18, and 20, it was suggested that they be removed from further consideration for remedial action. For the remaining WAGs (11, 12, 13, 15, and 19) the evidence concerning the possible release of contaminants was inconclusive and additional sampling was recommended. The purpose of this addendum is to report the analytical data obtained from the additional surveys, to make recommendations concerning future remedial actions within these WAGs, and to provide descriptive information for additional sites listed in Table 1.2 of the RFA. Since information concerning the rationale for identifying releases, the sampling survey methodology, and background information for each WAG is presented in the RFA, it is not repeated in this addendum.

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D.K. Solomon, J.D. Marsh, D.S. Wickliff, I.L. Larsen, and R.B. Clapp, Oak Ridge National Laboratory, Oak Ridge, TN

The Transport of Contaminants During Storms in the White Oak Creek and Melton Branch Watersheds

ORNL/RAP/LTR-89/8; 119 pp. (March 1989)

This report documents are transport of contaminants from Solid Waste Storage Area (SWSA) 5 along two principle pathways: the saturated groundwater system and the intermittently saturated stormflow system. The results of a baseflow sampling effort and a dye-tracer study indicated that much of the transport through the saturated groundwater system occurs along discrete geologic features. These features appear to be related to the contact between the Maryville and Nolichucky members of the Conasauga shale. Three discrete sources of tritium to Melton Branch Stream (MBS) were identified and traced to SWSA 5 by measuring soil moisture and evapotranspiration along transects between MBS and SWSA 5.

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T.L. Ashwood and B.P. Spalding, Oak Ridge National Laboratory, Oak Ridge, TN

SWSA 6 Interim Corrective Measures Environmental Monitoring: FY 1990 Results - Environmental Restoration Program

ORNL/ER-36; 162 pp. (July 1991)

This report presents the results and conclusions from a multifaceted monitoring effort associated with the high-density polyethylene caps installed in Solid Waste Storage Area (SWSA) 6 at Oak Ridge National Laboratory (ORNL) as an interim corrective measure (ICM). The caps were installed between November 1988 and June 1989 to meet Resource Conservation and Recovery Act (RCRA) requirements for closure of those areas of SWSA 6 that had received RCRA-regulated wastes after November 1980. Three separate activities were undertaken to evaluate the performance of the caps: (1) wells were installed in trenches to be covered by the caps, and water levels in these intratrench wells were monitored periodically; (2) samples were taken of the leachate in the intratrench wells and were analyzed for a broad range of radiological and chemical contaminants; and (3) water levels in wells outside the trenches were monitored periodically. With the exception of the trench leachate sampling, each of these activities spanned the preconstruction, construction, and postconstruction periods. Findings of this study have important implications for the ongoing remedial investigation in SWSA 6 and for the design of other ICMs.

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T.L. Ashwood, D.S. Wickliff, and C.M. Morrissey, Oak Ridge National Laboratory, Oak Ridge, TN

Active Sites Environmental Monitoring Program: Program Plan - ORNL

Report (1990)

DOE Order 5820.2A requires that (1) low-level waste (LLW) disposal sites active on or after September 1988 and (2) all transuranic (TRU) waste storage sites be monitored periodically to assure that radioactive contamination does not escape from the waste sites and pose a threat to the public or to the environment. This plan describes such a monitoring program for the active LLW disposal sites in SWSA 6 and the TRU waste storage sites in SWSA 5 North at Oak Ridge National Laboratory.

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T.L. Ashwood, Oak Ridge National Laboratory, Oak Ridge, TN

Ecological Assessment Plan for Waste Area Grouping 5

ORNL/M-1871; 18 pp. (April 1992)

Waste Area Grouping (WAG) 5 at Oak Ridge National Laboratory contains 13 solid waste management units (SWMUs), and covers a surface area of approximately 20 ha in Melton Valley south of the main plant area. The largest SWMUs are Solid Waste Storage Area (SWSA) 5 and SWSA 5 North. These two SWMUs also contain most of the radioactive contamination. WAG 5 contains two surface impoundments and two intermittent streams; runoff from WAG 5 enters White Oak Creek and Melton Branch. Principal contaminants include fission-product radionuclides and transuranic elements, but trace metals and some organics may also be present. This document describes the ecological assessment that will be performed to determine the ecological effects of contamination from WAG 5. This document also supports the baseline risk assessment and subsequent alternatives evaluations for WAG 5. Three specific tasks are incorporated in the WAG 5 ecological assessment: (1) threatened and endangered species surveys; (2) ambient toxicity tests of seeps, stream reaches, and soil that are identified as being contaminant sources; and (3) sampling of wildlife (specifically wild turkeys) that could potentially transfer contaminants from WAG 5 to humans.

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Oak Ridge National Laboratory, Oak Ridge, TN; Bechtel National, Inc., Oak Ridge, TN; CH2M Hill Southeast, Inc., Oak Ridge, TN; ERC Environmental and Energy Services Company, Oak Ridge, TN; PEER Consultants PC, Oak Ridge, TN

RCRA Facility Investigation Report for Waste Area Grouping 6 at Oak Ridge National Laboratory, Oak Ridge, Tennessee

ORNL/ER/Sub-87/99053/5&V4; 250 pp. (September 1991)

This report presents data and information related to remedial investigation studies for Oak Ridge National Laboratory (ORNL). Information is included on a soil gas survey, surface radiological investigations of waste areas, and well installation for ground water monitoring.

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P.A. Taylor, Oak Ridge National Laboratory, Oak Ridge, TN

Treatability Study for WAG 6 (SWSA 6) Trench Water

ORNL/ER-17; 61 pp. (August 1991)

The Environmental Restoration Program at Oak Ridge National Laboratory (ORNL) is examining methods for remediation and final closure of Waste Area Grouping 6 (WAG 6) under a Resource Conservation and Recovery Act (RCRA) closure plan. WAG 6 consists primarily of Solid Waste Storage Area 6 (SWSA 6), where solid low-level radioactive waste (and some hazardous waste) was buried from 1968 to 1985 in shallow trenches. To support the feasibility study that is being prepared for closure of WAG 6, lab-scale treatability tests were performed on the water from selected trenches in SWSA 6 to determine if the trench water could be treated at the existing wastewater treatment plants at ORNL. Water from 23 of the 500 trenches in SWSA 6 has been sampled and analyzed to date; the 4 most highly contaminated trenches identified thus far supplied the water used in the treatability tests. The softening and ion-exchange processes used in the

Process Wastewater Treatment Plant (PWTP) reduced the Sr-90 concentration, which was the only radionuclide present in the trench water at above the discharge limits, from 260 to 0.2 Bq/L. The air-stripping and activated-carbon adsorption processes used in the Nonradiological Wastewater Treatment Plant (NRWTP) removed volatile and semivolatile organics (mostly toluene, xylene, and naphthalene), which were the main contaminants in the trench water, to below detection limits. The trench water treated in the lab-scale equipment easily met all discharge limits for the PWTP and the NRWTP.

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M.S. Uziel, P.F. Tiner, and J.K. Williams, Oak Ridge National Laboratory, Health and Safety Research Division, Oak Ridge, TN

Surface Radiological Investigations of Trench 6 and Low-Level Waste Line Leak Site 7.4b at the Oak Ridge National Laboratory, Oak Ridge, Tennessee

ORNL/ER-37; 36 pp. (August 1991)

A surface radiological investigation of Trench 6 and low-level radioactive waste (LLW) Line Leak Site 7.4b was conducted in July and August 1989 and in January 1990 by the Measurement Applications and Development Group, Oak Ridge National Laboratory. The purposes of this survey were (1) to determine the presence, nature, and extent of surface radiological contamination and (2) to recommend interim corrective action that will limit human exposures to radioactivity and minimize the potential for contaminant dispersion. Highest surface gamma levels encountered during the survey (39 mR/h) were found just south of the asphalt covering LLW Line Leak Site 7.4b. Elevated surface gamma levels (measuring 28 to 560 uR/h) extended from this area to a width of 100 ft, westward 250 ft, and beyond the survey boundary. Beta-gamma levels up to 17 mrad/h measured on contact with the trunks of trees growing in the area southwest of Trench 6 suggest that tree roots are reaching contamination deep within the ground. Since no gamma activity is associated with the trees or their leaves, the elevated beta levels are probably due to the uptake of residual Sr-90 originating from the documented seepage at the Trench 6/Leak Site 7.4b area. Beta activity present in the leaf litter and surface soil indicate that decaying leaves are depositing measurable contaminants on the ground surface. Recommendations for corrective actions are included in this report.

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T.A. Fontaine, Oak Ridge National Laboratory, Oak Ridge, TN

Monitoring and Modeling Contaminated Sediment Transport in the White Oak Creek Watershed

ORNL/ER-65; 19 pp. (November 1991)

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

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J.M. Loar, S.M. Adams, L.J. Allison, B.G. Blaylock, H.L. Boston, M.A. Huston, B.L. Kimmel, J.G. Smith, G.R. Southworth, A.J. Stewart, B.T. Walton, J.T. Kitchings, and C.R. Olsen, Oak Ridge National Laboratory, Oak Ridge, TN

Oak Ridge National Laboratory Biological Monitoring and Abatement Program for White Oak Creek Watershed and the Clinch River

ORNL/TM-10370; 142 pp. (September 1991)

On April 1, 1986, a National Pollutant Discharge Elimination System permit was issued for the Oak Ridge National Laboratory (ORNL). As specified in Part 3: Special Conditions (Item H) of the permit, a plan for biological monitoring of the Clinch River, White Oak Creek, Northwest Tributary of White Oak Creek, Melton Branch, Fifth Creek, and First Creek shall be submitted for approval to the U.S. Environmental Protection Agency (EPA) and the Tennessee Department of Health and Environment (TDHE) within 90 days of the effective date of the permit. The plan, which is referred to in Part 3 (H) of the permit as the Biological Monitoring Plan and Abatement Program (BMPAP), describes characterization monitoring studies to be conducted for the duration of the permit (5 years). In order to be consistent with the terminology used for the Biological Monitoring and Abatement Programs for the Oak Ridge Y-12 Plant and the Oak Ridge K-25 Plant, BMPAP will subsequently be referred to as the Biological Monitoring and Abatement Program (BMAP). The proposed BMAP outlined in this document is based on preliminary discussions held on December 9, 1985, between staff of Martin Marietta Energy Systems, Inc. (ORNL and Central Management), the U.S. Department of Energy, EPA, and TDHE.

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T.L. Ashwood, D.S. Wickliff, and C.M. Morrissey, Oak Ridge National Laboratory, Oak Ridge, TN

Active Sites Environmental Monitoring Program: Mid-FY 1991 Report

ORNL/M-1442; 68 pp. (October 1991)

This report summarizes the activities of the Active Sites Environmental Monitoring Program (ASEMP) at the Oak Ridge Reservation from October 1990 through March 1991. The ASEMP was established in 1989 to provide early detection and performance monitoring at active low-level radioactive waste (LLW) disposal sites in Solid Waste Storage Area (SWSA) 6 and transuranic (TRU) waste storage sites in SWSA 5 as required by chapters II and III of U.S. Department of Energy Order 5820.2A. Monitoring results continue to demonstrate that no LLW is being leached from the storage vaults on the tumulus pads. Loading of vaults on Tumulus II began during this reporting period and 115 vaults had been loaded by the end of March 1991.

682
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Preliminary Analysis of Wind Data from the Oak Ridge Site Survey

NOAA-TM-ERL-ARL-193; 54 pp. (February 1992)

The U.S. Department of Energy operates six nuclear-material plants which are under the jurisdiction of Oak Ridge Operations (ORO), which is headquartered in Oak Ridge, Tennessee. All of the plants store chemicals that could produce a toxic atmospheric cloud during an accident. Although each plant had independently developed a capability to model and deal with hazardous atmospheric releases, ORO decided in 1986 to upgrade and integrate its emergency response capability. Part of the upgrade involves the development and implementation of improved computer models for simulating atmospheric diffusion. In this report a preliminary analysis of wind data from the Oak Ridge site survey is presented. The survey began in the fall of 1989 and ended in December 1990. Since the three Oak Ridge plants are relatively close together, the

National Oceanic and Atmospheric Administration, Atmospheric Turbulence and Diffusion Division conducted one meteorological survey for the entire Oak Ridge Reservation. Like the preliminary reports from the earlier site surveys, the primary goal of this report is to make a recommendation on the number and general location of permanent meteorological towers.

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Identification of Groundwater-Producing Fractures by Using an Electromagnetic Borehole Flowmeter in Monitoring Wells on the Oak Ridge Reservation, Oak Ridge, Tennessee

ORNL/ER-91; 54 pp. (March 1992)

This report describes the results of electromagnetic borehole flowmeter surveys taken on the Oak Ridge Reservation (ORR) with an instrument developed by the Engineering Laboratory of Tennessee Valley Authority. The borehole flowmeter can be used during water injection or pumping to determine the depth, vertical extent, and relative permeability of fractures that are intercepted by the wells. The flowmeter can also be used to measure any natural water flows, up or down an openhole interval, from one permeable fracture to another. These and other data have been used to select screen intervals or sampling ports in newly constructed wells on the ORR, to evaluate the potential for cross-contamination (the flow was dissolved pollutants from one level to another in a well or corehole), and to characterize permeable fractures and permeable intervals in wells.

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Active Sites Environmental Monitoring Program: FY 1990 Annual Report

ORNL/M-1327; 53 pp. (October 1991)

Chapter 3 of U.S. Department of Energy (DOE) Order 5820.2A (DOE 1988) sets forth requirements for environmental monitoring of active low-level waste (LLW) disposal sites. Active sites are defined as those LLW facilities that were in use on or after the date of the order (September 1988). The transuranic (TRU) waste storage areas in Solid Waste Storage Area (SWSA) 5 North are covered by Chapter 2 of the order. In both chapters, monitoring is required to provide for early warning of leaks before those leaks pose a threat to human health or the environment. Chapter 3 also requires that monitoring be conducted to evaluate the short- and long-term performance of LLW disposal facilities. In accordance with this order, the Solid Waste Operations Department at Oak Ridge National Laboratory (ORNL) has established an Active Sites Environmental Monitoring Program (ASEMP) that is implemented by staff of the Environmental Sciences Division (ESD) at ORNL. This report summarizes data from ASEMP monitoring activities for the final 6 months of FY 1990. A brief summary of the monitoring methodology for each site is also presented.

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J.K. Williams, R.E. Rodriguez, M.S. Uziel, and P.F. Tiner, Oak Ridge National Laboratory, Health and Safety Research Division, Oak Ridge, TN

Surface Radiological Investigations at White Wing Scrapyard, Oak Ridge Reservation, Oak Ridge, Tennessee

ORNL/ER-52; 72 pp. (September 1991)

A surface radiological investigation of accessible areas at the White Wing Scrap Yard on the Oak Ridge Reservation, Tennessee, was conducted intermittently from December 1989 through July 1991. The survey was performed by the Measurement Applications and Development Group of Oak Ridge National Laboratory (ORNL) at the request of Environmental Restoration Program (ERP) personnel at ORNL. The survey's purposes were to (1) determine the presence, nature, and extent of surface radiological contamination; and (2) recommend interim corrective action to limit human exposures to radioactivity and to minimize the potential for

contaminant dispersion. White Wing Scrap Yard was assigned to Waste Area Group (WAG) 11 by the ORNL ERP staff. Surface radiation measurements and visual inspections have identified a variety of radiological and physical hazards. In general, the site exhibited widespread clusters of localized radioactive hot spots throughout the accessible areas. The most numerous and concentrated regions of contamination, encompassing several grid blocks, were found north of Hot Yard Road. Three localized service hot spots, with gamma exposure rates of 12, 6.2, and 1.5 mR/h, were identified. Physical hazards include sharp pieces of metal and broken glass on the ground. Sample analysis results demonstrate high concentrations of enriched uranium (U-235) in most of the samples, suggesting the contamination is from waste from the Y-12 and K-25 plants. Sample analysis from the 12 mR/h hot spot revealed Cs-137 concentrations of up to 21,000 pCi/g. Elevated concentrations of U-238 in soil samples taken south of Hot Yard Road and elevated concentrations of Cs-137 taken northwest of Hot Yard Road suggest that the designated operational boundaries of the scrapping area were not strictly adhered to, and/or these facilities managed a variety of radionuclides. Chemical analysis of three soil samples collected from a dead-vegetation region north of Hot Yard Road demonstrates the presence of polychlorinated biphenyls (PCBs) at concentrations around 10 ppm per sample. Survey results show that previous cleanup operations were insufficient. Without a fence barrier with restricted access at the WAG 11 boundary, a potential risk to intruders exists. There is probable contaminated vegetation and, consequently, the potential for radionuclide transfer to higher levels in the food chain. In the site characterization and remediation processes, a baseline risk assessment for the site should be conducted. Full site characterization, including subsurface soil corings and subsequent sample analysis, will be necessary to adequately characterize the radiological and hazardous waste on the White Wing Scrap Yard Site and to determine appropriate long-term remediation. Besides highlighting areas for attention, this report recommends two surficial corrective measures: (a) the isolation of contaminated areas and (b) the removal, treatment, and disposal of contaminated material.

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J.M. Eaton and E.M. Ingram, Science Applications International Corporation, Oak Ridge, TN

Site Investigation Report and Corrective Action Plan for Tank 2310-U at the Pine Ridge West Repeater Station, Oak Ridge Y-12 Plant, Oak Ridge, Tennessee

Y/Sub-91/TJ997C/7; 56 pp. (April 1991)

This Site Investigation Report/Corrective Action Plan for the Pine Ridge West Repeater Station Site includes the Underground Storage Tank 2310-U. The site and tank are located at the Oak Ridge Y-12 Plant in Oak Ridge, Tennessee. This report documents the results of investigations of petroleum releases at the Pine Ridge West Repeater Station Site and satisfies the requirements of Rule 1200-1-15-06 of the Rules of the Tennessee Department of Health and Environment, which became effective for the Oak Ridge Reservation on April 15, 1990. Underlying soils were evaluated to determine the nature and extent of contamination. Results of the site-investigation soil analysis indicate that the horizontal extent of contaminant migration appears to be minute. The contamination appears to be limited to the areas directly adjacent to the former Tank 2310-U location. Although the horizontal extent of contamination has been adequately defined, the vertical extent of contaminant migration has not. This information was, however, adequate to conduct a review of corrective action alternatives, although it is apparent that soil permeability testing must be conducted prior to a final determination at the site. If the hydraulic conductivity of the soil is less than 10(E-4) cm/s, no further action is required. Should the hydraulic conductivity be equal to or greater than 10(E-4) cm/s, some corrective action would be required.

687

Oak Ridge Y-12 Plant, Oak Ridge, TN

Monitor Well Inspection and Maintenance Plan for the Department of Energy, Y-12 Plant, Oak Ridge, Tennessee

Y/Sub-91/YP507C/5; 93 pp. (July 1991)

This document is a groundwater monitor-well inspection and maintenance plan for the Department of Energy Y-12 Plant in Oak Ridge, Tennessee, prepared for the Y-12 Plant Groundwater Protection Program. The plan is intended to provide a systematic program for inspecting the physical condition of monitor wells at the Y-12 Plant, and to identify maintenance needs that will extend the life of each well and ensure that representative groundwater quality samples and hydrologic data are collected from the wells. The plan also formalizes well inspection and maintenance activities that have been, and are currently, implemented at the Y-12 Plant.

688
Oak Ridge Y-12 Plant, Oak Ridge, TN; ERC Environmental and Energy Services Company, Knoxville, TN

Calendar Years 1989 and 1990 Monitoring Well Installation Program Y-12 Plant, Oak Ridge, Tennessee

Y/TS-760; 332 pp. (October 1991)

This report documents well construction activities at the Y-12 Plant in Oak Ridge, Tennessee during 1989 and 1990. The well construction program consisted of installing seventy-five monitoring wells. Geologists from ERCE (formally the Engineering, Design and Geosciences Group) and Martin Marietta Energy Systems, supervised and documented well-construction activities and monitored for health and safety concerns. Sixty-seven monitoring wells were installed under the supervision of an ERCE geologist from March 1989 to September 1990. Beginning in September 1990, Energy Systems supervised drilling activities for eight monitoring wells, the last of which was completed in December 1990.

689
Oak Ridge Y-12 Plant, Oak Ridge, TN

Response to Comments and Recommendations on RCRA Facility Investigation Plan for Group 4 at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee

Y/ER-20/V2; 30 pp. (December 1991)

This document was prepared to respond to comments and recommendations resulting from the Department of Energy (DOE) Technical Working Group Meeting-Y12, attended by representatives from the following organizations: DOE Oak Ridge Field Office; Martin Marietta Energy Systems, Inc.; Environmental Protection Agency Region IV; and the Tennessee Department of Environment and Conservation. Comments and recommendations were provided to improve the sampling efforts proposed for the Abandoned Nitric Acid Pipeline (ANAPL) in the Resource Conservation and Recovery Act Facility Investigation Plan for Group 4 at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee (ES/ER-10/V1 D1 and ES/ER-10/V2 D1). Thus, the sampling methodology discussed in this document replaces the sampling approach discussed in Section 8.5 of that plan. The ANAPL transported wastes from operations in Buildings 9215, 9212, and 9206, and discharged these wastes into the S-3 Ponds surface impoundments. Materials known to be discharged through the stainless steel pipeline included free nitric acid and both depleted and enriched uranium. The revised sampling and analytical methodology for the ANAPL includes the following: (1) decreasing the number of soil sampling locations for this phase of the investigation; (2) taking deeper samples from the proposed shallow soil sample sites and archiving all samples except the one taken nearest the pipeline; (3) analyzing the sample taken nearest the pipeline for inductively coupled plasma metals, leachable nitrate, total uranium, and percent of U-235 present; (4) conducting field screening for volatile organic compounds; and (5) proposing nitrate and uranium concentration action levels to trigger analysis of archived samples after analysis and evaluation of the samples taken nearest the pipeline.

690
D.E. Bohrman and E.M. Ingram, Oak Ridge Y-12 Plant, Oak Ridge, TN; Science Applications International Corporation, Oak Ridge, TN

Release Investigation Report for Underground Storage Tank 2336-U at the Chestnut Ridge Repeater Station, Building 0962, Oak Ridge Y-12 Plant, Oak Ridge, Tennessee

Y/Sub-91/TJ997C/14; 57 pp. (December 1991)

This report represents the Release Investigation Report for Underground Storage Tank (UST) 2336-U at Building 0962, Oak Ridge Y-12 Plant, Oak Ridge, Tennessee. This tank was located at the Chestnut Ridge Repeater Station, which is southwest of the main Y-12 Plant facility. This report summarizes and evaluates field and laboratory data obtained during the tank removal in May 1991. These data were collected to determine the presence of possible petroleum contamination resulting from operation of the tank.

691
Martin Marietta Energy Systems, Inc., Oak Ridge, TN; CH2M Hill Southeast, Inc., Oak Ridge, TN

Remedial Investigation Report for Chestnut Ridge OU 2 (Filled Coal Ash Pond/McCoy Branch) at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee

ES/ER-23/D1; Y/ER/Sub-90/97777/2; 626 pp. (December 1991)

CH2M Hill was contracted by Martin Marietta Energy Systems to conduct a Remedial Investigation (RI) for Solid Waste Management Unit (SWMU) D-112, the Filled Coal Ash Pond (FCAP), at the Y-12 Plant. This site is identified by Energy Systems as associated with the Y-12 Plant Group 3 Sites. The RI was conducted in accordance with an existing RCRA Facility Investigation plan prepared by Battelle Columbus Division. The site investigation was conducted to define the nature and extent of contamination at the SWMU; it was designed to collect information to assess the migration pathways of contaminants and to assess the potential risk to human health from site contaminants. An alternatives assessment was also conducted to identify preliminary remedial action alternatives appropriate for the SWMU.

692
Oak Ridge National Laboratory, Office of Risk Analysis, Oak Ridge, TN

Response to Comments on Remedial Investigation Report for the Plating Shop Container Areas (S-334 and S-351) at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee

Y/ER-21; 67 pp. (December 1991)

The Plating Shop Container Storage Areas Site is composed of two solid waste management units (SWMUs), designated S-334 and S-351. Both SWMUs were previously sampled during a remedial investigation (RI) in 1989. Samples were collected at the ground surface, 2 feet below the ground surface, and 4 feet below the ground surface. Beryllium, chromium, cyanide, lead, uranium, and nickel were detected at slightly elevated concentrations at both SWMU locations within the site. The samples were not analyzed for organics. The samples collected for the Resource Conservation and Recovery Act Facility Investigation (RFI) should have been analyzed for volatile organic contaminants. The site was resampled in August 1991. Samples were collected from between 1 feet to 3 feet from the boreholes drilled for the original RFI. In addition, samples were obtained from the same depth horizons that were sampled previously. These additional samples were analyzed for volatile organics. Tetrachloroethane was detected in some of the samples at concentrations up to 86 ug/kg. The baseline risk assessment was revised to incorporate the organic sampling data. The risks are unchanged as a result of information from the latest sampling effort. This report, ES/ER-36/D2, is a companion document to ES/ER-36/D1, Remedial Investigation Report, Plating Shop Container Areas (S-334 and S-351), Oak Ridge Y-12 Plant, Oak Ridge, Tennessee.

693
J.M. Eaton and E.M. Ingram, Oak Ridge Y-12 Plant, Oak Ridge, TN

Initial Site Characterization for Underground Storage Tank 2081-U, Building 9212, Oak Ridge Y-12 Plant, Oak Ridge, Tennessee

Y/Sub-91/TJ997C/11; 70 pp. (September 1991)

This report represents the Initial Site Characterization (ISC) for the Underground Storage Tank (UST) 2081-U at Building 9212 of

the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee. This report documents results of the ISC concerning petroleum releases from the UST, characterization of the release site, and delineation of soil contamination, which are required to evaluate and conduct remedial actions at the tank site. The principle contaminants expected in the vicinity of Tank 2081-U are those associated with leaded gasoline. The probable source of these contaminants at the tank site is leakage from, and/or overfilling of, the tank. Soil samples were collected from the bottom of the former tank-pit excavation and waste-soil pile immediately after removal of Tank 2081-U on April 18, 1991. Results of the ISC soil-sample analyses indicated the presence within the former tank pit of total petroleum hydrocarbon (TPH) contamination exceeding the most stringent Tennessee Department of Environment and Conservation (TDEC) Closure Action Level for non-drinking water sources. Based on these results, excavation to remediate soil contamination within the Tank 2081-U pit is the next action recommended by TDEC. Confirmatory soil samples will be collected from the final excavation to determine if the excavation was effective and if additional investigation of the Tank 2081-U site is warranted.

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E.M. Ingram and J.M. Eaton, U.S. Department of Energy, Washington, DC; Science Applications International Corporation, Oak Ridge, TN

Release Investigation Report for Underground Storage Tank 2305-U at Building 9998, Oak Ridge Y-12 Plant, Oak Ridge, Tennessee

Y/Sub-91/TJ997C/8; 55 pp. (April 1991)

This document is a Release Investigation Report for Underground Storage Tank (UST) 2305-U at Building 9998 in the north-central portion of the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee. This report documents results of the Initial Site Characterization to identify the presence or absence of petroleum contamination from the UST, identify the possible presence of free product, determine the nature and quantity of any releases, and provide data on site characteristics. This Release Investigation Report presents the information gathered to date on Tank 235-U and the associated tank site. Observations made during tank removal and accompanying soil sampling are discussed. Conclusions drawn from the existing data are also presented.

695

C.C. Brandt, K.A. Rose, R.B. Cook, K.C. Dearstone, A.L. Brenkert, and C.R. Olsen, Oak Ridge National Laboratory, Oak Ridge, TN

Patterns of Sediment Accumulation in Watts Bar Reservoir Based on Cesium-137

CONF-9109234; Proceedings of the Fourth Annual Tennessee Water Resources Symposium, Knoxville, TN, September 24-26, 1991; (5 pp.) (1991)

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

696

R.J. Arthur, Pacific Northwest Laboratory, Richland, WA

1991 Yearly Calibration of Pacific Northwest Laboratory's Gross Gamma-Ray Borehole Geophysical Logging System

PNL-7785; 51 pp. (August 1991)

This report describes the 1991 yearly calibration of a gross gamma-ray geophysical pulse logging system owned by the U.S. Department of Energy (DOE) and operated by the Pacific Northwest Laboratory. The calibration was conducted to permit the continued use of this system for geologic and hydrologic studies associated with remedial investigations at the Hanford Site. Primary calibrations to equivalent uranium units were conducted in DOE borehole-model standards that reside on the Hanford Site. The calibrations were performed in borehole models SBL/SBH and SBA/SBB, which contain low-equivalent uranium concentrations. Correlations were established based on two similar approaches for relating observed count rate in before- and after-logging field calibrations to equivalent uranium concentrations. A new field source (Ra-20S-82) was fabricated to replace the old source (Ra-20S-204), whose activity led to variable field-calibration results previously, caused by a nonfixed geometry. A cross-calibration study was performed to compare the operation of the new source relative to the old source. A digitally based collection/recording system was recently acquired, so that many of the procedures were performed with the old analog system and the new digital system to compare the performance of the digital system.

697

L.E. Bisping, Pacific Northwest Laboratory, Richland, WA

Environmental Surveillance Master Sampling Schedule

PNL-7964; 57 pp. (January 1992)

Environmental surveillance of the Hanford Site and surrounding areas is conducted by Pacific Northwest Laboratory for the U.S. Department of Energy. This document contains the planned schedule for routine sample collection for the Surface Environmental Surveillance Project and Ground-Water Monitoring Project. Samples for radiological analyses include the following: (1) air-particulate filters; (2) water from the Columbia River, on-site ponds and springs, and irrigation and drinking water; (3) foodstuffs/animal products, including whole milk, poultry and eggs, and beef; (4) foodstuffs/produce, including leafy vegetables, vegetables, and fruit; (5) foodstuffs/farm products including wine, wheat and alfalfa; (6) wildlife; (7) soil; (8) vegetation; and (9) sediment. Direct radiation measurements include terrestrial locations, Columbia River shoreline locations, and on-site roadway, railway, and aerial radiation surveys.

698

L.L. Cadwell, L.E. Eberhardt, K.R. Price, and D.W. Carlile, Pacific Northwest Laboratory, Richland, WA

Trends in Radionuclide Concentrations for Wildlife and Food Products Near Hanford for the Period 1971-88

PNL-SA-18876;CONF-891053;Environmental Monitoring, Restoration and Assessment: What Have We Learned?, R.H. Gray (ed.), Proceedings of the 28th Hanford Life Sciences Symposium, Richland, WA, October 16-19, 1989, 340 pp.; (pp. 41-49) (1989)

The authors evaluated the Hanford environmental data base for trends in radionuclide concentrations in wildlife and food products sampled from 1971 through 1988 on or near the U.S. Department of Energy's Hanford Site in southeastern Washington. Although statistical analyses showed short-term changes, no upward trends in radionuclide concentrations were detected. Many samples showed a significant decline in some radionuclides, particularly for Cs-137. Concentrations of Zn-65 also showed a downward trend in many samples. Cessation of atmospheric testing by the U.S. and the USSR in 1971 contributed to the decline in radionuclide levels in some samples. Contaminants discharged to the Columbia River at Hanford were reduced after shutdown of the last "once-through" cooling-water reactor in 1971. A decline in concentrations of Zn-65 in oysters from Willapa Bay and Co-60 and Zn-65 in mountain whitefish from the Hanford Reach of the Columbia River are attributable to reactor closure. There was also an apparent reduction in availability of radiological contamination to Hanford wildlife after decommissioning of waste-water disposal ponds and remediation of contaminated terrestrial sites.

699
C.J. Chou, Westinghouse Hanford Company, Richland, WA

Statistical Approach on RCRA Groundwater Monitoring Projects at the Hanford Site

WHC-SA-1124; CONF-9108100; Proceedings of the 1991 American Statistical Association Annual Meeting, Atlanta, GA, August 18-22, 1991; (17 pp.) (April 1991)

Hanford Site interim-status groundwater monitoring projects are conducted as background, indicator parameter evaluation, or groundwater quality assessment monitoring programs as specified in the Resource Conservation and Recovery Act of 1976. Requirements for the groundwater monitoring system, sampling and analysis, and statistical evaluation found in Washington Administrative Code 173-303-400 and Title 40, Code of Federal Regulations, Paragraph 265, Subpart F are discussed. Problems associated with analyzing groundwater chemistry data are addressed. The use of limit-of-quantitation is proposed as the comparison value between the upgradient and downgradient wells for cases where the calculated critical mean is not quantifiable.

700
R.L. Dirkes, Pacific Northwest Laboratory, Richland, WA

Recovery and Evaluation of Historical Environmental Monitoring Data at Hanford

CONF-910603; Proceedings of the 1991 American Nuclear Society Annual Meeting, Orlando, FL, June 2-6, 1991; Transactions of the American Nuclear Society 63:45-46 (1991)

The objective of the Hanford Environmental Dose Reconstruction (HEDR) Project is to estimate the radiation doses that populations could have received from the nuclear operations at the Hanford Site since 1944. The Environmental Monitoring Data Task within HEDR is charged with assembling, evaluating, and summarizing key historical measurements of radionuclide concentrations in the environment on and around the Hanford Site. The recovery and evaluation of historical environmental-monitoring data are integral parts of the environmental dose-reconstruction process. The data generated through historical environmental-monitoring programs may be critical in the development of dose modeling codes and in performing a meaningful environmental pathway analysis. In addition, environmental-monitoring data are essential in the verification of model calculations and in the validation of the model itself. This paper presents a task logic flowchart illustrating how the process evolves within the Environmental Monitoring Data Task and the interaction with other project tasks. The reconstruction of such data presents numerous challenges, many of which are not generally encountered in typical scientific studies. This paper discusses the process of reconstructing historical environmental-monitoring data at Hanford. Several of the difficulties encountered during this process are presented. Items that may be beneficial and should be considered in performing such a task are identified.

701
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Historical Genesis of the Hanford Site Wastes

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 649-654) (September 1991)

This paper acquaints the audience with historical waste practices and policies at the Hanford Site as they have changed over the years, including the generation of the major waste streams that are of concern in the Hanford Site cleanup today. The paper also describes the founding and the operating history of the Hanford Site, including World War II construction and operations, three major postwar expansions (1947-1955), the peak years of production (1956-1963), production phase-downs (1964-present), and some past efforts to chemically treat, "fractionate," and/or immobilize the Hanford Site's wastes. Recent events, which include the designation of the Hanford Site as the "flagship" of Department of Energy (DOE) waste remediation efforts and the signing of the

landmark Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement), have generated new interest in the Hanford Site's history. Cleanup milestones dictated in the Tri-Party Agreement demand information about how, when, in what quantities and mixtures, and under what conditions Hanford Site wastes were generated and released. This paper presents original, primary-source research into the waste history of the Hanford Site. The paper reviews (a) the earliest, 1940s knowledge base; (b) assumptions and calculations about radioactive and chemical discharges, as discussed in memos; and (c) the correspondence and reports of the builders and operators of the original Hanford Site, then the Hanford Engineer Works. The paper also traces the growth of the knowledge of, the research efforts in, and the subsequent changes in Hanford Site waste disposal practices. Finally, the paper places the current waste remediation endeavors at the Hanford Site in the broad context of American and world history.

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Accelerated Cleanup of Past Practice Waste Sites on the Hanford Site, Richland, Washington

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 81-84) (September 1991)

This report provides a basic description of the Expedited Response Action (ERA) program currently being implemented at the Hanford Site. It includes reference to the regulations applicable to the program, i.e., the Resource Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The Hanford Site contains over 1500 waste management units containing radioactive and/or chemical wastes. During environmental restoration activities at Hanford, it became apparent that some sites required remedial responses to be undertaken earlier than those allowed for in the CERCLA Remedial Investigation/Feasibility Study or the RCRA Facility Investigation/Corrective Measure Study. According to the Hanford Federal Facility Agreement, as provided for in RCRA and CERCLA, ERAs may be made (1) to mitigate a threat to the public and/or the environment; (2) to make future remedial investigation activities safer or more effective by removing or controlling on-site wastes; (3) to demonstrate a promising technology; or (4) to take a course of remedial action that is readily evident. Three ERAs have been initiated at the Hanford Site: (a) the 618-9 Burial Ground ERA, (b) the 316-5 Process Trenches ERA, and (c) the 200 West Area Carbon-Tetrachloride Vadose Plume ERA. As remedial investigations at Hanford proceed, more waste sites warranting ERAs will be identified.

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Development of an Adjoint Sensitivity Method for Site Characterization, Uncertainty Analysis, and Code Calibration/Validation

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 883-888) (September 1991)

The adjoint method is applied to ground-water flow-mass transport coupled equations in variably saturated media. The sensitivity coefficients derived by this method can be calculated by a single execution for each performance measure, regardless of the number of parameters in question. The method provides an efficient and effective way to rank the importance of the parameters so that data collection in support of site characterization programs can be guided. The developed code will facilitate the sensitivity/uncertainty analysis in both model prediction and model calibration/validation.

704

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Temporal Variations in Atmospheric Dispersion at Hanford

PNL-SA-18876;CONF-891053;Environmental Monitoring, Restoration and Assessment: What Have We Learned?, R.H. Gray (ed.), Proceedings of the 28th Hanford Life Sciences Symposium, Richland, WA, October 16-19, 1989, 340 pp.; (pp. 323-325) (1990)

Climatological data are frequently used to estimate atmospheric dispersion factors for historical periods and for future releases for which adequate meteorological data are unavailable. This practice routinely leads to questions concerning the representativeness of data used. The work described here was performed to provide a basis for answering these questions at the U.S. Department of Energy's Hanford Site in eastern Washington. Atmospheric transport and diffusion near Hanford have been examined using a Lagrangian-puff dispersion model and hourly meteorological data from the Hanford Meteorological Station and from a network of 24 surface wind stations for a 5-yr period. Average normalized monthly concentrations were computed at 2.5-km intervals on a 31 by 31 grid from January 1983 through 1987, assuming an elevated release in the 200-East Area. Monthly average concentrations were used to determine 5-yr mean pattern and monthly mean patterns and the interannual variability about each pattern. Intra-annual and diurnal variations in dispersion factors are examined for six locations near Hanford.

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Strontium-90 in Canada Goose Eggshells: Nonfatal Monitoring for Contamination in Wildlife

PNL-SA-18876;CONF-891053;Environmental Monitoring, Restoration and Assessment: What Have We Learned?, R.H. Gray (ed.), Proceedings of the 28th Hanford Life Sciences Symposium, Richland, WA, October 16-19, 1989, 340 pp.; (pp. 25-31) (1989)

The researchers measured Sr-90 in eggshells from Canada geese (Branta candensis moffitti) that nested on Columbia River islands up- and downstream from deactivated plutonium production reactors on the Hanford Site. They also measured Sr-90 in wing bones of goose carcasses. Background levels of Sr-90 were based on eggshells collected on an island upstream of the reactors. A few eggshells collected from nests on a single island downstream of the reactors had slightly higher than background levels of Sr-90. This may have resulted from geese eating shoreline plants or crops irrigated with Columbia River water that contained Sr-90 released into the river through groundwater seepage.

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Identification of Contaminants of Concern in Hanford Ground Waters

PNL-SA-18876;CONF-891053;Environmental Monitoring, Restoration and Assessment: What Have We Learned?, R.H. Gray (ed.), Proceedings of the 28th Hanford Life Sciences Symposium, Richland, WA, October 16-19, 1989, 340 pp.; (pp. 51-59) (1989)

More than 1500 waste-disposal sites have been identified at the U.S. Department of Energy Hanford Site. At the request of the U.S. Environmental Protection Agency, these sites were aggregated in to four administrative areas for listing on the National Priority List. Within the four aggregate areas, 646 inactive sites were selected for further evaluation using the Hazard Ranking System (HRS). Evaluation of inactive waste sites by HRS provided valuable insight to design a focused monitoring network for radiological and hazardous substances. Ground water monitoring site-wide was expanded to address both radioactive constituents and hazardous chemicals. The HRS scoring process considers the likelihood of groundwater contamination from past disposal practices at inactive waste sites. The network designed to monitor ground water at those past-practice waste sites identified I-129, Tc-99, Sr-90, uranium, chromium, carbon tetrachloride, and cyanide.

707
U.S. Department of Energy, Richland Field Office, Richland, WA

Hanford Federal Facility Agreement and Consent Order Quarterly Progress Report for the Period Ending March 31, 1991

DOE/RL-91-23; 108 pp. (May 1991)

This is the seventh quarterly report required by the Hanford Federal Facility Agreement and Consent Order, also known as the Tri-Party Agreement, established between the U.S. Department of Energy (DOE), the U.S. Environmental Protection Agency (EPA), and the Washington State Department of Ecology (Ecology). The Tri-Party Agreement sets the plan and schedule for achieving regulatory compliance and cleanup of waste sites at the Hanford Site. This report covers progress for the quarter that ended March 31, 1991.

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U.S. Department of Energy, Richland Field Office, Richland, WA

Quarterly Report of RCRA Groundwater Monitoring Data for Period April 1, 1991 Through June 30, 1991

DOE/RL-91-47; 68 pp. (September 1991)

Hanford Site interim-status groundwater monitoring projects are conducted as either background, indicator parameter-evaluation, or ground-water quality assessment monitoring programs as defined in the Resource Conservation and Recovery Act of 1976 (RCRA); and 40 CFR 265, Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities, as amended (EPA 1989). Compliance with the 40 CFR 265 regulations are required by the Washington Administrative Code 173-303 (Ecology 1991). This submittal provides data obtained from groundwater monitoring activities for April 1, 1991 through June 30, 1991.

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U.S. Department of Energy, Richland Field Office, Richland, WA; Westinghouse Hanford Company, Richland, WA

Quarterly Report of RCRA Groundwater Monitoring Data for Period July 1, 1991 Through September 30, 1991

DOE/RL-91-57; 255 pp. (December 1991)

Hanford Site interim-status groundwater monitoring projects are conducted as either background, indicator-parameter evaluations, or groundwater quality assessment monitoring programs as defined in the Resource Conservation and Recovery Act of 1976 (RCRA) and 40 CFR 265, Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities, as amended (EPA 1989). Compliance with the 40 CFR 265 regulations is required by the Washington Administrative Code 173-303 (Ecology 1991). This submittal provides data obtained from groundwater monitoring activities for July 1, 1991 through September 30, 1991. This report contains groundwater monitoring data from Hanford Site groundwater projects. A RCRA network is currently being established at the 100-D Pond. Groundwater chemistry analyses have not yet been performed.

710
R.A. Winship and M.C. Hughes, Westinghouse Hanford Company, Richland, WA

Hanford Site Surface Soil Radioactive Contamination Control Plan for Fiscal Year 1992

WHC-EP-0489; 113 pp. (November 1991)

The Surplus Facilities and Resource Conservation and Recovery Act of 1976 (RCRA) closures program is responsible to the U.S. Department of Energy Field Office, Richland, Washington, for the safe and cost-effective surveillance, maintenance, and decommissioning of surplus facilities and RCRA closures at the Hanford Site. This program is also responsible for the Radiation Area Remedial Action (RARA) work that includes the surveillance, maintenance, decontamination, and/or interim stabilization of inactive burial grounds, cribs, ponds, trenches, and unplanned release sites. This plan addresses only the RARA activity requirements for managing and controlling the contaminated surface-soil areas associated with these inactive sites until they are remediated as

part of the Hanford Site environmental restoration process. All known RARA and non-RARA contaminated surface-soil areas are listed in this document so that a complete list of the sites requiring remediation is in one document. Specific organizational responsibility for management and control of these sites is shown in Appendix A.

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Air Quality Monitoring at Toxic Waste Sites: A Hanford Perspective

PNL-SA-18876;CONF-891053;Environmental Monitoring, Restoration and Assessment: What Have We Learned?, R.H. Gray (ed.), Proceedings of the 28th Hanford Life Sciences Symposium, Richland, WA, October 16-19, 1989, 340 pp.; (pp. 61-66) (1989)

Air-quality monitoring is part of the remedial investigation (RI) activities at waste sites in the 1100-EM-1 Operable Unit on the Hanford Site. The sampling is being conducted for volatile organic compounds, semivolatile organic compounds (including pesticides and polychlorinated biphenyls), metals, and asbestos. The monitoring at the site will take place in three phases: before, during, and after intrusive RI activities. Battery-powered monitoring equipment is positioned at one location upwind of each site (to measure background air quality) and, typically, at two locations downwind. Control samples identify contamination that may occur during handling or analysis. All samples are analyzed by approved Environmental Protection Agency methods. Results from the first monitoring have been assessed, and are being used to upgrade sampling and laboratory analysis procedures.

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Remedial Investigation for the 200-BP-1 Operable Unit, Hanford Site, Richland, Washington

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 891-894) (September 1991)

The Hanford Site near Richland, Washington, contains over 1500 identified waste sites that will be characterized and remediated over the next 30 years. In support of the Hanford Federal Facility Agreement and Consent Order, the U.S. Department of Energy has begun a remedial investigation/feasibility study (RI/FS) of the 200-BP-1 operable unit on the Hanford Site. The 200-BP-1 operable unit is a 10 ha area located in the north-central portion of the 200 East Area, which lies near the center of the Hanford Site. The 200-BP-1 operable unit includes 13 waste management units (10 inactive cribs and 3 unplanned releases), most of which are concentrated in a 1.6 ha section in the eastern end of the operable unit. Waste disposal activities in this operable unit were associated with the U-Plant uranium reclamation, which used tributyl phosphate (TBP), and the 241-BY Tank Farm operations. Some of the TBP wastes were cribbed in the 200-BP-1 operable unit. Also, from 1965 to 1974, 241-BY storage tank condensate, called ITS (for in-tank solidification), was cribbed in the 200-BP-1 operable unit. During the period when the TBP supernatant was discharged to cribs, the concept of "specific retention disposal" was employed as a standard. This practice limited the volumes of waste discharges to the specific retention volumes of the soils, based on their capacity to retain moisture. It is apparent that this concept was not fully implemented and that the calculated specific retention volumes of the soil columns were exceeded. Subsequently, the exact concentrations and quantities of radionuclides and contaminants of concern in the 200-BP-1 operable unit are uncertain. Historical records indicate that seven cribs received an estimated 33,840 l of the TBP waste, 2 cribs received an estimated 139,200,000 l of ITS condensate, and one crib was constructed but has no documented history of past disposal. The primary, known contaminants are radionuclides (hydrogen-3, technetium-99, strontium-90, cesium-137, cobalt-60, plutonium-238, -239, and -240, total uranium, and ruthenium-106) and nonmetallic ions (nitrate,

phosphate, total cyanide, ferrocyanide, and free cyanide). The RI/FS of the 200-BP-1 operable unit is the first Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) investigation on the Hanford Site that involves drilling into highly radioactive and chemically contaminated soils. The initial phase of the site characterization is oriented toward determining the nature and extent of any contamination present in the vicinity of the 200-BP-1 operable unit. A 44-well ground-water monitoring network, designed for the characterization of contamination in and around the operable unit, was initiated in January 1991. The major focus of Phase I of the RI/FS is the drilling and sampling of the 10 inactive cribs within the operable unit. Some of the extensive planning activities for the RI/FS included: (1) completion of hazard classification, (2) identification of the drilling and sampling methodology, and (3) procurement of interim storage facilities to accommodate mixed waste. With the start-up and continuation of the drilling and sampling, the extensive planning and preparation activities have paid off. Site characterization at the operable unit has resulted in the development of many new drilling and sampling strategies. When this paper was prepared, four boreholes had been completed or were being drilled. The drilling and sampling were to continue for approximately 6 months.

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Carbon Tetrachloride Contamination, 200 West Area, Hanford Site: Arid Site Integrated Demonstration for Remediation of Volatile Organic Compounds

PNL-SA-19564; 8 pp. (May 6, 1991)

The Arid State Integrated Demonstration is a U.S. Department of Energy (DOE) program targeted at the acquisition, development, demonstration, and deployment of technologies for evaluation and cleanup of volatile organic compounds and associated contaminants in soils and ground waters. Several DOE laboratories, universities, and industry will participate in the program. Candidate technologies will be demonstrated in the following areas: (1) site characterization; (2) performance prediction, monitoring, and evaluations; (3) contaminant extraction and ex situ treatment; (4) in situ remediations; and (5) site closure and monitoring. The performance of these demonstrated technologies will be compared to baseline technologies and documented to promote the transfer of new technologies to industry for use at DOE facilities. The initial host site is the Hanford Site's 200 West Area. The location of the demonstration contains primarily carbon tetrachloride (CCl4), chloroform, and a variety of associated mixed waste contaminants. Chemical processes used to recover and purify plutonium at Hanford's plutonium finishing plant (Z Plant) resulted in the production of actinide-bearing waste liquid. Both aqueous and organic liquid wastes were generated and were routinely discharged to subsurface disposal facilities. The primary radionuclide in the waste streams was plutonium and the primary organic was CCl4. This paper contains brief descriptions of the principal CCl4 waste disposal facilities in Hanford's 200 West Area, associated hydrogeology, existing information on the extent of soil and ground-water contamination, and a conceptual outline of suspected subsurface CCl4 distributions.

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Initial Site Characterization Approach and Preliminary Results: 200 West Area Carbon Tetrachloride Expedited Response Action, Hanford Site, Washington

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 421-426) (September 1991)

An Expedited Response Action (ERA) has been proposed to remediate the carbon tetrachloride contamination in the unsaturated soils beneath the 200 West Area of the Hanford Site in Washington. The ERA is based on the preliminary conceptual model that carbon tetrachloride vapors remaining in the unsaturated zone continue to provide a

source of carbon tetrachloride contamination in the groundwater. The goal of the initial phase of site characterization was to refine this conceptual model, and to collect data in support of the selection and design of an initial remedial action, while meeting the accelerated schedule of the ERA. Using this approach, site characterization activities were designed to make optimum use of field screening level data and existing boreholes. Field tasks included (1) analysis of soil gas samples collected from the bottoms of boreholes or detected at the wellhead; (2) a soil gas survey; (3) a pilot test of a vapor extraction system; (4) and groundwater sampling and analysis. Results of this initial phase of site characterization suggest that carbon tetrachloride vapors are still contained within the unsaturated zone in concentrations sufficient to support an effective early removal action.

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Drilling and Sampling Highly Radioactive Contaminated Soil at the 200-BP-1 Operable Unit, Hanford Site, Richland, Washington

WHC-SA-1460; CONF-920307; Waste Management '92, R.G. Post (ed.), Proceedings of a Conference, Tucson, AZ, March 1-5, 1992; (11 pp.) (January 1992)

The Hanford Site, Richland, Washington, contains over 1500 identified waste sites and four groundwater plumes that will be characterized and remediated over the next 30 years. In support of the Hanford Federal Facility Agreement and Consent Order, the U.S. Department of Energy has initiated a remedial investigation/feasibility study at the 200-BP-1 Operable Unit. The 200-BP-1 remedial investigation is the first Comprehensive Environmental Response, Compensation, and Liability Act of 1980 investigation on the Hanford Site that involves drilling into highly radioactive and chemically contaminated soils. The initial phase of the site characterization is oriented toward determining the nature and extent of any contamination present in the vicinity of the 200-BP-1 Operable Unit. The major focus of the Phase I remedial investigation is the drilling and sampling of 10 inactive waste disposal units that received low-level radioactive liquid waste.

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Westinghouse Hanford Company Environmental Surveillance Annual Report - 200/600 Areas - Calendar Year 1990

WHC-EP-0145-3; 126 pp. (June 1991)

This document presents the results of near-field environmental surveillance in 1990 of the Operations Area of the Hanford Site, in south central Washington State, as performed by Westinghouse Hanford Company. These activities are conducted in the 200 and 600 Areas to assess and control the impacts of operations on the workers and the local environment. Surveillance activities include sampling and analyses of ambient air, surface water, groundwater, sediments, soil, and biota. External radiation measurements and radiological surveys are taken of waste disposal sites, radiological control areas, and roads.

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Conducting a Soil Washing Treatability Investigation at the Hanford Site

CONF-9010166; Waste Management and Environmental Restoration, Proceedings of the 1990 DOE Model Conference, Oak Ridge, TN, October 29-November 2, 1990, 343 pp.; (1 p.) (1990)

Contaminated sites on the Hanford reservation will undergo a complete Remedial Investigation/Feasibility Study (RI/FS) prior to environmental restoration. A requirement of the Phase 1 RI is the treatability investigation of candidate remediation techniques. For the 300-FF-1 operable unit, and presumably many

others, soil washing will be considered as a volume reduction step in cleanup. In preparing for the treatability investigation, bench-scale screening tests were performed on actual site soils contaminated with radionuclides and heavy metals. Retained in process ponds from several years of fuel rod fabrication, research and development, the contaminants have shown a significant affinity for the particles passing a No. 60 screen (250 um) in the wet-sieve process. This fraction comprises less than 10% of the contaminated soil. The results from parametric studies were interpreted for design of a 100 lb/hr pilot-scale screen washer for demonstration. In addition, criteria for cleanup levels were determined and incorporated into a treatability investigation test plan, now being reviewed by the Environmental Protection Agency.

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Report on Geological Surveys in the 300-FF-1 Operable Unit

EMO-1032; 126 pp. (March 1991)

This report describes a set of geophysical surveys performed by Pacific Northwest Laboratory at selected locations within the 300-FF-1 Operable Unit at Hanford, Washington. Field work and preliminary data processing activities were initiated in September 1989. These actions were terminated by the Westinghouse Hanford Company before completion in December 1989. In October 1990, work was reinitiated to complete the processing of the data that had already been collected and to report the results. Because the field work was only partially completed, the task objectives presented in the Statement of Work could not be fully met. This report is, therefore, a progress report covering the work performed through December 11, 1989. This task involved (1) ground-penetrating radar surveys of the 618-4 and 618-5 Burial Grounds, and (2) ground-penetrating radar and electromagnetic induction surveys along the assumed routes of the abandoned process sewers and radioactive liquid waste sewers in the 300-FF-1 Operable Unit. The surveys in the burial grounds were intended to identify burial trenches and pits, to determine the depth of fill, and to locate waste materials, including any that might be outside the perimeter fences. The surveys along the sewer routes were intended to confirm the locations of the sewers as shown on existing maps or to otherwise accurately determine their locations, and to attempt to identify locations of possible leaks.

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Facility Effluent Monitoring Plan Determinations for the 400 Area Facilities - Environmental Assurance

WHC-EP-0442; 56 pp. (September 1991)

This facility effluent monitoring plan determination resulted from an evaluation conducted for the Westinghouse Hanford Company 400 Area facilities on the Hanford Site. The facility effluent monitoring plan determinations have been prepared in accordance with "A Guide for Preparing Hanford Site Facility Effluent Monitoring Plans." Two major Westinghouse Hanford Company facilities in the 400 Area were evaluated: (1) the Fast Flux Test Facility and (2) the Fuels Manufacturing and Examination Facility. The determinations were prepared by Westinghouse Hanford Company. Of these two facilities, only the Fast Flux Test Facility will require a facility effluent monitoring plan.

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Facility Effluent Monitoring Plan Determinations for the 600 Area Facilities - Environmental Assurance

WHC-EP-0443; 68 pp. (August 1991)

This document determines the need for facility effluent monitoring plans for Westinghouse Hanford Company's 600 Area facilities on the Hanford Site. The facility effluent monitoring plan determinations were prepared in accordance with "A Guide For Preparing Hanford Site Facility

Effluent Monitoring Plans" (WHC 1991). Five major Westinghouse Hanford Company facilities in the 600 Area were evaluated: (1) the Purge Water Storage Facility, (2) 212-N, -P, and -R Facilities, (3) the 616 Facility, (4) the 213-J Storage Vaults, and (5) the 213-K Storage Vault. Of the five major faciiities evaluated in the 600 Area, none will require preparation of a facility effluent monitoring plan.

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Engineering Evaluation of the 618-9 Burial Ground Expedited Response Action - Draft A

DOE/RL-91-38 (Draft A); 132 pp. (August 1991)

Throughout Hanford Site history, chemical waste products were disposed via burial in trenches. One such trench was the 618-9 Burial Ground, located in the 600 Area on the Hanford Site. The 618-9 Burial Ground was suspected to contain approximately 5000 gallons of uranium-contaminated solvent in 55-gallon steel drums. On December 20, 1990, the U.S. Department of Energy (DOE) was instructed by the U.S. Environmental Protection Agency (EPA) and the State of Washington Department of Ecology to initiate planning necessary to implement an expedited response action (ERA) for the 618-9 Burial Ground. The project was to be implemented in two phases: (1) removal of immediate human health and environmental hazards and (2) remediation of contaminated soil. Phase 1 of the project was initiated February 15, 1991. During Phase 1 activities, approximately 700 gallons of methyl isobutyl ketone (hexone) and 900 gallons of kerosene solvent were removed from the 618-9 Burial Ground. A significant amount of scrap process equipment/building debris was excavated. The results of an environmental risk assessment for chemicals above detection further determined that risks posed by other detected constituents to human health and the environment are negligible. A compilation of activities utilized for determining subsequent remediation activities for the 618-9 Burial Ground is presented. This includes: (1) Phase 1 activities, (2) sampling performed and associated data results, (3) results of the risk assessment, and (4) applicable or relevant and appropriate requirements.

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Dose Assessment for a Cs-137 Contamination Incident

CONF-911107; Proceedings of the American Nuclear Society Winter Meeting, San Francisco, CA, November 10-15, 1991; (5 pp.) (1991)

Radiological surveys along the CSX Transportation Group railroad tracks in Oak Ridge, Tennessee, have found areas of Cs-137 contamination which probably resulted from low-level waste operations during the 1960s. This paper summarizes an assessment of potential radiation doses to the public, including railroad workers, from exposure to the Cs-137. The significance of the contamination and needs for remediation are evaluated by comparing the dose estimates and survey data with proposed guidelines for limiting exposures to the public.

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FY 1993 Task Plans for the Hanford Environmental Dose Reconstruction Project

PNL-7760-HEDR; 49 pp. (October 1991)

The purpose of the Hanford Environmental Dose Reconstruction (HEDR) Project is to estimate radiation doses from Hanford Site operations since 1944 to individuals and populations. The primary objective of work to be performed in FY 1993 is to complete the source-term estimates and dose estimates for key radionuclides for the air and river pathways. At the end of FY 1993, the capability will be in place to estimate doses for individuals in the extended (32-county) study area, from 1944 through 1991. Native American research will continue to provide input for tribal dose estimates.

In FY 1993, the Technical Steering Panel (TSP) will decide whether demographic and river-pathways data collection should be extended beyond FY 1993 levels. The FY 1993 work scopes and milestones in this document are based on the work plan discussed at the TSP Budget/Fiscal Subcommittee meeting on August 19-20, 1991. Table 1 shows the FY 1993 milestones; Table 2 shows estimated costs. The subsequent work-scope descriptions are based on the milestones. This document and the FY 1992 task plans will form the basis for a contract with Battelle and the Centers for Disease Control (CDC). The 2-year dose-reconstruction contract is expected to begin in February 1992. This contract will replace the current arrangement, whereby the U.S. Department of Energy directly funds the Pacific Northwest Laboratory to conduct dose-reconstruction work. In late FY 1992, the FY 1993 task plans will be more fully developed, with detailed technical approaches, data quality objectives, and budgeted labor hours. The task plans will be updated again in July 1993 to reflect any scope, milestone, or cost changes directed by the TSP during the fiscal year.

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Overview of the Hanford Environmental Dose Reconstruction Project

CONF-910603; Proceedings of the 1991 American Nuclear Society Annual Meeting, Orlando, FL, June 2-6, 1991; Transactions of the American Nuclear Society 63:31-32 (1991)

The Hanford Environmental Dose Reconstruction (HEDR) Project was initiated as a result of public interest in the historical releases of radioactive materials from the Hanford Site. The interest became strong enough by 1985 that 19,000 pages of early environmental monitoring documentation was released to the public. The state of Washington and the Centers for Disease Control (CDC) performed worst-case thyroid dose calculations based on the monitoring data, and special committees were appointed to review the historical documents and make recommendations for further studies. Two of the studies recommended were the HEDR project and the Hanford Thyroid Disease Study. The HEDR project was assigned to the U.S. Department of Energy's (DOE's) Pacific Northwest Laboratory (PNL) in Richland, Washington, and the Hanford Thyroid Disease Study was awarded to the Fred Hutchinson Cancer Research Center in Seattle, Washington.

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Project Management Plan for the Hanford Environmental Dose Reconstruction Project

PNL-7870-HEDR; 60 pp. (March 1992)

This Project Management Plan describes the approach that will be used to manage the Hanford Environmental Dose Reconstruction (HEDR) Project. The plan describes the management structure and the technical and administrative control systems that will be used to plan and control the HEDR Project performance. The plan also describes the relationship among key project participants: Battelle, the Centers for Disease Control, and the Technical Steering Panel.

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Implications of Recent ICRP Recommendations for Risk Assessments for Radioactive Waste Disposal and Cleanup

ANL/CP-74093; CONF-920307; Waste Management '92, R.G. Post (ed.), Proceedings of a Conference, Tucson, AZ, March 1-5, 1992; (9 pp.) (1992)

The International Commission on Radiological Protection (ICRP) adopted a new set of recommendations in November 1990 which were issued as ICRP Publication No. 60 in March 1991. These recommendations incorporate new radiobiological information and outline a comprehensive system of radiological protection. This paper evaluates the implications of these new recommendations regarding risk assessments for radioactive waste disposal and remediation of radioactively contaminated sites.

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Soil Washing Results for Mixed Waste Pond Soils at Hanford

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 511-515) (September 1991)

Soil washing technology was assessed as a means for remediating soil contaminated with mixed wastes primarily composed of heavy metals and radionuclides. The soils at the U.S. Department of Energy's Hanford Site are considered suitable for soil washing because of their relatively low quantities of silt and clay. However, in a limited number of soil washing experiments using soils from different locations in the north pond of the 300 Area, the degree of decontamination achieved for the course fraction of the soil varied considerably. Part of this variation appears to be due to the presence of a discrete layer of contaminated sediment found in some of the samples. The following conclusions about the character of the contaminated soil in the north pond of the 300 Area and its behavior during soil washing can be drawn from these experiments: (1) The soil is primarily sand or larger material. At least 80 to 90% of the material has a particle size greater than 250 micrometers. (2) The primary hazardous contaminant present is copper and the primary radionuclide is uranium. (3) Initially, the contamination is distributed throughout the range of particle sizes, but after washing the contamination is partitioned preferentially to the fine fraction (less than 250 micrometers) of the soil. (4) After washing, the coarse fraction still contains significant levels of contamination, which appears in the form of discrete packets and as a coating on the sand particles. The amount of decontamination achieved for this fraction also varies significantly for soils from different locations in the pond. (5) Very little of the contamination is water soluble, indicating that high water recycle ratios can be used. (6) Additional unit operations, such as attrition scrubbing, will be necessary to further reduce the contamination of the coarse fraction.

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Removal of Actinides from Rocky Flats Soil

RFP-4479; 20 pp. (September 12, 1991)

A study was performed to evaluate a gravimetric separator (mineral jig) in conjunction with wet sieving for removing actinide-containing clays from Rocky Flats soil. Both field-moist (3% moisture) and pre-dried (110 deg C) soils were wet sieved and mineral jigged. In addition, size separation (dry sieving), attrition scrubbing, and rotary scrubbing were evaluated for actinide removal in field-moist soil. Wet sieving removed more than 98% of the activity in both field-moist and pre-dried soils. More than 99% of the activity was removed from soil that was first size separated and then wet sieved. Actinide removal was performed in the following sequence: (1) attrition scrubbing, (2) wet sieving, and (3) rotary scrubbing. Wet sieving removed about 20% more activity from field-moist soil compared to similar, pre-dried soil fractions.

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Land Surface Cleanup of Plutonium at the Nevada Test Site

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 321-327) (September 1991)

The Nevada Test Site (NTS) covers approximately 3300 sq km of high desert about 100 km northwest of Las Vegas, Nevada. Soil contaminated by plutonium from safety tests conducted in the 1950s and 1960s exists there and in surrounding areas, including Nellis Air Force Base. About 150 curies of contamination have been measured over 1200 hectares of land surface. Most of the contamination is in the top 5 cm of soil, but may be found as deep as 25 cm. The cost of conventional removal and disposal of the full

volume of contaminated soil (more than 1,600,000 cu m) is estimated at over $500 million. This study is directed toward minimizing the volume of waste by controlling precisely the depth of soil removal. The following soil removal machines were demonstrated at the NTS: (1) a CMI Corporation Model PR-500FL pavement profiler, (2) a CMI Corporation Model TR-225B trimmer reclaimer, (3) a Caterpillar Model 623 elevating scraper equipped with laser depth control, (4) a Caterpillar Model 14G motor grader equipped with laser depth control, (5) a Caterpillar Model 637 auger scraper, and (6) a SCR Series Guzzler vacuum truck. The most effective removal technique tested was the CMI Corporation Model PR-500FL pavement profiler, which provided for dust control and precisely removed thin layers of soil. Soil removal with the motor grader and paddle scraper generated unacceptable levels of dust, even after the soil was extensively watered. The vacuum truck was ineffective because of: (a) its limited intake volume, which is a function of the small size of its intake; (b) its weak intake force; and (c) the tendency of its filters to clog.

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Design and Construction of an Interceptor System for Radioactively Contaminated Solvent

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 307-312) (September 1991)

During fuel reprocessing operations at the Western New York Nuclear Service Center from 1966 to 1972, the site operator disposed of spent solvent (a mixture of tributyl phosphate and n-dodecane) by shallow land burial in the area used for disposal of solid radioactive waste. The spent solvent was placed in twenty-two, 3785 liter (1000 gallon) steel tanks, which were then placed in eight, 6 meter-deep burial holes. Over time, groundwater entered the tanks, displacing the solvent and causing it to enter the surrounding aquifer. The solvent, which is lighter than water, floated to the surface of the groundwater in the burial holes and began to migrate laterally through weathered cracks in the Lavery Till, the silty clay burial medium. The U.S. Department of Energy (DOE) in 1983 began the West Valley Demonstration Project. At that time, trace amounts of solvent were encountered in a monitoring well near the perimeter of the disposal area. Since that discovery, extensive studies and continued monitoring of the solvent migration have been conducted. In the fall of 1989, monitoring showed further on-site migration of the solvent in the disposal area. DOE authorized West Valley Nuclear Services Company, Inc. (WVNS) to design and construct a trench system to intercept the flow of solvent and prevent its discharge to nearby streams. The solvent and the contaminated groundwater samples taken from the disposal area exhibited high levels of Iodine-129 in an organic complex, so it was necessary for WVNS to construct a pretreatment facility. An important aspect of the trench construction was management of the contaminated soil and construction water. Contaminated soils were placed into storage containers and held for future treatment and disposal. All water pumped from the trench during construction was stored in large bladder tanks, analyzed for hazardous constituents, and, if none were found, discharged. As of this writing, no solvent has been detected in the interceptor trench, but its quick design and construction provides a barrier to potential migration of the solvent.

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Removal Action Under CERCLA Section 104 for PCB-Contaminated Soil at DOE Mound Plant

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 475-478) (September 1991)

A removal action was completed for polychlorinated biphenyl (PCB)-contaminated soil at the U.S. Department of Energy (DOE) Mound Plant in Dayton, Ohio. Mound Plant is a National Priority List site, and removal was completed by authority of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 104. The Toxic Substances Control Act (TSCA) was considered to be a relevant and appropriate requirement (ARAR). Accordingly, the sampling and analysis guidelines and disposal standards of the TSCA were used in the Mound removal action. Significant aspects of the removal are: (1) it is one of the first removal actions by DOE under Section 104 of CERCLA; (2) it encompasses cleanup at an NPL site for a substance regulated under TSCA; (3) no remedial investigation/feasibility study was done prior to removal, so characterization of the extent of PCB contamination was done as part of the removal; (4) on-site screening was used to identify PCB contamination; and (5) the project, from conception to completion, took seven months, including the writing of a work plan, the sampling and analysis, the excavation and disposal, and the writing of a report by the on-scene coordinator.

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Air Stripping of Volatile Organic Chlorocarbons: System Development, Performance, and Lessons Learned

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 469-474) (September 1991)

The Savannah River Site (SRS) is a 780 sq km reservation in South Carolina that produces tritium for the national defense program. Due to past waste handling practices, the ground water at several locations on the SRS has become contaminated with solvents, metals, and radionuclides. In 1981, the ground water located under the SRS fuel and target rod fabrication area (M-Area) was found to be contaminated with degreasing solvents, specifically trichloroethylene (TCE) and tetrachloroethylene (PCE). In 1983, a program was begun to evaluate air stripping and to determine its applicability to the cleanup of M-Area contamination. In this paper, lessons learned about the efficiency and effectiveness of air stripping technology are presented.

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Ground Water Extraction, Treatment, and Upgradient Injection Systems Provide a Mechanism to Control Tritium Plumes at DOE Facilities

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 707-712) (September 1991)

Tritium has migrated from waste management units into the groundwater at some Department of Energy facilities. The U.S. Environmental Protection Agency and the South Carolina Department of Health and Environmental Control (SCDHEC) have requested that the Savannah River Site (SRS) remediate a plume of tritiated groundwater downgradient from the F and H-Area seepage basins on the SRS. Approximately 2 billion gallons of groundwater downgradient from the seepage basins became contaminated with tritium, at concentrations as high as 0.00002 Ci/l. The areal extent of the tritium contamination covered approximately 220 acres. The other radionuclides and metal constituents have migrated over approximately 207 acres and have contaminated approximately 900 million gallons of groundwater; this zone also has the highest concentrations of tritium. Existing techniques for treating the tritiated groundwater were investigated and are described in this paper. They were determined to be infeasible because of their high

capital and operating costs, and due to the dilute concentrations of the F and H-Area plume. Because of tritium's short half-life, treating the tritiated groundwater through extracting it, treating it, and recycling it (by injecting the treated groundwater back into the aquifer upgradient of the plume) is a cost-effective alternative that can be installed relatively quickly. The corrective action plan for the F and H-Area plume, submitted under a Resource Conservation and Recovery Act (RCRA) Part B Post-Closure Permit, consisted of a groundwater extraction system and a neutralization treatment system with solids removal. The treatment system will extract that portion of the plume with the radionuclide, heavy metal, and nitrate contamination. The treated effluent, containing the radioactively-decaying tritium, will be injected upgradient of the F and H-Area seepage basins and allowed to migrate back towards the groundwater extraction system. Tritium treatment will be accomplished by the radioactive decay of the tritium during the recycling process. To effect this treatment system, SRS applied to the state to designate a portion of the contaminated area as a South Carolina Groundwater Mixing Zone. A risk assessment performed for this application demonstrated that the tritium and constituents at the fringes of the treated plume would not have an adverse impact on human health or the environment. The treatment system, if approved by SCDHEC, would represent a new approach to groundwater remediation in South Carolina, because injection wells are currently illegal in the state. At the time of the presentation of this paper, the SCDHEC had indicated that, in accordance with the proposed RCRA subpart S, it was reconsidering its position on the injection of wastewater back into contaminated aquifers. To treat tritiated plumes at Department of Energy sites by using the technology described in this paper, (1) the regulating agencies must accept the injection of wastewater back into the contaminated aquifers, and (2) the remediation design group must know a great deal about the hydrogeologic characteristics of the site.

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24 Hour Pumping Test of Production Well 905-120P

WSRC-RP-90-1326; 15 pp. (December 1990)

As part of the Savannah River Site (SRS) Aquifer Characterization Program, the Environmental Sciences Section (ESS) of the Savannah River Laboratory (SRL) is attempting to determine the water-transmitting characteristics of the different aquifer units underlying the SRS by conducting single-well pumping tests on wells installed as part of the SRS Baseline Hydrogeologic Investigation. In April 1990, while performing the single-well pumping test, the opportunity to collect data on aquifer properties utilizing both a production well and observation wells came to the ESS. At this time, the U.S. Army Corps of Engineers (COE) was completing a new production well (Well 905-120P) in the P-Area of the SRS. This well, located in close proximity to well cluster P-24, was to undergo a 24-hour performance test by the COE. ESS arranged with the subcontractor working on the single-well pumping test project, Dames & Moore, to instrument the appropriate observation wells and to coordinate data collection with the COE. This paper describes the ESS operation at Well 905-120P.

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In Situ Grouting of Low-Level Burial Trenches with a Cement-Based Grout

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 107-113) (September 1991)

Trench stabilization using a cement-based grout is being evaluated for use in closing one of the low-level radioactive waste burial grounds at Oak Ridge National Laboratory. For this evaluation, two interconnecting waste trenches in Solid Waste Storage Area Six (SWSA 6) were selected as candidates for in situ grouting with particulate grout. The primary objectives were to demonstrate that trench stability was increased and that the

potential for leachate migration was decreased following the injection of particulate grout into the trenches. Stability against trench subsidence is a critical issue; for example, construction of impermeable covers over the trenches will be ineffective unless subsequent subsidence is permanently prevented. After grouting, soil-penetration tests disclosed that stability in the trenches was improved greatly: refusal (defined as more than 100 blows to penetrate one foot) was the result in 17 of the 22 tests within the trench area. Mean refusal depths for the two trenches were 3.5 and 2.6 meters. Stability of the trenches was better than before the grout injection; at depths greater than 2.4 meters, the stability was very near that in the native soil formation outside the trench. Tests showed that the major differences in stability between the grouted trenches and native soil outside the trench area were at soil depths of 1.8, 2.1, and 2.4 meters. Further tests showed that the lower stability at these depths was probably caused by intermediate-size voids, formed during backfilling, that were too small for the conventional cement grout to penetrate and fill. Hydraulic conductivity inside the trench remained very high (greater than 0.1 cm/s) and was significantly higher than that of the soil outside the trench. Air pressurization tests done after the grouting revealed much linkage between voids within and between the two trenches. Researchers plan to inject a clay/microfine cement grout into the upper level of the grouted trenches to develop stability at the less stable depths and to reduce the trenches' hydraulic conductivity.

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An Effective Methodology for Establishing Cleanup Standards for Mercury Contaminated Soils

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 301-305) (September 1991)

The Department of Energy has determined that an integrated planning approach to the remediation of mercury contamination is an effective methodology for addressing the mercury related problems at the Oak Ridge Reservation. The methodology for determining the soil response action levels for the Oak Ridge Site should be an important component of the integrated plan, thereby ensuring that the risk of migration of contaminants to groundwater will be minimized and acceptable. This paper summarizes those applicable or relevant and appropriate requirements (ARARs) pertaining to mercury, based on federal, state, and other regulations. The analysis in this paper shows that irrational application of the ARARs may result in the selection of alternatives that are not cost effective. The best technology-based soil response action levels, selected on the basis of realistic risk assessment and toxicity characteristic leaching procedure (TCLP) test criteria will yield a more practical and cost effective cleanup standard.

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Treatment of Y-12 Plant Mixed Waste Contaminated Soils Utilizing the Westinghouse Soil Washing Process

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 139-142) (September 1991)

A soil washing demonstration was conducted for Martin Marietta Energy Systems, Inc., under contract to the U.S. Department of Energy (DOE), on two contaminated soils from DOE's Y-12 Plant in Oak Ridge, Tennessee. The two soils were (1) a contaminated sewer sediment, which contained excessive levels of mercury, uranium, and polychlorinated biphenyls (PCBs); and (2) an oil landfarm soil, which was contaminated with heavy metals, uranium, and PCBs. The goal of the treatment study was to reduce the chemical and radiological contaminants in the soils to a level

that would allow most of the soil to be accepted into an industrial landfill. The acceptable soil criteria were: (a) mercury, less than 12 ppm; (b) PCBs, less than 2 ppm; (c) metals and organics, treated soil must pass the Environmental Protection Agency's Toxicity Characteristics and Leachate Procedure (TCLP) test; and (d) liquid, must pass a paint filter test. Physical segregation and chemical extraction techniques reduced the uranium content in both soils, making them non-radioactive. Both soils were cleansed of PCBs to acceptable levels and passed the TCLP test, making them non-hazardous. The mercury level of the sewer sediment was reduced by over 90 percent, but still exceeded the desired level. Additional washing may achieve that level. All of the oil landfarm soil and more than 85 percent of the sewer sediment were recovered as non-radioactive and non-hazardous materials.

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Alternate Cap Designs Under RCRA Regulations

CONF-880839; Closure and Decommissioning - Session 6, Proceedings of the Tenth Annual Department of Energy Low-Level Waste Management Conference, Denver, Colorado, August 30-September 1, 1988, 99 pp.; (pp. 45-60) (December 1988)

Low-level radioactive waste and mixed wastes have been disposed of in several sites in the vicinity of the Y-12 Plant in Oak Ridge, Tennessee. Most of these materials have been placed in shallow land burial pits. Closure plans have been developed and approved by appropriate regulatory agencies for several of these sites. A variety of cap (final cover) designs for closure of these sites were investigated to determine their ability to inhibit the infiltration of precipitation to the waste. The most effective designs are those that use synthetic materials as drainage layers and/or impermeable liners. The more complex, multi-layer systems perform no better than simpler covers and would complicate construction and increase costs. Despite the successful analytical results described in this paper, additional considerations must be factored into use of geosynthetic as well as natural materials.

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Sampling for Certification of Removal of PCB-Contaminated Soils at the Oil Retention Ponds, Y-12 Plant, Oak Ridge, Tennessee

CONF-900225; WATTec '90: Global Competitiveness - Managing Technology, Proceedings of the 17th Annual Technical Conference and Exhibition, Knoxville, TN, February 20-23, 1990, 78 pp.; (p. 23) (1990)

The Bear Creek Burial Grounds at the Oak Ridge Y-12 Plant have been sites for the disposal of polychlorinated biphenyl contaminated liquids. Subsequent contamination of portions of Tributary 6 and 7 of Bear Creek occurred due to seepage from these waste-disposal areas. Two oil-retention ponds were constructed to prevent contaminated oils and water from migrating into Bear Creek. As part of the Resource Conservation and Recovery Act (RCRA) closure plan for the site, the contaminated sediments from the ponds and tributaries were removed. This paper presents the results of the sampling and analysis done to certify excavation of PCB-contaminated soils per the RCRA closure plan approved by the Tennessee Department of Health and Environment.

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Land Reclamation at the Basalt Waste Isolation Project

PNL-SA-18876;CONF-891053;Environmental Monitoring, Restoration and Assessment: What Have We Learned?, R.H. Gray (ed.), Proceedings of the 28th Hanford Life Sciences Symposium, Richland, WA, October 16-19, 1989, 340 pp.; (pp. 283-286) (1989)

Between 1976 and 1987, the U.S. Department of Energy (DOE) conducted extensive studies to evaluate the Hanford Site as a potential commercial nuclear waste repository, an effort called the Basalt Waste Isolation Project. In October 1987, DOE terminated all the nuclear waste repository activities at Hanford except reclamation. DOE made the commitment to restore the land areas disturbed by the repository studies to their original conditions, as nearly as practicable. The lands that were denuded of plants during the repository studies are being planted with native grasses and shrubs. The objective of this reclamation is to stabilize the soil against wind and water erosion and to restore the habitat to a condition suitable for native wildlife.

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Soil Washing: A Promising Technology for the Cleanup of Hanford

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 697-702) (September 1991)

Soil washing is a hazardous waste treatment technology that shows promise for reducing the cost of cleaning up the Hanford Site. The soil at the Hanford Site ranges from sandy to gravelly in character. This makes Hanford a good candidate for the application of the soil washing technology. A variety of soil washing vendors offer different approaches to removing contaminants from soil. Factors to consider when selecting soil washing equipment for soil washing at Hanford include: (1) properties of the soil and its contaminants; (2) the different levels of cleanup required; (3) throughput capacity of the equipment; (4) the properties of secondary wastes generated by the equipment; and (5) cost. During soil remediation, it may be possible to achieve savings of up to $5000 per ton of contaminated soil by using soil washing technology.

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Decommissioning of a Resource Conservation and Recovery Act Treatment, Storage, and Disposal Facility: A Case Study of the Interim Stabilization of the 216-A-29 Ditch at the Hanford Site

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 333-338) (September 1991)

This paper describes the interim stabilization of a ditch carrying liquid mixed wastes. The 216-A-29 Ditch is located in the central portion of the Hanford Site within Operable Unit 200-PO-5. It carries Plutonium-Uranium Extraction (PUREX) plant chemical sewer liquid effluent to the 216-B-3 ditch, which in turn flows into the 216-B-3 pond. The ditch is classified under the Resource Conservation and Recovery Act of 1976 (RCRA) as a Treatment, Storage, and Disposal Facility (TSD). As a RCRA TSD, the ditch is to be removed from service, in support of the Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement). Milestone M-17-10 of the Tri-Party Agreement states that operators of the Hanford Site will "cease all liquid discharges to hazardous land disposal units unless such units have been clean closed in accordance with" RCRA. The 216-A-29 Ditch's removal from service is necessary to support the closure strategy for the 216-B-3 Pond system. Interim stabilization of the 216-A-29 Ditch is the first step required to comply with the Tri-Party Agreement and eventually decommission the entire B Pond system. Interim stabilization is required to maintain the 216-A-29 ditch in a stable configuration until closure actions have been determined and initiated. The first objective of the interim stabilization is to place the ditch in a configuration that would maintain the environmental control of any radioactive or potentially hazardous sediments after the chemical sewer stream was rerouted to another existing pipeline. The second objective is to reduce the size of the posted zone around the ditch as much as possible and reclassify the remainder as underground radioactive material. This reduces

the size of the area for surveillance and maintenance, and by leaving an uncontaminated surface, simplifies access requirements for those performing these activities. Interim stabilization is expected to be completed around the end of September 1991. The closure plan for the 216-A-29 Ditch should be submitted to the Washington State Department of Ecology and the U.S. Environmental Protection Agency (the other parties in the Tri-Party Agreement) in May 1996. The interim stabilization will maintain the ditch until closure.

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Bioremediation of Hanford Groundwater

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 101-106) (September 1991)

Liquid wastes containing radioactive, hazardous, and regulated chemicals have been generated throughout the forty years of operations at the Hanford Site. Some of these wastes were discharged to the soil column. Many of the waste components, including nitrate (NO3), carbon tetrachloride (CCl4), and several radionuclides have been detected in Hanford groundwater. A research and development program is underway to develop bioremediation technologies for treating contaminated Hanford groundwater. The program includes development of both ex situ and in situ treatment methods, with primary emphasis on the in situ process. The in situ process should stimulate the native microorganisms and accelerate the natural degradation of NO3 and CCl4. A demonstration site for the in situ biological treatment at the Hanford Site was selected in 1990. Extensive hydrological, chemical, and biological characterization of the site is underway. Current research and development activities focus on (1) supplying nutrients to the subsurface, (2) evaluating the effect of in situ bioremediation on the long-term mobility of metal and radioactive co-contaminants, and (3) modeling the bioremediation process using three-dimensional visualization tools to design the field-scale demonstration site to predict process performance.

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Accelerated Cleanup of Carbon Tetrachloride in a Radiologically Contaminated Site at the Hanford Site

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 313-320) (September 1991)

Radioactively-contaminated acidic aqueous wastes and organic liquids were discharged to the soil column at three disposal sites within the Hanford Site, resulting in carbon tetrachloride contamination of the groundwater and unsaturated soils. A Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Expedited Response Action (ERA) has been initiated for the removal of carbon tetrachloride from the unsaturated soils to mitigate further contamination of the ground water. Based on the contaminant nature and distribution, site physical characteristics, and technology pilot tests, soil vapor extraction with above-ground treatment of the soil vapor was chosen as the preferred remedial technology for the ERA.

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Soil Vapor Extraction Test in a Radiologically Contaminated Site, Hanford Site

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 143-146) (September 1991)

A pilot test of soil vapor extraction technology was conducted in April 1991 at the Hanford Site, to try the technology under the conditions at the Hanford Site and to provide data for designing a large-scale vapor extraction system to stabilize an existing vadose zone carbon tetrachloride (CCl_4) vapor plume. The test took place at the 216-Z-1A tile field, where over 5 million liters of water, 245 metric tons of CCl_4, and 58 kilograms of plutonium and americium were disposed in the 1960s. The test objectives were: (1) to determine the distribution of CCl_4 beneath the tile field, (2) to estimate soil permeability, (3) to observe trends in CCl_4 concentration during soil vapor extraction, and (4) to determine the behavior of radionuclides during the extraction process. The presence of the radionuclides required the use of a high-efficiency particulate filter mounted in-line with the conventional vapor extraction equipment. Gas and filter samples were collected for laboratory analysis using a gas chromatograph/mass spectrometer. Real-time monitoring was performed using on-line flame- and photo-ionization detectors for CCl_4, and continuous alpha- and beta-radiation air monitors for radionuclides. The test results showed that (a) CCl_4 concentrations generally increased with depth, while significant concentrations of CCl_4 were detected outside the tile field boundaries; (b) large amounts of CCl_4 were produced (over 365 lb for the 80 hr test at concentrations up to 900 ppmv); (c) plutonium and americium were not detected during the test or later on any of the test equipment; and (d) unexpectedly high volumes of radon can be produced. The test demonstrated that the technology is a viable method for removing CCl_4 at the tile field, with the ability to separate CCl_4 from the plutonium and americium soil contamination.

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Expedited Response Action Proposal for 316-5 Process Trenches

DOE/RL-91-11; 99 pp. (July 1991)

A summary of the evaluation of remedial alternatives for the 300 Area Process Trench sediment removal at Hanford is presented. Based on the preliminary technology screening, screening factors, and selection criteria, the preferred alternative for the 300 Area Process Trench is to remove and interim stabilize the sediments within the fenced area of the process trenches. This alternative involves proven technologies that are easily applied at this mixed-waste site. This alternative removes and isolates contaminated sediments from the active portion of the trenches, allowing continued use of the trenches until an inspection and treatment facility is constructed. The alternative does not incorporate any materials or actions that preclude consideration of a technology for final remediation of the operable unit. The estimated initial and annual costs would enable this alternative to be implemented under the guidelines for an Environmental Protection Agency - funded ERA ($2 million). Implementation of the alternative can be accomplished with trained personnel using familiar procedures to provide a safe operation that accomplishes the objective for removing a potential source of contamination, thereby reducing potential environmental threat to groundwater.

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In Situ Technology Evaluation and Functional and Operational Guidelines for Treatability Studies at the Radioactive Waste Management Complex at the Idaho National Engineering Laboratory

EGG-WTD-9799; 211 pp. (July 1991)

The purpose of this document is to provide EG&G Idaho's Waste Technology Development Department with a basis for selection of in situ technologies for demonstration at the Radioactive Waste Management Complex of the Idaho National Engineering Laboratory and to provide information for feasibility studies to be performed according to the Comprehensive Environmental Response, Compensation, and Liability Act. The demonstrations will aid in meeting Environmental Restoration/Waste Management schedules for remediation of waste at Waste Area Group 7. This report is organized in six sections. Section 1

summarizes background information on the sites to be remediated at WAG-7; specifically, the acid pit, soil vaults, and low-level pits and trenches. Section 2 discusses the identification and screening of in situ, buried-waste remediation technologies for these sites. Section 3 outlines the design requirements. Section 4 discusses the schedule (in accordance with Buried Waste Integrated Demonstration scoping). Section 5 includes recommendations for the acid pit, soil vaults, and low-level pits and trenches. A listing of references used to compile the report is given in Section 6. Detailed technology information is included in the Appendix section of this report.

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Integrated Waste Management at the Weldon Spring, Missouri Site Remedial Action Project

CONF-9107139; Environmental Engineering, Proceedings of the 1991 Specialty Conference, Reno, NV, July 8-10, 1991. American Society of Civil Engineers, New York, NY; (pp. 78-83) (1991)

There is a wide diversity of contaminants and contaminated media at the Weldon Spring, Missouri, CERCLA site, located about 30 miles west of St. Louis. This diversity necessitates the formulation of various integrated unit-process scenarios prior to selecting the final remedial action. To date, studies have assessed the remedial potential of a number of media-specific technologies for the Weldon Spring Site. Analysis of these studies indicates that remedial technologies must be examined as components of a comprehensive remedial strategy. This paper reports the results of an evaluation of individual remedial-unit processes and the development of potential integrated remedial strategies for the contaminated Weldon Spring Site media. Twenty engineering studies and treatability test reports were reviewed for the evaluation.

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Technology Development for a Disposal Cell at the Weldon Spring Site Remedial Action Project

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 685-688) (September 1991)

The Weldon Spring Site Remedial Action Project (WSSRAP) is a cleanup by the Department of Energy of property and facilities near St. Louis, Missouri. The site was used during World War II to produce explosives such as TNT. During post-war years, it was used to produce uranium metal. The long history of operations at Weldon Spring generated a complex mixture of contaminants, which include toxicants such as nitroaromatics, metals, and radionuclides like uranium and thorium. These contaminants occur in soil, sludges, construction debris, and bulk wastes from the nearby quarry, which was used for waste disposal. Final decisions for site and quarry remediation have not been determined. Alternatives being evaluated include on-site and off-site disposal options for contaminated materials. As part of this evaluation, studies are under way to define technical approaches and performance criteria for an engineered disposal cell that could be located at the chemical plant on the Weldon Spring Site. This disposal cell would be designed to contain by-product radioactive wastes and the end products of treated chemical wastes. A program of support studies has been initiated to facilitate the planning of the disposal cell remedial action. These studies include an evaluation of the suitability of the cell site and the potential for the cell's long-term performance. The information gathered from these studies will assist regulators to determine the acceptability of on-site disposal and will address public concerns about on-site disposal, if it is selected as the preferred alternative. The support studies will also lay the groundwork for the conceptual design of the disposal cell. The disposal cell studies encompass a broad range of topics in four basic categories: (1) siting, (2) barriers, (3) waste, and (4) constructibility. Because of the breadth of technical topics and an

aggressive schedule, most of the studies are being performed concurrently by a broad array of experts. This means that each principal investigator must proceed with a degree of uncertainty about how the final configuration of the disposal cell's components relates to that particular topic of investigation. This paper describes how the concurrent disposal cell facility studies are defined. It describes how the studies are managed to ensure that all relevant technical information is provided in a format that will support an evaluation of on-site disposal. The paper discusses how providing the technical information in this format provides a meaningful foundation for the conceptual design of a disposal cell.

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An Approach to Regulatory Compliance with Radioactive Mixed Waste Regulations

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 633-642) (September 1991)

Radioactive mixed waste (RMW) at the West Valley Demonstration Project (WVDP) became subject to the State of New York hazardous waste regulations on May 7, 1990. The facility was required to be in full compliance with these regulations by June 6, 1990. This goal was difficult to achieve because of the short time for its implementation. WVDP's compliance with the New York regulations also presented some potential conflicts between the requirements of the hazardous waste regulations and other regulatory requirements that are specifically applicable to nuclear facilities. These conflicts involved construction, operation, and control measures. However, before May 7, WVDP had been working with U.S. Environmental Protection Agency (EPA) Region 2 and the New York State Department of Environmental Conservation (NYSDEC) on the application of hazardous waste regulations to the facility. During these preliminary contacts, WVDP identified three issues that posed potential conflicts between hazardous waste regulations and nuclear facility regulations: (1) equivalency of design and equipment; (2) land disposal restrictions (LDR); and (3) the principle of as low as reasonably allowable (ALARA) radiation exposure. The equivalency of nuclear facility design and equipment to the hazardous waste requirements (1) is based in part on the increased criteria for construction of nuclear facilities, the use of remote radiological monitoring for leak detection, and testing of system components that are not accessible to personnel due to high levels of radiation. Regulations limiting the storage of LDR materials (2) posed additional concerns. EPA has granted a two-year national capacity variance for radioactive mixed waste (RMS), but the presence of the California-listed metal, nickel, in WVDP high-level radioactive waste prevents the site from utilizing the variance. WVDP held discussions with both state and federal agencies to resolve this dilemma. The regulatory agencies and WVDP agreed on a two-fold solution to the RMW problem. First, it was recognized that WVDP was accumulating sufficient quantities of RMS to facilitate proper treatment, which is vitrification for high-level waste. Second, the material was placed in storage prior to the effective date of the LDR regulations, so it is not subject to these regulations until WVDP begins the vitrification process. The ALARA principle (3) could be violated if certain hazardous waste regulations were implemented in radiological areas. ALARA would be violated, for example, if regular inspection of stored hazardous materials were required in areas with high radiation fields, or if the dense packing used for radioactive shielding were replaced with typical storage requirements for space between hazardous waste containers. WVDP requested several extensions of the regulatory schedule to give the site time to bring its RMS program into compliance. For example, a six-month extension was granted to conduct an historical- and process-knowledge review of stored wastes that are currently classified as "low-level radioactive" to determine if these wastes are RMS. WVDP requested an additional extension to accommodate appropriate sampling and analyses of the low-level wastes. This paper discusses, in detail: (a) the implementation and results of WVDP's interaction with its regulators; (b) how

WVDP helped the regulators to understand the difference between situations and conditions in nuclear and chemical facilities; and (c) how the regulators and WVDP, working together, ensured the health and safety of workers, the public, and the environment.

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Report of the Advisory Committee on Nuclear Waste: West Valley Demonstration Project

NUREG-1423 (Vol. 1); (pp. 31-32) (January 26, 1989)

This letter from the Advisory Committee on Nuclear Waste (ACNW) to the chairman of the Nuclear Regulatory Committee (NRC) presents the committee's assessment of the West Valley Demonstration Project. The ACNW specifically examined the procedures for solidifying decontaminated supernatant low-level wastes and for testing the melter for vitrification. The ACNW concludes that the program is appropriately focused. Although communication among DOE contractors and staff and NRC staff is found to be good, two areas for improvement are cited: (1) Acceptance criteria for the vitrified high-level waste, including the enumeration of testing procedures to indicate conformance with these criteria, need to be identified by DOE for the waste producers, and these criteria, in turn, need to be reviewed by the NRC to determine if they are acceptable; and (2) Public health and safety criteria for the facilities and land areas being decontaminated and decommissioned as part of this project need to be established.

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Improving Conduct of Operations in Nuclear Waste Cleanup Operations

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 681-684) (September 1991)

The West Valley Demonstration Project (WVDP) is a Department of Energy (DOE) cleanup effort that is removing liquid high-level waste from an underground storage tank, extracting cesium from the liquid waste through an ion-exchange system, and stabilizing the resulting low-level waste in a Nuclear Regulatory Commission-endorsed cement waste form. Additional activities at WVDP include: (1) volume reduction of low-level waste; (2) low-level waste treatment; (3) spent-fuel management; (4) hazardous waste management; (5) facility and equipment decontamination and decommissioning; (6) vitrification facility construction and testing; (7) analytical and environmental chemistry; and (8) engineering, construction, and quality-related activities. The WVDP involves managing nuclear and hazardous wastes with the utmost attention to the safety of the work force, the public, and the environment. An aggressive program to implement DOE Order 5480.19, "Conduct of Operations Requirements for DOE Facilities," is proceeding on schedule. The championing by first-line supervisors of the implementation of new procedures, area and process "ownership" by facility personnel, and interaction among the various WVDP divisions with other Westinghouse divisions have added value to operations at the DOE facility. Training the WVDP work force in a graded approach to the conduct of operations has resulted in benefits like (a) more formalized control room ethics, (b) formalized logs, (c) improved lock- and tag-out control, (d) elimination of posted notes, and (e) increased cleanliness and pride in the work areas.

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Development of a Polishing System for FEMP Wastewater Discharges

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 551-554) (September 1991)

The Fernald Environmental Management Project (FEMP) in Fernald, Ohio generates a wide variety of wastewaters, ranging from process water to stormwater runoff. The current practice is to treat water from process areas prior to discharge into the Great Miami River. Stormwater, on the other hand, is discharged with only settling prior to release. The discharge to the river can contain up to 1-2 ppm of uranium. FEMP is designing an advanced waste water treatment (AWWT) plant for treatment of the water before release to the river. The objective is to provide effluent containing less than 20 ppb uranium and having all other contaminants within Safe Drinking Water Act maximum contaminant levels. Treatment process development included a series of laboratory evaluations to determine the most effective treatment technologies, followed by a series of on-site pilot-plant tests to further optimize the treatment system and provide the data required for scaling-up to the full AWWT Plant. Treatment methods evaluated included chemical pretreatment, filtration, ion exchange, and reverse osmosis. The tests indicated that a combination of filtration (using 50 mesh sand) and ion exchange (three Dowex 21K columns in series) was most effective in polishing the wastewater to below specified levels. This method will be used in the AWWT plant.

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Floodplain Notification for Proposed Removal Action at the Feed Materials Production Center, Fernald, OH

Federal Register 56(115):27505 (June 14, 1991)

The U.S. Department of Energy (DOE) proposes a removal action to manage the radioactively contaminated groundwater in an area south of the Feed Materials Production Center (FMPC) located near Fernald, Ohio. The fundamental objective of the removal action is to protect public health by limiting access to and use of groundwater with uranium concentrations exceeding the DOE-derived concentration limit for uranium in drinking water. The proposed action would involve the installation of groundwater pumping wells and a transfer station, at grade, in the 100-year floodplain. In addition, an underground discharge line would be installed, leading north from the pump station to the FMPC, and from there eastward to an outfall in the Great Miami River. The proposed action would be carried out with the concurrence of the U.S. Environmental Protection Agency (EPA) and the Ohio EPA. The action would be performed in such a manner as to avoid or minimize impacts to the 100-year floodplain.

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Test Program for Closure Activities at a Mixed Waste Disposal Site at the Savannah River Plant

CONF-880839; Closure and Decommissioning - Session 6, Proceedings of the Tenth Annual Department of Energy Low-Level Waste Management Conference, Denver, Colorado, August 30-September 1, 1988, 99 pp.; (pp. 89-95) (December 1988)

A 58-acre site at the Savannah River Plant, which was used for disposal of low-level radioactive waste and hazardous materials such as lead, cadmium, scintillation fluid, and oil, will be the first large waste site at the Savannah River Plant to be permanently closed. Actions leading to closure of the facility include surface stabilization and capping of the site. Test programs have been conducted to evaluate the effectiveness of dynamic compaction as a stabilization technique and the feasibility of using locally derived clay as a capping material.

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National Laboratory, Oak Ridge, TN; Oak Ridge K-25 Site, Oak Ridge, TN

Handling 78,000 Drums of Mixed-Waste Sludge

CONF-9110207; HazMat '91 South, Proceedings of the Hazardous Materials Management Conference, Atlanta, GA, October 2-4, 1991; (24 pp.) (1991)

The Oak Ridge Gaseous Diffusion Plant (now known as the Oak Ridge K-25 Site) prepared two mixed-waste surface impoundments for closure by removing the sludge and contaminated pond-bottom clay and attempting to process it into durable, nonleachable, concrete monoliths. Interim, controlled, above-ground storage of the stabilized waste was planned until final disposition. The strategy for disposal included delisting the stabilized pond sludge from hazardous to nonhazardous and disposing of the delisted monoliths as radioactive waste. Because of schedule constraints and process design and control deficiencies, approximately 46,000 drums of material in various stages of solidification and approximately 32,000 drums of unprocessed sludge are presently being stored. In addition, the abandoned treatment facility still contains approximately 16,000 gallons of raw sludge. Such conditions do not comply with the requirements set forth by the Resource Conservation and Recovery Act (RCRA) for the storage of listed waste. Various steps are being taken to bring the storage of approximately 78,000 drums of mixed waste into compliance with RCRA. This paper reviews the current situation, discusses the plan for remediation of regulatory noncompliances (including decanting liquid from stabilized waste and dewatering untreated waste), and provides an assessment of alternative raw-waste treatment processes.

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U.S. Department of Energy, Oak Ridge Field Office, Oak Ridge, TN

DOE to Hold Public Meeting on Proposed Interim Cleanup Action at Drum Storage Yards

DOE News (910903):1-2 (September 3, 1991)

The Department of Energy (DOE) Oak Ridge Field Office and Martin Marietta Energy Systems, Inc., announce a public meeting to present and receive information related to a proposed cleanup plan for the K-25 Site Drum Storage Yards. In consultation with the U.S. Environmental Protection Agency and the Tennessee Department of Environment and Conservation, DOE has determined that an immediate cleanup action is needed to prevent or minimize possible public health or environmental risks until a final cleanup action can be implemented. This interim measure is needed due to the deteriorating condition of some of the storage drums, and to bring DOE into compliance with the requirements of the Resource Conservation and Recovery Act. The storage yard contains over 70,000 drums of sludge removed from two nearby settling ponds during the mid-1980s. A portion of the sludge was solidified with concrete before being placed into drums. The sludge contains trace quantities of uranium and heavy metals. In 1990, DOE announced that liquids were present in a number of drums used to store solidified sludge at the K-25 Site, and therefore these drums were not in compliance with federal regulations. The free liquid in the drums indicated that a concrete-like solid mixture, consisting of fly ash and cement, may not have hardened properly in some of the drums. Based on information currently available, DOE's preferred alternative for an interim action involves removing free liquids from all solidified sludge, drying and repackaging all of the raw sludge, and storing the containers in existing or new buildings on site. This action complies with applicable federal and state requirements.

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U.S. Department of Energy, Oak Ridge Field Office, Oak Ridge, TN

DOE Begins Transfer of Drums at K-25

DOE News (920401):1 (April 1, 1992)

The U.S. Department of Energy (DOE) has begun transferring approximately 36,000 drums of solidified waste from an outdoor storage yard at the DOE's Oak Ridge K-25 Site into approved and

permitted storage areas at the K-25 Site. The drum storage pad contains 68,000 drums loaded with sludge removed from two nearby settling basins. The sludge contains trace quantities of uranium and heavy metals. The Drum Storage Yard was determined to be out of compliance with the Resource Conservation and Recovery Act (RCRA) in July 1990, when plant officials discovered the presence of free liquids in a number of stabilized sludge drums. Improper processing of the flyash, cement, and sludge mixture made the waste incompatible with the metal drums. DOE developed a preferred alternative for interim cleanup which entails removal of free liquids from all solidified sludge, drying and repackaging all of the raw sludge, and storage of the containers in existing or new buildings on-site. During transfer, each drum is inspected, weighed, and assigned an electronic bar code for tracking during storage. Free liquids are drained and grout is added to ensure structural integrity of stacked drums. About 9000 drums will be processed each month. The transfer is managed by Martin Marietta Energy Systems, Inc. (Energy Systems), operator of the K-25 Site for DOE. Construction is underway to complete five new storage facilities at K-25 that will provide an additional 224,000 square feet of storage space to house drums removed from the yards. Also, Energy Systems will award a contract this spring for the dewatering and repackaging of 32,000 drums that are known to contain raw sludge. The total cost of the drum storage cleanup project is approximately $70 million.

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Contaminated Scrap Metal Management at the ORGDP - A Problem Solved

CONF-8509121; Proceedings of the Seventh Annual Department of Energy Low-Level Waste Management Program Participants Information Meeting, Las Vegas, NV, September 10, 1985; (pp. 451-460) (February 1986)

Cleanup operations have been performed at the Oak Ridge Gaseous Diffusion Plant contaminated scrap metal storage yard. The storage yard, in existence since the early 1970s, contains an estimated 30,000 tons of contaminated mixed-type metals spread over an area of roughly 30 acres. Work has been performed to remove the metal from the storage yard, to sort it into various types, and to size reduce specific types for overall volume reduction and possible further processing. This paper explains the methods and procedures used to accomplish this task. The scrap metal is contaminated with low-enriched uranium, Tc-99, and trace amounts of transuranics.

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Molten Salt Reactor Option for Beneficial Use of Fissile Material from Dismantled Weapons

CONF-910208; Earth Science, Proceedings of the American Association for the Advancement of Science Annual Meeting, Washington, DC, February 15-19, 1991; (37 pp.) (1991)

The Molten Salt Reactor (MSR) option for burning fissile fuel from dismantled weapons is examined. It is concluded that MSRs are very suitable for beneficial utilization of the dismantled fuel. The MSRs can utilize any fissile fuel in continuous operation with no special modifications, as demonstrated in the Molten Salt Reactor Experiment. Thus MSRs are flexible while maintaining their economy. MSRs further require a minimum of special fuel preparation and can tolerate denaturing and dilution of the fuel. Fuel shipments can be arbitrarily small, all of which supports nonproliferation and averts diversion. MSRs have inherent safety features which make them acceptable and attractive. They can burn a fuel type completely and convert it to other fuels. MSRs also have the potential for burning the actinides and delivering the waste in an optimal form, thus contributing to the solution of one of the major remaining problems for deployment of nuclear power.

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Oak Ridge Y-12 Plant, Oak Ridge, TN

Feasibility Study for the United Nuclear Corporation Disposal Site at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee

ES/ER-15/D1; Y/ER/Sub-90/VK168/3/D1; 150 pp. (February 1991)

For two years, the UNC Disposal Site accepted and disposed of waste from the decommissioning of a UNC uranium recovery facility in Wood River Junction, Rhode Island. Between June 1982 and November 1984, the UNC Disposal Site received 11,000 55 gallon drums of sludge fixed in cement, 18,000 drums of contaminated soil, and 288 wooden boxes of contaminated building and process demolition materials. In July 1990, the U.S. Environmental Protection Agency (EPA) directed the Department of Energy Oak Ridge Operations to comply with Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) requirements for the remediation of the United Nuclear Corporation (UNC) Disposal Site located at the Y-12 Plant, Oak Ridge, Tennessee. EPA, Waste Management Branch, had approved a closure plan in December 1989 for the UNC Disposal Site. This feasibility study (FS) fully satisfies the National Oil and Hazardous Substances Contingency Plan (NCP) requirements for support of the selection of a remedial response for closure of the UNC Disposal Site. The FS assembles a wide range of remedial technologies from which the most appropriate actions can be selected to remediate potential contamination to below the maximum level of acceptable risk. Technologies were evaluated based on technical effectiveness, ease of implementation, and costs. Applicable technologies were then selected for alternative development.

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Application of United States Department of Transportation Regulations to Hazardous Material and Waste Shipments on the Hanford Site

WHC-SA-1426; CONF-920307; Waste Management '92, R.G. Post (ed.), Proceedings of a Conference, Tucson, AZ, March 1-5, 1992; (11 pp.) (January 1992)

All hazardous material and waste transported over roadways open to the public must be in compliance with the U.S. Department of Transportation (DOT) regulations. The DOT states that the hazardous material regulations (HMR) also apply to government-owned, contractor-operated (GOCO) transportation operations over any U.S. Department of Energy (DOE) site roadway where the public has free and unrestricted access. Hazardous material and waste in packages that do not meet DOT regulations must be transported on DOE site roadways in a manner that excludes the public and nonessential workers. At the DOE Richland Field Office (the Hanford Site), hazardous material and waste movements that do not meet DOT requirements are transported over public access roadways during off-peak hours with the roadways barricaded. These movements are accomplished using a transportation plan that involves the DOE, DOE contractors, and private utilities who operate on or near the Hanford Site. This method, which is used at the Hanford Site to comply with regulations on-site, can be communicated to other DOE sites to provide a basis for achieving consistency in similar transportation operations.

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Control of Soil Column Discharges at the Hanford Site

PNL-SA-18876;CONF-891053;Environmental Monitoring, Restoration and Assessment: What Have We Learned?, R.H. Gray (ed.), Proceedings of the 28th Hanford Life Sciences Symposium, Richland, WA, October 16-19, 1989, 340 pp.; (pp. 311-312) (1989)

For the past forty-five years, the ion exchange capabilities of soils was used at Hanford to dispose of low-level aqueous waste streams. Those that are discharged to the soil column include effluents with very low contamination. Examples of such effluent streams include steam condensates, process

cooling waters, and process condensates (evaporator overhead). Currently, 33 waste streams are discharged to the soil column. In 1987, the U.S. Department of Energy issued a plan and schedule to discontinue soil column disposal at Hanford. This paper discusses the progress through 1989 in attaining this objective.

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U.S. Department of Energy, Richland Field Office, Richland, WA

Hanford Site Waste Management Units Reports

DOE/RL-88-30 (Vol. 1, Rev. 2); 639 pp. (January 1992)

The Hanford Site Waste Management Units Report (HSWMUR) was originated to provide information responsive to Section 3004(u) of the Hazardous and Solid Waste Amendments (HSWA) of the 1984 United States Code (USC 1984). This report provides a comprehensive inventory of all types of waste management units at the Hanford Site, including a description of the units and the waste they contain. Waste management units in this report include: (1) Resource Conservation and Recovery Act of 1976 (RCRA) disposal units, (2) Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) disposal units, (3) unplanned releases, (4) inactive contaminated structures, (5) RCRA treatment, storage, and disposal (TSD) units, and (6) other storage areas. Because of the comprehensive nature of this report, the listing of sites is more extensive than required by Section 3004(u) of HSWA. The information in this report is extracted from the Waste Information Data System (WIDS). The WIDS provides additional information concerning the waste-management units described in this report, and is kept current with changes to these units. This report is updated annually if determined necessary per the Hanford Federal Facility Agreement and Consent Order (commonly referred to as the Tri-Party Agreement). This report identifies 1414 waste management units. Of these, 1015 units are identified as solid waste management units (SWMU), and 342 are RCRA treatment, storage, and disposal units. The remaining 399 are comprised mainly of one-time spills to the environment, sanitary waste disposal facilities (i.e., septic tanks), and surplus facilities awaiting decontamination and decommissioning.

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Strategy for Management of Investigation-Derived Waste

WHC-SA-1350; CONF-920307; Waste Management '92, R.G. Post (ed.), Proceedings of a Conference, Tucson, AZ, March 1-5, 1992; (7 pp.) (January 1992)

This paper outlines the strategy for handling and storing investigation-derived waste within a given operable unit until a waste unit-specific record of decision can be issued. To date, the strategy for management of investigation-derived waste has not been finalized. However, formal approval by the U.S. Environmental Protection Agency (EPA) is expected soon, and will result in implementation of the management strategy at waste sites in which the EPA is the lead regulatory agency. Negotiations with the Washington State Department of Ecology are ongoing. It is uncertain what the Washington State Department of Ecology's position will be regarding investigation-derived waste. Both the EPA and the U.S. Department of Energy believe the strategy for management of investigation-derived waste to be protective of human health and the environment and to be a cost-effective method of dealing with the investigation-derived waste.

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Remediation of a Gasoline Spill by Soil Vapor Extraction, Lawrence Livermore National Laboratory, Livermore, CA

UCRL-JC-108064; CONF-911185; Petroleum Hydrocarbons and Organic Chemicals in Groundwater: Prevention, Detection and Restoration, Proceedings of a Conference and Exposition, Houston, TX, November 20-22, 1991; (19 pp.) (September 1991)

Lawrence Livermore National Laboratory (LLNL) is located approximately 40 miles east of San Francisco in the southeastern portion of the Livermore Valley near Livermore, California. In 1979, an underground gasoline tank there was found to be leaking. The spill occurred near Building 403 in the southeast corner of LLNL. The initial investigation confirmed the presence of gasoline contamination in both the soil and ground water. The water table is at a depth of approximately 100 feet. A pilot study on the use of soil vapor extraction in heterogeneous deposits was begun in August 1988. Fieldwork to assess the efficacy of the vapor extraction, including soil sampling and installation of three vadose-zone monitoring devices, began in October 1990.

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U.S. General Accounting Office, Resources, Community, and Economic Development Division, Washington, DC

GAO Report on Rocky Flats Plant Solar Evaporation Pond Cleanup

GAO/RCED-92-18; 13 pp. (October 1991)

This paper reports the General Accounting Office (GAO) discussion of the Department of Energy's (DOE) efforts to clean up the solar evaporation ponds at its Rocky Flats Plant in Colorado. DOE is trying to excavate the ponds which were used for storing and evaporating low-level liquid radioactive and hazardous wastes, and to stabilize the excavated material by mixing it with concrete. DOE issued a press release in March 1991 stating that it had imposed strict cost-control measures in managing the project. Yet DOE's most recent cost data show that total cleanup costs have soared to an estimated $169 million through completion in 2009, $50 million more than the amount GAO reported nine months ago. Delays have plagued the completion and approval of the management plans for conducting and monitoring the program. Cleanup activities that DOE expected to resume by December 1990 have not yet begun. DOE will not meet the first major milestone of the solar ponds program, which is to clean up the ponds and move all the pondcrete off-site by October 1991. Further, unless DOE provides enough project funding or resolves concerns over pondcrete disposal in Nevada, it will not finish pondcrete processing before Rocky Flats' interim status permit for pondcrete operations expires in November 1992.

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Application of Vapor Vacuum Extraction to Waste Sites with Chlorinated Solvent Problems - A Case Study

CONF-9010166; Waste Management and Environmental Restoration, Proceedings of the 1990 DOE Model Conference, Oak Ridge, TN, October 29-November 2, 1990, 343 pp.; (1 p.) (1990)

Groundwater problems associated with the migration of organic vapor from waste sites have been noted at a number of U.S. Department of Energy facilities. At the Idaho National Engineering Laboratory, for example, organic vapors from the Radioactive Waste Management Complex (RWMC) have migrated through the vadose zone and have reached the Snake River Plain Aquifer. Trace levels of organic chemicals, including carbon tetrachloride, have been reported in wells in the vicinity of the RWMC. Both detailed field studies and modeling studies have addressed the organic problems at the RWMC. These studies have lead to the Vapor Vacuum Extraction (VVE) system. The VVE concept relies on applying a vacuum in a centrally located well to induce large flows of soil gases toward the well. Thus, the contaminant plume is swept to the extraction well and removed. A VVE demonstration project was initiated at the RWMC this year for the purposes of evaluating the effectiveness of the remedial technique and for collecting data for model validation. The purposes of this paper are to: (1) describe the features of

the VVE system; (2) present and interpret the field data; and (3) summarize the primary findings of the demonstration project.

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Issuance of the CERCLA ROD for an Operable Unit Remedial Action at the Weldon Spring Site - Lessons Learned

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 793-794) (September 1991)

Finalizing a record of decision (ROD) for remedial action at a federal facility involves considerable interagency coordination, and can be very time-consuming. The ROD incorporates input on a proposed remedial action that is received from the public and state and federal agencies, and it represents the culmination of the decision-making process for that action. Because varying views on a number of issues must be brought together to finalize decisions, the sign-off process can be somewhat arduous. This paper discusses lessons learned in completing the record of decision for an operable unit at the Weldon Spring Site. The ROD process took over one year to complete following the issuance to the public of the remedial investigation/feasibility study documents for an action that had universal acceptance. This time frame must be shortened if DOE is to meet its commitments. Two important lessons learned that will help streamline this process include: (1) finalizing the Applicable or Relevant and Appropriate Requirements (ARARs) evaluation early in the ROD process and (2) assuring adequate agency input during ROD development.

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Los Alamos National Laboratory, Los Alamos, NM

Closure Certification Report: TA-35 TSL-125 Surface Impoundment - Volume 2

LA-UR-91-2600 (Vol. 2); 472 pp. (July 31, 1991)

This report summarizes the actions that were taken to clean and close the TA-35 TSL-125 surface impoundment, located at Los Alamos National Laboratory, Los Alamos, New Mexico. Building 125 is used for developing electron guns and related laser assemblies/equipment for a laser technology research program at the laboratory. There is no permanent outfall from the surface impoundment; however, the impoundment accidentally overtopped on December 3, 1986, spilling an unknown volume of insulating oil and water into Ten Site Canyon. Sandbags were installed around the surface impoundment on June 25, 1988, to provide additional freeboard in the impoundment and reduce the risk of overtopping during a precipitation event. On July 1, 1988, the impoundment again overtopped releasing an unknown volume of insulating oil and water. Actions taken include removal of waste from the surface impoundment and its associated structures, decontamination of the floor trough and piping inside Building 125, grouting of the piping connecting the floor drain/trough system to the impoundment, decontamination, removal, and disposal of the impoundment liner and sandbags lining the top of the impoundment, and removal and disposal of contaminated soil underlying the impoundment area. Procedures followed to verify that clean closure objectives have been met are also documented in this report. Initial verification was performed through an extensive soil sampling and analysis program.

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Los Alamos National Laboratory, Los Alamos, NM

Closure Certification Report: TA-35 TSL-125 Surface Impoundment - Volume 1

LA-UR-91-2600 (Vol. 1); 352 pp. (July 31, 1991)

This closure report documents closure activities for the TA-35 TSL-125 surface impoundment and associated structures at Los Alamos National

Laboratory (the Laboratory). Prior to formal approval of the closure plan, the decision was made to proceed with closure activities to prevent any further releases from the site, following informal discussions with New Mexico Environment Department (NMED) personnel. The closure plan is a revision of the previously submitted draft dated July 1988. Clean closure of the TSL-125 site was accomplished through: (1) removal and proper disposal of all wastes contained within the surface impoundment system; (2) decontamination and/or removal and proper disposal of the surface impoundment, its associated structures, and contaminated soil underlying the impoundment area; (3) sampling and analysis of soil to determine the presence and concentrations of any hazardous constituents remaining in the soil at the TSL-125 site; and (4) demonstration, through a risk assessment, that any constituents remaining in the soil at the TSL-125 site pose no threat to human health and the environment. All remaining soil concentrations of hazardous constituents were below health-based action levels. Analytical results indicated that benzidine, n-nitrosodimethylamine, and n-nitrosodi-n-propylamine were not detected at or above their limits of quantitation, and beryllium was not present at or above its laboratory detection limit. However, the limits of quantitation and detection for these constituents were greater than their calculated health-based action levels. To demonstrate that these constituents were not present, historical data was researched and it was determined that the constituents were not utilized at the Building 125 site.

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Groundwater Clean-Up: The Savannah River Site Experience

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 407-412) (September 1991)

A full-scale pump and treat groundwater remediation program for a large plume of volatile organics has been ongoing at the Savannah River Site (SRS) since 1985. While the pumping is achieving overall environmental protection, it is not reducing the concentration of contaminants to very low levels. In 1981, the groundwater beneath the SRS fuel and target fabrication facility (A/M Area) was found to be contaminated with volatile organic degreasing solvents, primarily trichloroethylene (TCE) and tetrachloroethylene (PCE). The sources of contamination were a settling basin and sewer line (now closed), a solvent storage area, and other release points near the fabrication facility. Over three hundred monitoring wells were installed to characterize the contaminant plume. Full scale groundwater recovery with treatment by air stripping began in 1985, using eleven recovery wells and an air stripper. The system has recovered over 114,000 kilograms of solvent from 4,920,000,000 liters of pumped groundwater. The system is reducing the mass in the central region of the plume and effectively contains the contamination there; but significant amounts of solvent remain in the vadose zone. Recently, a separate phase of solvents was detected in a monitoring well near the closed settling basin. Contamination in the vadose zone has been and will be treated through vacuum extraction. The presence of dense non-aqueous phase liquids in the aquifer presents another challenge to current characterization and remediation efforts. SRS has increased the recovery rate of the groundwater treatment system, and has installed a recovery well and prototype stripper near the SRS north boundary, outside the original recovery area. SRS plans to increase the recovery capacity of this new system and to install another recovery system in a dilute plume region south of the A/M Area. Experimental horizontal wells using vacuum extraction and in situ air stripping are being used for removing contaminants from an aquifer near the closed sewer line. While new technologies offer hope for achieving low concentrations of contaminants in groundwater, they must still overcome the difficulties presented by a complex hydrogeologic system. Risk based approaches to cleanup may lead to more logically deduced cleanup goals and standards.

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An Overview of Major Progress in the Environmental Restoration Program at the Savannah River Site

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 61-67) (September 1991)

The Savannah River Site (SRS) vision of demonstrating major progress in environmental remediation is being achieved. In fiscal year 1991, four large Resource Conservation and Recovery Act waste sites received certification of successful closure from the South Carolina Department of Health and Environmental Conservation. These sites include the eight M, F, and H seepage basins and the Mixed Waste Management Facility (MWMF). Combined, they encompass about 85 acres. Originally, the basins represented a capacity for annual treatment of over 85 million gallons of effluent from various separation and fuel manufacturing processes. The MWMF is the largest mixed solid waste closure of its kind accomplished in the DOE complex, and perhaps in the world. The F and H seepage basins similarly may be the largest closures of their type achieved to date. These projects, which had various challenging aspects, were completed in a relatively short time, on schedule and with cost savings. A total quality approach described in this paper was an integral part of this progress. Other significant closures, such as the four acid/caustic basins and the metallurgical laboratory basins, have also been initiated. In total, 23 additional plans have been submitted to the regulators for approval, and another 29 are currently in preparation. SRS is committed to progress in environmental remediation, and continues to pursue progressive initiatives to further demonstrate SRS waste site closure accomplishments.

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M-Basin Closure - Savannah River Site

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 327-332) (September 1991)

This paper briefly describes the characterization and closure of the M-Area basin. The M-Area of the Savannah River Site manufactures and produces aluminum-clad, enriched uranium fuel tubes and aluminum-clad target rods for use in nuclear reactors. Stringent nuclear industry manufacturing standards necessitate the use in the M-Area of more cleaners and degreasers than in commercial aluminum operations. Effluent from M-Area processes were discharged into the M-Area settling basin (100.9 m by 85.0 m by 6.1 m deep) and Lost Lake, a natural wetland. During 27 years of operation, the basin area received wastes containing primarily lead, nickel, magnesium, zinc, and uranium, with concentrations of nitrate, phosphate, sulfate, sodium hydroxide, and degreasers. Between 1974 and 1985, total uranium discharge to the basin was 1150 MCi. It is estimated that 30,000 kg of heavy metals and 2.0 million kg of volatile organic solvents were discharged to the M-Area Basin. The closure of the basin began in 1988. It included the removal and stabilization of basin fluids, excavation of all contaminated soils from affected areas and from Lost Lake, and placement of all waste materials from the operation in the bottom of the empty M-Area basin. These materials were covered with a Resource Conservation and Recovery Act-style cap of multiple barriers of kaolin clay and a geosynthetic material, a gravel drainage layer overlaid with clean fill, topsoil, and a vegetative cover. Restoration of the excavated uplands and wetlands is currently underway. The final cost to close the 1.0 ha (2.4 a) basin and restore approximately 10.1 ha (25 a) of affected land was $5.4 million.

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J.E. Stone, Oak Ridge Y-12 Plant, Oak Ridge, TN

Chestnut Ridge Sediment Disposal Basin (D-025): Summary of Closure under Rules Governing Hazardous Waste Management in Tennessee

Y/TS-390/2; 13 pp. (July 1989)

On February 29, 1988, the "Revised Closure Plan for Chestnut Ridge Sediment Disposal Basin," Y/TS-390 (Reference 1) was submitted to the United States Department of Energy for review and transmittal to the Tennessee Department of Health and Environment. The closure activities described in the closure plan have been performed. The purpose of this document is to summarize the closure activities for the Chestnut Ridge Sediment Disposal Basin (CRSDB). The closure of CRSDB is a final closure. The CRSDB, Unit D-025, was an unlined, man-made sediment disposal facility on Chestnut Ridge, south of New Hope Pond (NHP). The CRSDB was constructed during 1972-1973 for the disposal of sediments hydraulically dredged from NHP. It was designed to hold approximately 30,000 cu yds of sediments. Since 1973, the basin had been used for the periodic disposal of sediments excavated from NHP and its appurtenant structures. NHP previously received discharges form RCRA-related waste streams.

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W.D. Adams, U.S. Department of Energy, Oak Ridge Field Office, Oak Ridge, TN

Lessons Learned from the Implementation of Environmental Regulations at Oak Ridge

CONF-910603; Proceedings of the 1991 American Nuclear Society Annual Meeting, Orlando, FL, June 2-6, 1991; Transactions of the American Nuclear Society 63:72-73 (1991)

The Oak Ridge Operations (ORO) Office of the U.S. Department of Energy (DOE) is responsible for carrying out environmental restoration activities at 40 different sites located in 7 Environmental Protection Agency (EPA) regions and 13 states. Many of these sites contain multiple solid waste management units or other environmental legacies resulting from up to 45 years of operation as research, production, and defense-related facilities. These sites include 5 that are listed on the EPA National Priorities List, 5 that are currently operating facilities, and 32 that are former Manhattan Engineering District/Atomic Energy Commission sites. Cleanup activities are executed under the applicable regulations of the Resource Conservation and Recovery Act, Comprehensive Environmental Recovery and Compensation Liability Act, and National Environmental Policy Act. These activities include various stages of characterization, design, and remedial actions. This paper discusses the lessons learned from the successes and failures of selected cleanup experiences at ORO facilities and describes opportunities for improvement in project planning, implementation, quality assurance, training, and regulatory interactions. This very candid discussion of ORO experience is presented in the spirit of helping to achieve DOE's goal of managing environmental cleanup activities in a technically sound, cost-effective, and compliant manner.

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M.H. Bowers, Lockwood Greene Engineering, Inc., Oak Ridge, TN

A Successful Environmental Remediation Program Closure and Post-Closure Activities (CAPCA), Y-12 Plant, Oak Ridge, Tennessee

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 339-344) (September 1991)

Eleven waste management units (more than 80 ha) have been successfully closed at the Department of Energy's Y-12 Plant in Oak Ridge, Tennessee. The closures were accomplished as required by the Resource Conservation and Recovery Act (RCRA) and the Rules Governing Hazardous Waste Management in Tennessee. The basic closure plan consisted of waste stabilization and the installation of a multi-media cap with appropriate surface drainage improvements. The sites include: (1) Bear Creek Burial Ground A, (2) Bear Creek Burial Ground B and Walk In Pits, (3) Bear Creek Burial Ground C, (4) the S-3 Ponds, (5) Oil Retention Pond 1, (6) Oil Retention Pond 2, (7) the Oil Landfarm, (8) Hazardous Chemical

Disposal Area, (9) Chestnut Ridge Security Pits, (10) Chestnut Ridge Sediment Disposal Basin, and (11) New Hope Pond. Ancillary facilities included the completion of two borrow areas, several miles of haul road, and a 1 ha settling and spill catchment basin for the Y-12 Plant. Closure of one additional waste management unit has not been completed. These projects were performed through the Y-12 Plant Closures and Past Closures Activities Program (CAPCA), under an accelerated schedule and with a total cost of $47 million. This paper provides details of the closures and technical and managerial features that led to the program's success.

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Lessons Learned in Negotiating a Federal Facility Agreement

CONF-910603; Proceedings of the 1991 American Nuclear Society Annual Meeting, Orlando, FL, June 2-6, 1991; Transactions of the American Nuclear Society 63:73-74 (1991)

In September 1987, the U.S. Department of Energy Richland Operations Office (DOE-RL) began discussing the need for a federal facility agreement with the U.S. Environmental Protection Agency (EPA). The DOE-RL and EPA agreed that it would be beneficial to integrate the Resource Conservation and Recovery Act (RCRA) requirements into the Federal Facility Agreement to minimize conflicts between the two regulators and between the state and EPA. With this in mind, the State of Washington Department of Ecology (Ecology) was included in negotiations. The resulting agreement, signed by the three parties on May 15, 1989, has been dubbed the Tri-Party Agreement. Despite predictable differences between the individual agency desires, the overall goal of each of the agencies was to set a process and schedule that would drive the Hanford Site to achieve compliance with RCRA and to begin the long process of environmental remediation. Since the end goal was essentially the same, differences which arose during the course of the negotiations were resolved without mediation, and lessons learned are noted in this paper.

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Accelerated Cleanup of Mixed Waste Units on the Hanford Site, Richland, Washington

WHC-SA-1465; 14 pp. (January 1992)

This report provides a basic description of the Expedited Response Action Program currently being implemented at the Hanford Site. Included is a reference to the applicable regulations regarding the program's implementation. The first three expedited response actions (a burial-ground exhumation and drum-removal project, a sediment removal and consolidation project, and a soil-vapor extraction and treatment project) are discussed in detail in the form of case studies.

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Accelerated Cleanup of the 316-5 Process Trenches at the Hanford Site

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 191-194) (September 1991)

In October 1990, the U.S. Department of Energy, the U.S. Environmental Protection Agency, and the Washington State Department of Ecology signed an Agreement in Principle to accelerate remedial actions on the Hanford Site. The 300 Area (316-5) Process Trenches was one of the three initial candidate locations identified for the accelerated remediation. The 316-5 Process Trenches have received small quantities of radioactive and hazardous wastes in large volumes of process water (up to 11,360,000 l/day). The trenches are approximately 300 m west of the Columbia River and 7 m above the water table. The trenches are an active interim permitted disposal facility that may remain active for the next few years. To reduce the potential for migration

of contaminants from the trench sediments into the groundwater, an expedited response action to remove approximately 2,500 sq m [sic] of soil from the active portion of the trenches is being performed. Field activities were initiated in July 1991 with site preparation. The first trench to be excavated was completed by August 15, 1991. Approximately two weeks were needed to begin removal activities in the second trench. The second trench was scheduled to be completed by October 1, 1991, with the subsequent construction of an interim cover over the consolidated materials completed by December 1991.

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Accelerated Cleanup of the 618-9 Burial Ground

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 427-431) (September 1991)

This paper describes the expedited response action (ERA) taken at a potentially uranium-contaminated, solvent waste disposal trench on the Hanford Site, the 618-9 Burial Ground. In December 1991, the U.S. Department of Energy was instructed by the U.S. Environmental Protection Agency and the Washington State Department of Ecology to begin planning an ERA for the 618-9 Burial Ground. The ERA was undertaken in accordance with a the Hanford Site Agreement in Principle (Tri-Party Agreement) and under the ERA provision of the Comprehensive Environmental Response, Compensation, and Liability Act. Time-critical activities began at this past-practices waste disposal unit in February and were completed in May, 1991. The historical records indicated that the 618-9 Burial Ground, located approximately one mile west of the Columbia River in the 300-FF-2 Area of the Hanford site, was operational in the early 1950's. The facility received about 5000 gallons of uranium-contaminated solvent, suspected to be methyl isobutyl ketone (MIBK), also known as hexone. The solvent was believed to be contained in an unknown number of 55-gallon drums. Oral interviews with personnel employed at the facility in the 1950's indicated the possible presence of other debris and other chemicals in the burial trench. Further site characterization consisted of a ground-penetrating radar study and a soil gas survey. After assumptive procedural documentation, careful excavation of the trench boundary began. Over 1600 gallons of solvent and a large volume of debris were removed safely. Results of sampling of the solvent are still pending, but preliminary results indicate that the recovered solvents were primarily NPH/tributyl phosphate and hexone. This waste will be disposed offsite at a permitted facility. Removal of the debris in the trench facilitated further remedial action by (1) identifying items buried in the trench, thereby exposing constituents of concern; (2) removal of potential hazards; and (3) exposing the trench bottom for soil sampling. The paper concludes that expedited response actions should have more flexible documentation, allowing qualified field personnel to make real-time decisions critical to completing the accelerated cleanup safely and on schedule.

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Oak Ridge Y-12 Plant, Oak Ridge, TN; ERC Environmental and Energy Services Company, Knoxville, TN

Documentation Report for the 1989 Monitor Well Plugging and Abandonment Program, Oak Ridge Y-12 Plant

Y/Sub-90/99005V/2; 97 pp. (April 1991)

This report documents the 1989 well-plugging and abandonment activities at the Y-12 Plant in Oak Ridge, Tennessee. Twenty-one monitoring and investigation wells were plugged and abandoned during the period from January 1989 through December 1989. ERC Environmental and Energy Services Company (ERCE - formerly the EDGe Group) supervised and documented the well-plugging and abandonment activities and monitored for health and safety concerns. The wells were decommissioned for several reasons. They were either no longer needed as groundwater

monitoring or investigation wells, or they were in the way of construction or site-closure and post-closure activities (CAPCA). The wells were plugged and abandoned according to the procedures outlined by Haase and Gillis (1989).

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Environmental Restoration Activities at the U.S. Department of Energy's Pinellas Plant

GEPP-CP-1283; 12 pp. (1991)

The Pinellas Plant, located in Largo, Florida, is part of the U.S. Department of Energy's (DOE) weapons complex. General Electric Neutron Devices (GEND) has initiated an extremely aggressive, proactive Environmental Restoration (ER) Program at the Pinellas Plant. The ER program was started to investigate environmental concerns associated with past waste-management practices and procedures at DOE weapons installations. The Pinellas Plant has been involved with ER activities since the mid 1980's when the DOE's Pinellas Area Office (PAO) entered a voluntary cleanup agreement with the Florida Department of Environmental Regulation (FDER). The agreement was for the remediation of an adjacent parcel of previously owned property used for disposal of drums containing waste solvents and resins. Remediation issues at the Pinellas Plant are equivalent to those experienced by many private industries. For example, limited volatile-organic-compound (VOC) and heavy-metal contamination of the surficial aquifer system and heavy-metal contamination of soils. ER activities in progress are aimed toward: (1) confining, repositioning and remedying areas of heavy metal and VOC contaminants found within the surficial aquifer system; (2) maintaining consistency with EPA's draft Corrective Action rules; (3) protecting a U.S. Department of Interior national wetland; and (4) ensuring that the risks to human health and safety and the environment posed by the plant's past, present and future operations are either eliminated or reduced to acceptable, safe levels. This paper will summarize the progress made and the strategies of the Pinellas Plant ER program as well as implementation of interim remedial actions.

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Surface Water Management at a Mixed Waste Remediation Site

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 465-468) (September 1991)

The Weldon Spring Site Remedial Action Project (WSSRAP) in Missouri deals with chemical and radiological contaminants. MK-Ferguson Company manages the project under contract with the U.S. Department of Energy. Remedial activities include demolishing buildings, constructing material storage and staging areas, excavating and consolidating waste materials, and treating and disposing of the materials in a land disposal facility. Due to the excavation and construction required during remediation, a well-planned surface water management system is essential. Planning the system involves the characterization of source areas and surface water transport mechanisms and the identification of applicable regulations. The components of the system include (1) erosion control, (2) sediment control, (3) flow attenuation, and (4) management of contaminated water. Combinations of these components may be utilized during actual construction and remediation to obtain optimum control. Monitoring to assess the effectiveness of control measures is performed during implementation. This scheme provides for the comprehensive management of surface water at the WSSRAP site by providing control of, and/or treatment to appropriate standards of the surface water. Although some of the treatment methodologies for contaminated water are specific to WSSRAP site contaminants, this comprehensive program incorporates a management approach that is applicable to many remedial projects where it is necessary to minimize contaminant release and meet the requirements of the Clean Water Act.

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WSSRAP Update

WSSRAP Update 3(2):1-8 (December 1991)

This semi-annual newsletter is intended to keep the public informed about the progress of cleanup operations in the Weldon Spring Site Remedial Action Project (WSSRAP). This issue describes work on: (1) the Quarry and Site Water Treatment Plants, (2) a temporary haul road from the quarry to the chemical plant site and relocation of a section of Highway 94, (3) a new water tower, (4) the Temporary Storage Area, and (5) dismantling of several non-process buildings. An open house and other community relations events are described, and some of the project's personnel are featured. The newsletter contains several photographs of the site, events, and personnel.

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West Valley Demonstration Project Progress Report Compiled for the Technical Advisory Group Meeting - April 22-26, 1991

OECD/NEA Co-Operative Program on Decommissioning, 10th Meeting of the Technical Advisory Group, Karlsruhe, Federal Republic of Germany, April 22-26, 1991; (3 pp.) (April 1991)

Progress at the West Valley Demonstration Project, West Valley, New York, was reported at the April 22-26, 1991 Technical Advisory Group meeting. Approximately 80% of the cesium has been removed by ion exchange from the high-level waste supernate. An additional 1400 drums have been cemented by low-level waste solidification operations. Solidified waste drums have been processed with an average drum activity of 0.022 Ci per drum, and an average radiation level of 22 mr/hr. Total drums processed are 10,393 of the 13,000 planned. The solidified drums passed quality assurance procedures with a 99.8% acceptance rate. Vitrification of the high-level waste is planned to start in mid-1996.

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L.D. Bates, Martin Marietta Energy Systems, Inc., Oak Ridge, TN

Oak Ridge Restoration Typical of Federal Sites

Forum for Applied Research and Public Policy 6(1):27-31 (1991)

The Oak Ridge reservation traces its beginnings to the early 1940s when the then-sparsely populated area became home to the Manhattan Project, which fostered the development of the first nuclear weapon. For more than 45 years, Oak Ridge activities and operations have produced hazardous and radioactive materials representing varying degrees of environmental risks. The facilities are now undergoing an environmental restoration administered by the U.S. Department of Energy. The cleanup program is typical of what is occurring at other federal installations. Years of operation have produced a diverse legacy of on-site and off-site contaminants, including metals, radionuclides, fission products, transuranics, and organic chemicals including PCBs. Off-site contamination exists primarily in East Fork Poplar Creek and the downstream Clinch River and Watts Bar Reservoir. A figure illustrates the contaminated areas currently under study. The sites were contaminated by what are now considered crude waste-management, disposal, and handling practices. These practices include hazardous-waste burial grounds, liquid-waste leak sites, disposal pits, process ponds, contaminated streams, environmental research areas, and underground waste-storage tanks.

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Oak Ridge National Laboratory, Oak Ridge, TN

Summary of the Landfill Remediation Problems and Technology Needs of the Oak Ridge Reservation Environmental Restoration Programs

ES/ER/TM-7; 97 pp. (January 1991)

This report contains the following: (1) a brief description of the Oak Ridge Reservation Environmental Restoration Program; (2) descriptions of representative waste burials at each site; (3) ongoing, planned, or potential remediation; (4) known or anticipated remediation

problems; and (5) potential applications for robotics in the remediation of Oak Ridge Reservation landfills.

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U.S. Department of Energy, Oak Ridge Field Office, Oak Ridge, TN

Oak Ridge Environmental Restoration and Waste Management Plan Available for Public Comment

DOE News (910917):1 (September 17, 1991)

A plan explaining the U.S. Department of Energy (DOE) environmental restoration and waste management objectives for the Oak Ridge Reservation for 1992 is available for public comment and review. The Site-Specific Plan (SSP), updated annually, describes how restoration and waste management activities will be implemented for the Oak Ridge National Laboratory, Oak Ridge K-25 Site, and the Oak Ridge Y-12 Plant. Additional facilities and programs addressed include the Oak Ridge Associated Universities, Hazardous Waste Remedial Action Program, and Transportation Program. The SSP is part of DOE's long-range strategy for cleanup of its facilities nationwide, as contained in the Environmental Restoration and Waste Management Five-Year Plan, issued September 5, 1991. Major sections of the SSP include (1) corrective activities, (2) environmental restoration, (3) waste management, and (4) technology development. Corrective activities reduce or eliminate unacceptable discharges of contaminants to the environment, while environmental restoration activities protect the environment and the public from potential hazards from past plant activities or waste disposal practices. Waste management focuses on management of currently produced waste to protect the environment and public health and safety, and to maintain regulatory compliance. Technology development activities demonstrate innovative processes, new equipment, and new methods that will aid in cleaning up these sites.

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Waste Management and Environmental Activities at the Y-12 Plant

Y/WM-114; 16 pp. (March 17, 1992)

This report presents a historical perspective on environmental regulations which influence waste management practices at the Y-12 plant in Oak Ridge, TN.

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The New Mission for the Hanford Site

CONF-910603; Proceedings of the 1991 American Nuclear Society Annual Meeting, Orlando, FL, June 2-6, 1991; Transactions of the American Nuclear Society 63:155 (1991)

There has been a distinct shift in the mission of the defense nuclear waste management program at the Hanford Site, from handling the waste streams that resulted from the production of nuclear materials to supporting the site-wide environmental restoration effort. Since 1943, 14 nuclear materials production reactors were built, 9 at Hanford and 5 at the Savannah River Site in South Carolina. At present, there are no plans to resume production reactor operations at Hanford. Therefore, future waste-management operations will be directed toward supporting environmental restoration and decommissioning and decontamination efforts. This new mission will emphasize the management of wastes in a manner that complies with applicable environmental laws during the cleanup of the numerous sites at Hanford that are no longer required for national-defense, nuclear-materials production. In discussing the transition from the old to the new mission, this paper focuses on the Hanford Site, where production activities are being phased out and site cleanup will be one of the prime areas of focus for future U.S. Department of Energy (DOE) activities.

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Legend and Legacy: Fifty Years of Defense Production at the Hanford Site

WHC-MR-0293 (Rev. 1); 64 pp. (March 1992)

The Hanford Site is engaged in the largest waste cleanup effort ever undertaken in human history. Hanford has been designated the "flagship" of Department of Energy (DOE) waste remediation endeavors. The Hanford Site was unique for establishing a detailed, scientific, and multifaceted environmental monitoring program. The extensive environmental monitoring records of the site are the most complete in the world. Historical data on the amounts and components of wastes discharged, from which locations and at which times, can guide and simplify the waste remediation program. Likewise, oral history interviews yield understanding of the alternatives that were considered when past decisions were made. This public document incorporates all of these aspects of Hanford Site history into an overview of Hanford's important contributions to the nation's defense over the past fifty years. It includes a brief pre-site history of the Columbia Basin and chapters on: (1) site selection criteria and wartime construction; (2) World War II operations and monitoring program development; (3) postwar production lull, 1945-1947; (4) first postwar expansion, 1947-1949; (5) first and second Korean War expansions, 1950-1955; (6) peak production years, 1956-63; (7) Hanford Site wastes in the Columbia River; (8) development of the 300 Area; (9) history of the 200 Area cribs and tanks; and (10) historic structures on the Hanford Site.

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Hanford Federal Facility Agreement and Consent Order Quarterly Progress Report for the Period Ending June 30, 1991

DOE/RL-91-30; 84 pp. (August 1991)

This is the ninth quarterly report required by the Hanford Federal Facility Agreement and Consent Order, also known as the Tri-Party Agreement, established between the U.S. Department of Energy, the U.S. Environmental Protection Agency, and the Washington State Department of Ecology. The Tri-Party Agreement sets the plan and schedule for achieving regulatory compliance and cleanup of waste sites at the Hanford Site. This report covers progress for the quarter that ended June 30, 1991. A total of 87 milestones have been completed to date.

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U.S. Department of Energy, Richland Field Office, Richland, WA

Hanford Federal Facility Agreement and Consent Order Quarterly Progress Report for the Period Ending September 30, 1991

DOE/RL-91-41; 97 pp. (November 1991)

This is the tenth quarterly report as required by the Hanford Federal Facility Agreement and Consent Order, also known as the Tri-Party Agreement, that was established between the U.S. Department of Energy (DOE), the U.S. Environmental Protection Agency (EPA), and the Washington State Department of Ecology (Ecology). The Tri-Party Agreement sets the plan and schedule for achieving regulatory compliance and cleanup of waste sites at the Hanford Site. This report covers progress for the quarter that ended September 30, 1991. Expedited response actions (ERA) were completed at the 300 Area process trenches. Under the Resource Conversation and Recovery Act of 1976 (RCRA) or Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) regulations, investigating waste-site cleanup methods, developing and selecting methods, and implementing the cleanup can require several years. However, cleanup can begin before all the studies are completed if the contaminants at a particular waste site potentially threaten people or the environment, or where preventive measures are appropriate. An ERA is being performed on this site because of the proximity of the waste-disposal site to the Columbia River. This expedited cleanup project involved removing and isolating contaminated soil in the process trenches to prevent further spread of the contaminants. The removal of contaminated soil from the 300 Area Process Trenches has been completed ahead of schedule. Field work began on July 1, and actual excavation began July 31 on the east trench. All the soil to be removed in both the

east and west trenches, has been removed and placed at the end of the trenches where it will be isolated from future discharges. While awaiting final disposition, the contaminated soil stored at the end of the trenches will be covered to prevent erosion and the spread of contaminants.

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Grout for Closure of Waste-Disposal Vaults at the US DOE Hanford Site

CONF-920559; The Use of Fly Ash, Silica Fume, Slag, and Natural Pozzolans in Concrete, Proceedings of the Fourth Annual International Conference, Istanbul, Turkey, May 3-8, 1992; (21 pp.) (1991)

For permanent disposal of radioactive wastes from reprocessing, the U.S. Department of Energy (DOE) has chosen to grout wastes in concrete vaults within a subsurface multiple-barrier system. The subject of this research is the non-radioactive, or "cold cap" grout, which fills the upper 120 cm of these vaults, and provides support for overlying barriers. Because of the heat evolved by the waste form, this void-filling grout must perform at temperatures higher than those of usual large-volume grouting operations. The grout must have: (1) low potential for thermal expansion and heat retention; (2) a low modulus to withstand thermal and mechanical stresses without cracking; (3) strength adequate to support overlying barrier-system components; and (4) minimal potential for shrinkage. In addition, it must be pumpable, self-leveling, and non-segregating. Materials for formulation included a large percentage of Class F fly ash and coarsely ground oil-well cement. Grout development included chemical and physical characterization, and physical and thermal modeling.

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Safe Storage of Deactivated Radiological Chemical Processing Plants in the 200 West Area of the Hanford Site

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 361-366) (September 1991)

Two retired chemical processing plants at the Hanford Site must be maintained in safe storage until decommissioning, scheduled for 2007. Both the S Plant, or Reduction Oxidation Plant (REDOX) facility, and the U Plant facility are nearly 20 years past their initial design life. The current design-life ratings require that the structures and operational equipment at the facilities be carefully monitored under an ongoing surveillance and preventive maintenance program until final decommissioning. The U Plant facility is in the 200 West Area, and was originally constructed in 1944 and 1945 as part of the U-Plant fuel separation facility. It was not used for this purpose but was extensively modified from 1950 to 1952 for uranium metal recovery. The U Plant's main building is the 221-U Canyon Building, approximately 244 meters long. The canyon building has reinforced concrete floors, walls, and roof ranging from about 1 to 3 meters thick. Connected to the 221-U Canyon Building are: (1) the 271-U Building, a four-story office/storage complex; (2) the 276-U Solvent Handling Facility, a 20.1 m by 16.5 m by 2.4 m above-ground concrete basin; (3) the 291-U Exhaust Fan Facility, which maintains the canyon building under negative atmospheric pressure, housing two 60-hp electric, 566 cu m/min blowers; (4) the 291-U sand filter, a 25.9 m by 25.9 m by 3 m filter made of layers of rock and sand that remove radioactive particles from the exhaust ventilation air; and (5) the 291-U process stack, a 61 m-high discharge point for the exhaust air. The S Plant, or REDOX facility, was built in 1950 to 1952 in the 200 West Area south of the U Plant. It was the first large-scale, continuous flow, solvent extraction process plant for the recovery of plutonium from irradiated uranium fuel. The S Plant's main building is the REDOX Canyon Building, or 202-S Building, a reinforced concrete structure 142.6 meters long and 49.1 meters wide with walls typically 1.8 meters thick. Also part of

the S Plant are: (a) the 233-S Plutonium Concentration Facility, directly north of the REDOX Canyon Building, with a 9.7 m tall bay area; (b) the 276-S Solvent Handling Building, west of the REDOX Canyon Building, 13.1 m by 17.7 m; (c) the 291-S Exhaust Fan Facility, housing two 60-hp electric, and one steam-powered, 566 cu m/min blowers; (d) the 291-S sand filter, identical to the 291-U sand filter described above; and (e) the 291-S process stack, 60 m high. Since the deactivation of the U Plant and S Plant facilities in 1967, all identified critical systems have been maintained under an on-going surveillance and maintenance program that includes the building structure, ventilation systems, and instrumentation. Surveillance for off-standard conditions in specific sections of the plants is done in daily to bi-monthly intervals. The Preventative Maintenance System, a non-database recall system, documents and forecasts preventive maintenance required in the operational exhaust systems, inspects the architectural features of the confinement structures, and provides general inspection and lubrication of rotational equipment. The Plant Instrumentation, Calibration, and Evaluation System (PISCES) uses a database to document and forecast plant-installed instrument calibrations and equipment verifications. PISCES is used for calibration of all continuous air monitors, which monitor personnel safety and air effluent discharge; the differential pressure gauges, which measure liquid levels in tanks and sumps; and all operational instrumentation that provides a visual, audio, or control function output. Nonroutine maintenance is identified through surveillance activities and is required when equipment failures occur, or to maintain the integrity of the confinement system. This paper outlines three components of continued safe storage for the deactivated chemical processing plants: (1) nonroutine maintenance on the operational systems of the REDOX and U Plant facilities have greatly improved them and must continue to ensure their operational reliability and durability until final decommissioning; (2) before rebuilding the existing systems, their replacement with more current models must be considered; and (3) the PISCES and Preventive Maintenance recall programs must be continued to maintain the critical operational systems.

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Pacific Northwest Laboratory Annual Report for 1990 to the Assistant Secretary for Environment, Safety, and Health, Part 5: Environment, Safety, Health, and Quality Assurance

PNL-7600 (Pt. 5); 67 pp. (May 1991)

Part 5 of the 1990 Annual Report to the U.S. Department of Energy's Assistant Secretary for Environment, Safety, and Health presents Pacific Northwest Laboratory's progress on work performed for the Office of Environmental Guidance, the Office of Environmental Compliance, the Office of Environmental Audit, the Office of National Environmental Policy Act Project Assistance, the Office of Nuclear Safety, the Office of Safety Compliance, and the Office of Policy and Standards. For each project, as identified by the Field Work Proposal, there is an article describing progress made during fiscal year 1990. Authors of these articles represent a broad spectrum of capabilities derived from five of the seven technical centers of the Laboratory, reflecting the interdisciplinary nature of the work.

CONTAMINATED SITE RESTORATION

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Changes in "Selected Remedy" After Record of Decision

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 795-799) (September 1991)

The U.S. Environmental Protection Agency (EPA) chose the U.S. Department of Energy (DOE) and its prime contractor, Chem-Nuclear Geotech. Inc. (Geotech), to remediate several operable units in the Denver Radium Superfund Site. The Denver Radium Site consists of 41 properties grouped into 11 operable units containing low-level radioactive contamination (radium and uranium) that could endanger public health, welfare, and the environment. This environmental restoration was completed in compliance with applicable environmental laws and the Denver Radium Project was recognized by the EPA as the "Regional Superfund Team of the Year" in 1989 and the "National Superfund Team of the Year" in 1990. This paper examines a case at Operable Unit III of the Denver Radium Site in which new information regarding the location of contamination was discovered after the Record of Decision (ROD) had been signed. This discovery required a significant change to the remedy described in the ROD, which was off-site permanent disposal. The new information prompted the analysis and choice of a "no action" alternative. This decision was justified in terms of the supplemental standards (40 Code of Federal Regulations 192.21), which limit the need for remedial action under streets if such action poses a greater threat to remediation workers than to subsequent utility workers, and if such action is deemed more costly than justified by its benefits. A history of the Denver Radium Site is presented, along with an overview of the methods and processes of risk assessment, remedy selection, cleanup standards, and remedial actions. Results indicate that flexibility in environmental laws does permit changes to the ROD, given reasonable interpretation and application of statutory provisions.

799
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In-Situ Storage: An Approach to Interim Remedial Action - Recent Case Studies in Canada

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 459-464) (September 1991)

The Low-Level Radioactive Waste Management Office (LLRWMO) of Atomic Energy of Canada Limited acts on behalf of the federal government to manage historic low-level radioactive wastes. Recent interim remedial work in the town of Port Hope, Ontario, has included the consolidation of radium- and uranium-contaminated soils into temporary storage facilities on two sites, where the wastes await final disposal elsewhere. Simple containments constructed and sited on already-contaminated sites have been found effective as part of an interim remedial strategy. This paper reviews the experience of the LLRWMO in undertaking the simple containment structures built at the Cavan Street site and the Strachan Street site in Port Hope. The approach has been accepted and supported by the local public. Lessons have been learned in project management, environmental remediation and engineering design.

800
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Public Involvement in Remedial Work Programs at Historic Low-Level Radioactive Waste Sites: Recent Canadian Experience

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the

21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 165-168) (September 1991)

This paper discusses the evolution of the Canadian public environmental screening process. In Canada, the Low-Level Radioactive Waste Management Office (LLRWMO) is required to inform the public about low-level radioactive wastes. One aspect of this involves consulting with the public about remedial work projects carried out by the LLRWMO. The LLRWMO is operated by the Atomic Energy of Canada Limited (AECL) Research through an agreement with the Department of Energy, Mines and Resources (EMR), the federal agency which provides funding and establishes national policy. Historic waste problems are those for which the original producer can no longer reasonably be held responsible and are now the responsibility of the Canadian federal government. This paper describes public involvement with LLRWMO remedial work programs at historic low-level radioactive waste sites: (1) early experiences in Scarborough (Malvern), near Toronto, Ontario; (2) Port Hope, Ontario, on Lake Ontario; (3) Strachan Ravine, in Port Hope; (4) other Port Hope remedial projects; and (5) a new site in the Malvern area of Scarborough. These experiences show that true consultation with the public, combined with a local solution to a local problem, can produce results more satisfactory than those of remediation programs that are limited to informing the public about decisions that have already been made outside the community.

801
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International Similarities and Differences in Regulating Nonradiation Hazards

EPA/520/1-90-013; CONF-8909236; Residual Radioactivity and Recycling Criteria, A.B. Wolbarst, H. Terada, and A.C.B. Richardson (eds.), Proceedings of a Workshop, St. Michaels, MD, September 27-28, 1989, 311 pp.; (pp. 173-178) (September 1989)

This paper relates the style of regulation of nonhazardous waste in different countries to possible residual radiological regulation in those countries. Assessment of cancer risk and other health effects, and of injury or other deleterious consequences of technological hazards, involves intricate interactions between science and policy. These interactions are best understood in terms of a gradual overlay or replacement of traditional administrative approaches to regulation with "scientific" principles and methods, and the emergence of different styles or approaches to regulation in different countries. All regulatory styles involve some mix of consultation, reliance on expertise, self-regulation, and consideration of political context. But variations in the regulations in different countries lead to characterization a of "typical" regulatory styles such as: (1) evidential in the United States; (2) consensual in Sweden and the United Kingdom; (3) authoritative in France and Japan; and (4) corporatist in the Netherlands and West Germany. The persistence of these political and administrative traditions suggests that they will hold true for other areas of regulatory action, including the determination of criteria for residual radioactivity.

802
U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, DC

Superfund Record of Decision (EPA Region 10): Teledyne Wah Chang, Albany, OR (First Remedial Action), December 1989

EPA/ROD/R10-90/021; 60 pp. (December 28, 1989)

The Teledyne Wah Chang (TWC) Site, in Millersburg, Oregon, is an active plant used to produce nonferrous metals and products. The site consists of a 110-acre plant site, which contains the plant's former sludge ponds, and a 115-acre farm site, which contains four active wastewater-sludge ponds. Portions of the TWC site are within the Willamette River's 100- and 500-year flood plain. The Wah Chang Corporation began operating a U.S. Bureau of Mines zirconium metal sponge pilot plant under contract with the U.S. Atomic

Energy Commission in 1956. Additional facilities were subsequently built near the plant, beginning in 1957, to produce nonferrous metals and products. The Lower River solids pond (LRSP) and Schmidt Lake sludge pond, which stored wastewater generated from the plant operations, are being addressed by this remedial action. The sludge in both the LRSP and Schmidt Lake contains heavy metals, organic compounds, and trace levels of radionuclides. The selected remedial action for the site includes excavation of 85,000 cu yds of sludge, with partial solidification of the sludge, followed by off-site disposal in a permitted solid waste landfill.

803

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Contract Management Guide for Air Force Environmental Restoration

AFIT/GCM/DEM/91S-3; 205 pp. (September 1991)

This study was conducted to examine the extent to which written guidance was available to Air Force contracting officers involved in environmental restoration projects. The study examines literature from sources inside and outside the Air Force, classifies it by source, and extracts guidance from the subject matter. The study indicates that written guidance exists, but is fragmented. As a result, contracting officers lack concise guidance on the special considerations in contracting for environmental restoration. Guidance from the literature is summarized and presented in a stand-along guide appended to the report. The guide is targeted toward new and mid-level contracting officers and recommends specific contract management techniques for environmental restoration. In addition, the thesis recommends further study and suggests changes to the contracting guidance in the Federal Acquisition Regulation.

804

R.B. Craig and G.L. Dippo, Martin Marietta Energy Systems, Inc., Oak Ridge, TN

Lessons Learned Implementing Environmental Regulations at Non-Department of Energy Sites

CONF-910603; Proceedings of the 1991 American Nuclear Society Annual Meeting, Orlando, FL, June 2-6, 1991; Transactions of the American Nuclear Society 63:74 (1991)

The Hazardous Waste Remedial Actions Program (HAZWRAP) has been involved in the implementation of environmental regulations at non-Department of Energy (DOE) facilities for more than 5 years. If any common thread has been identified in working at these sites, it is that no two sites can be treated the same. Each site and its associated wastes, governing regulations, and environmental conditions are different. The list of technical lessons learned is long, and their applicability to other sites must be examined for each specific case. That is far too large a task to undertake here. The most important lesson HAZWRAP learned is not technical. Implementing environmental regulations at non-DOE sites is not any different from implementing regulations or anything else done at DOE facilities. The key to success lies in quality, planning, and communication. Taking the time to implement a good quality program based on sound planning and open communication will ensure program success.

805

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Radium and Radon Regulations

CONF-9008109; Environmental Issues and Waste Management in Energy and Minerals Production, T.M. Yegulalp and K. Kim (eds.), Proceedings of the First International Conference, Secaucus, NJ, August 27-29, 1990. Battelle Press, Columbus, OH, 602 pp.; (pp. 185-196) (1992)

This paper presents an overview of regulations governing radium and radon. The evolution of regulations is traced from the beginnings of the first industry to use radium-enlivened paint, the watch industry, through recent regulations requiring the clean up of uranium tailings.

806
E.C. Thayer and L.M. Racioppi

Naturally Occurring Radioactive Materials

CONF-911110; Health, Safety and Environment in Oil and Gas Exploration and Production, Proceedings of the First International Conference, The Hague, Netherlands, November 11-14, 1991. Society of Petroleum Engineers, Richardson, TX, 856 pp.; (pp. 735-742) (1991)

The initial literature on naturally occurring radioactive materials (NORMs) on a low-specific activity scale (LSA) found in upstream petroleum operations focused on where NORMs were found and the radiochemistry of scale formation. This paper builds upon initial efforts and presents detailed procedures that can be used to ensure a safe work environment. Topics of discussion include monitoring equipment, maintenance, decontamination, and trends.

807
U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, DC

Compendium of CERCLA ARARs, Fact Sheets and Directives

CERCLA-005/1091; 254 pp. (October 1991)

Section 121 (d) of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), requires attainment of federal and state applicable and relevant and appropriate requirements (ARARs). Subpart E, Section 300.400(g), "Identification of applicable or relevant and appropriate requirements" of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (55 CFR 8666, March 8, 1990) describes the process for attaining ARARs. The purpose of this compendium is to provide a complete and current source of "Quick Reference Fact Sheets" and Directives on ARARs. These fact sheets provide overviews of the ARARs for CERCLA cleanup actions.

808
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Geophysics: Building E5032 Decommissioning, Aberdeen Proving Ground - Interim Progress Report

ANL/ESD/TM-20; 144 pp. (July 1991)

Integration of data from surveys using three geophysical technologies has provided information used to define the locations of buried utilities, tanks, vaults, and debris near building E5032 at the Aberdeen Proving Ground. Ground penetrating radar (GPR) profiles indicate the presence of buried pipes, tanks, reinforcement rods (rebar), and remnants of railroad tracks. A magnetic map constructed from a detailed magnetic survey on the north side of the building outlines buried iron-rich objects that are interpreted to be iron pipes, tank, and other debris of uncertain origin at relatively shallow depths. Horizontal electrical resistivity surveys and vertical electrical resistivity soundings essentially corroborated the findings obtained with the magnetometer and GPR. In addition, a highly resistant layer was observed on the east side of the building, where a former railroad bed with a thick grave fill is believed to immediately underlie the lawn. The resistivity data show no evidence of a conductive leachate plume. Geophysical measurements from three techniques over a buried concrete slab approximately 130 ft north of Building E5032 give geophysical signatures interpreted to be due to the presence of a large iron tank or vault. An attempt was made to gather meaningful magnetic data on the east, west, and south sides of the building; however, the quality of subsurface interpretations in those areas was poor because of the influence of surficial iron lids, pipes, grates, and the effects of the corrugated iron building itself.

809
U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, DC

Superfund Record of Decision (EPA Region 2): Montclair/West Orange Radium Site,

Essex County, NJ (Second Remedial Action), June 1990 - Final Report

PB-91-921431/XAB; EPA/ROD/R02-90/126; 61 pp. (June 1, 1990)

The 120-acre Montclair/West Orange Radium Site is comprised of 239 residential properties in the town of Montclair and 127 residential properties in the town of West Orange, Essex County, NJ. The site is located in proximity to the Glen Ridge Radium Superfund Site. In the early 1900s, a radium processing or utilization facility was located near the site. It is suspected that radioactive waste material from the facility was disposed of in then-rural areas within the community. Environmental Protection Agency (EPA) investigations in 1981 and 1983 confirmed the presence of gamma radiation contamination in the Glen Ridge area and in several adjacent houses. Subsequently, EPA established an air quality monitoring program to determine the levels of radon decay products in the contaminated houses. The ROD also addresses contaminated on-site soil, and is a final source control remedy. The primary contaminants of concern affecting the soil are radioactive materials, especially radium-2, and metals including lead.

810

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Remedial Investigation Concept Plan for Picatinny Arsenal - Volume 1: Environmental Setting, Applicable Regulations, Summaries of Site Sampling Plans, Sampling Priorities, and Supporting Appendixes

ANL/EAIS/TM-40; CETHA-IR-CR-91018; 294 pp. (March 22, 1991)

A Remedial Investigation (RI) Concept Plan for Picatinny Arsenal in New Jersey has been planned. Based on types of activity and location, the 156 RI sites identified during the study are grouped into 16 areas. The plan assesses the environmental impact and identifies additional data needed for each RI site in each area. The plan was developed to comply with state and federal hazardous waste and water quality regulations. The plan also provides a ranking of the 16 areas according to their potential for impacts on public health and the environment. Volume 1 describes the environmental setting of Picatinny Arsenal, discusses applicable federal and state environmental regulations, briefly describes the areas and the sites within each area, provides a ranking of the areas, summarizes the proposed RI sampling plan for each site in each area, and gives supplementary information. Description of the study area includes: location and geography, climate, soils and geology, hydrology and arsenal activities. Chemicals and radioactive materials used at this facility are listed.

811

D.I. Ehreth and J.W. Davis, Versar, Inc., Springfield, VA; Versar, Inc., Grand Junction, CO

Case Study of a Mixed Waste Site - RI/FS

CONF-910697; HazMat '91 International, Proceedings of the Ninth Annual International Hazardous Materials Management Conference, Atlantic City, NJ, June 12-14, 1991. Tower Conference Management Company, Wheaton, IL, 1135 pp.; (pp. 724-746) (1991)

A complex, industrial chemical-processing site and adjacent commercial and residential vicinity properties contaminated with radionuclides, hazardous nuclides, and organic compounds was the subject of a Remedial Investigation/Feasibility Study (RI/FS) by Versar, Inc. The site is a National Priorities Listed (NPL) CERCLA operable unit, with RI/FS funding provided by the U.S. Environmental Protection Agency (EPA) through a state-lead agency. Over the past eighty years, the site has been occupied by a number of companies engaged in the processing of radium, uranium, molybdenum, and rhenium. These prior processing activities have resulted in significant contamination of air, water, and soil on the site and in the vicinity. This paper reports on the findings of the remedial investigation, and goals of the study.

812
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Radiological Dose Assessments in the Northern Marshall Islands (1989-1991)

BNL-45868 (Rev. 12/91); CONF-920501; Proceedings of the Eighth International Radiation Protection Association Conference, Montreal, Quebec, Canada, May 17-22, 1992; (4 pp.) (December 1991)

The Republic of the Marshall Islands (RMI) is located in the central Pacific Ocean about 3500 km southeast of Hawaii and 4500 km east of Manila, Philippines. It consists of 34 atolls and 2 coral islands, having a total land area of about 180 square km, distributed over more than 2.5 times 10(E+6) sq km of ocean. Between 1946 and 1958, the United States conducted nuclear tests in the RMI: 43 at Enewetak and 23 at Bikini. Thirty-three years after the cessation of nuclear testing in the RMI, the impact of these operations on the health and radiological safety of the people living in or planning to return to their contaminated homelands is still an important concern. The present Brookhaven National Laboratory (BNL) Marshall Islands Radiological Safety Program (MIRSP) began in 1987, with funding from the U.S. Department of Energy (DOE). The objectives of the MIRSP are to determine the radionuclides present in the bodies of those people who were potentially exposed to residual radionuclides from weapon tests and fallout, and to assess their present and lifetime doses from external and internal sources. Field bioassay missions involving whole-body counting (WBC) and urine sample collection therefore have been important components of the MIRSP. WBC is used to measure gamma-emitters, such as K-40, Co-60, and Cs-137, that are present in individuals. Urine samples are used to measure alpha- and beta-emitting nuclides, such as Pu-239 and Sr-90, that are undetectable by routine WBC methods.

813
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Health Assessment for West Lake Landfill, Bridgeton, St. Louis County, Missouri, Region 7

Report; 27 pp. (October 4, 1991)

The West Lake Landfill, located in the city of Bridgeton, St. Louis County, Missouri, was proposed for the National Priorities List in October 1989. Soil contaminated with radioactive waste from decontamination efforts at the Cotter Corporation's Latty Avenue plant in Hazelwood, Missouri, was dumped at the landfill in 1973. The radioactive soil was used as cover over refuse and in later years the radioactive soil itself was covered with additional soil and debris. The area around the landfill consists mostly of industrial buildings and business offices with small residential communities to the south and east. Agricultural river-bottom land borders to the west, but it is fast being encroached upon by Earth City, which is being developed for commercial purposes. The site presents no apparent public health hazard because the available data indicate human health is not currently being affected. Exposures of concern could occur if ground water contamination increases and spreads, exposed radioactive materials on the northwestern edges of the landfill move off site, or on-site worker exposure increases. Continued monitoring is recommended until additional environmental data is available to assess the on-site and off-site contamination and help predict future activity.

814
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Implications of the Upper Bound and Average Exposure Scenario on Risk Management Decisions for Contaminated Site Remediation

CONF-910659; Proceedings of the 84th Annual Air and Waste Management Association Meeting and Exhibition, Vancouver, British Columbia, Canada, June 16-21, 1991; (p. 256) (1991)

Incorporating the average exposure to a risk assessment will allow a range of estimates, average

to upper bound, to represent the upper limits of the health risk. This practice can provide an improved characterization of risk information and allow risk managers to more effectively assess risk reduction methods where other balancing factors (e.g., costs) must also be considered. This practice, considered together with an improved understanding of biological plausibility factors, is necessary to ensure that practical and effective risk reduction measures are achieved. The approach described here offers risk managers greater opportunities to more fully utilize their knowledge and responsibilities toward the goal of reducing the overall health risks arising from contaminated sites.

815

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Overview of Kesterson Reservoir Selenium Remediation Project

LBL-29700; (pp. 9-11) (June 1991)

The continued presence of a large inventory of selenium within the upper portions of unfilled areas of Kesterson Reservoir and immediately below the fill material requires a continued awareness of the status of this inventory. Major topics of these investigations include the following: (1) chemical evolution of the inventory of selenium residing in Kesterson soils, including physical redistribution within the soil profile, biological and geochemical transformation from immobile to mobile forms, and transformation to volatile forms; (2) transport of selenium from soils to surface-water pools formed by ponding of rainwater on Kesterson soils; (3) processes and rates of processes leading to dissipation of the surficial inventory of selenium through microbial volatilization; (4) feasibility of land disposal of seleniferous San Luis Drain sediments, including evaluation of potential application rates, transport to groundwater, and biological uptake in grasses and shrubs; and (5) reservoir-wide assessment of total selenium concentration and the fraction of this inventory that is soluble. The current status of these investigations and implications for management of the former Kesterson Reservoir are summarized below.

816

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Sorters for Soil Cleanup

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 531-532) (September 1991)

A soil sorter is a system with conveyor belts, radiation detectors, and a gate. The system activates the gate based on radiation measurements to sort soil to either clean or contaminated paths. Automatic soil sorters have been perfected for use in the cleanup of plutonium contaminated soils at Johnston Atoll (JA). Contaminated soils are directed through a plant which uses mining and milling techniques to concentrate the plutonium into a small volume for waste disposal. Sorters at various locations in the plant effectively minimize the volume of soil for cleanup, and aid in assuring that clean soil meets guidelines. The design of the soil sorter at JA is described. Such sorters, made with precision hardware, microprocessors, adequate programming, and sensitive gamma detectors, can provide more thorough sampling than the most comprehensive site survey. The cost of excavating and processing soil through a sorter may be less than the cost of site characterization. Based on the cost economy and performance of automated soil sorting demonstrated at JA, soil sorting should be useful for other radiological cleanups.

817

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An Improved Method for Remediation of Transuranic-Contaminated Coral Soil at Johnston Atoll

Report; 6 pp. (1992)

An improved approach for removing mixed plutonium and americium contamination from coral soil matrix at the Defense Nuclear Agency's (DNA's) Johnston Atoll Site in the mid-Pacific has been developed by DNA's contractor, TMA/Eberline. The system uses arrays of sensitive radiation detectors coupled with sophisticated computer software newly designed by Eberline Instrument Corporation. The software controls a unique segmented gate methodology for removing contaminated soil from a moving feed supply on conveyor belts. Contaminated soil is diverted to either a metal drum for collecting larger size "hot" particles (greater than 5000 Bq), or to a soil-washing process designed to remove dispersed low-level contamination from a soil fraction consisting of very small particles. Low to intermediate levels of contamination are removed from soil to meet DNA's criteria for release for unrestricted use, based on U.S. Environmental Protection Agency guidelines.

818

K.S. Moroney, TMA/Eberline, Albuquerque, NM

Quality Assurance Applications for Remediation of Plutonium Contaminated Soil

Report; 9 pp. (1992)

This paper describes quality assurance (QA) applications for an environmental cleanup of coral soil matrix contaminated with low levels of transuranic elements, mainly plutonium and americium. The cleanup is being conducted by TMA/Eberline, as prime contractor to the Defense Nuclear Agency, on Johnston Atoll in the mid-Pacific. Radioactive material is sorted from uncontaminated coral using a unique system of segmented gates. After decontamination, clean soil will be released for unrestricted use elsewhere on the island. Waste concentrates containing low levels of radioactive material will require eventual certification for disposal at an approved defense-waste disposal site in accordance with established Waste Acceptance Criteria (WAC). The U.S. Department of Energy's WAC for the Nevada Test Site (NVO-325) was used as an example. Project QA requirements are specified in a QA Plan based on NQA-1. The QA plan is supported by approved standard operating procedures incorporating numerous QA elements.

819

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Major Remediation

CONF-9007232; Hazardous and Industrial Wastes, J.P. Moore, S.C. Cheng, and M.A. Susavidge (eds.), Proceedings of the 22nd Annual Mid-Atlantic Industrial Waste Conference, Philadelphia, PA, July 24-27, 1990. Technomic Publishing Company, Lancaster, PA, 800 pp.; (pp. 303-320) (1990)

This paper reports on a pre-transfer property investigation at an industrial facility in which significant trichloroethylene (TCE) contamination was detected in the subsurface. Further investigation detected a free-product TCE perched on a silt layer within the shallow overburden aquifer. Additional investigation indicated that the thickness of this free-product layer was as great as 6 feet. The quantity of free-product TCE perched on the silt layer has been estimated at several thousand gallons. The state regulatory agency was notified about the situation. Additional groundwater monitoring wells were placed into all three aquifer systems (shallow overburden, confined overburden, and bedrock). Data for these wells, including pumping tests, were used to better characterize the hydrogeology. Groundwater analysis from all three aquifers indicated TCE concentrations exceeding 10 mg/l. After review of the pumping test data and the ground water and soil laboratory analyses, a preliminary treatment design was prepared and submitted to the regulatory agency. Regulatory approval was received for the installation of a treatment system to remediate the on-site contamination. The system includes groundwater extraction from the bedrock, shallow overburden, and confined overburden wells using pneumatic and electrical pumps.

820

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Characterization of Waste Products Prepared from Radioactive Contaminated Clayey Soil Cemented According to the GEODUR Process

RISO-M-2909; 44 pp. (November 1990)

Soil may be radioactively contaminated due to accidents or during decommissioning of nuclear installations. Ordinary surface soil typically cannot be conditioned using conventional cementation processes because the content of humic materials retards or prevents solidification. An additive available from the Danish firm Geodur A/S makes it possible to circumvent this difficulty and to produce a monolithic, nondusting waste type using relatively small amounts of cement. This report describes work on characterization of such a cemented waste product used with clayey top soil from the Risoe area. The claimed advantages of the process were verified, and data for the compression strength (low), hydraulic conductivity (satisfactory) and other pore structure-related properties are given for the obtained products. The behavior of cesium and strontium, representing two of the most relevant radionuclides, was not promising. Greatly improved cesium retention after drying of the materials was noticed. Good retention of strontium is obtained only after reaction of the material with atmospheric carbon dioxide.

821

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Dioxin Destruction on a Small Scale - A Success Story

CONF-9010166; Waste Management and Environmental Restoration, Proceedings of the 1990 DOE Model Conference, Oak Ridge, TN, October 29-November 2, 1990, 343 pp.; (18 pp.) (1990)

Reported here is a case study of a successful small-scale remediation of 1138 drums containing dioxin-contaminated materials at Fort A.P. Hill, a job site that was scrutinized closely because it had previously been publicized as a dioxin site in local, state, and national media. All site procedures were extensively researched to satisfy the review of the U.S. Environmental Protection Agency (EPA), the U.S. Army Toxic and Hazardous Materials Agency (USATHAMA), the U.S. Army Environmental Hygiene Agency (USAEHA), the Commonwealth of Virginia, interested individuals, and public participation groups. The remediation was performed according to an engineering and design report prepared and approved prior to the commencement of field work. The design report described and detailed the plans, equipment, procedures, rationale, and methodology for each activity performed on-site during the remediation. The design report evaluated the proven effectiveness of a mobile rotary-kiln incinerator and detailed the performance criteria for the incinerator, the required sampling and analysis, health and safety considerations and the overall implementation of the thermal treatment of dioxin-contaminated materials. The remediation of more than 190 tons of dioxin-contaminated material was accomplished successfully despite the numerous obstacles encountered. On-site adjustments were required to effectively and efficiently, complete the remediation in full compliance with regulatory and policy requirements. This presentation describes how appropriate treatment technologies were combined with effective site management, engineering expertise, and advance planning strategies to safely remediate successfully a dioxin-contaminated site.

822

Department of Primary Industries and Energy, Safety Review Committee, Canberra, Australia

Management of Radioactive Waste at Lucas Heights Research Laboratories

Book; 26 pp. (August 28, 1991)

A report on the management of radioactive wastes at the Australian Nuclear Science and Technology Organization, Lucas Heights Laboratories, has found that the organization's waste management practices are sound, and present minimal risk to the public. The report was prepared by the independent Safety Review Committee for the Minister for Science and Technology, following representations from the nearby Sutherland Shire

Council. It concluded that risks associated with managing waste at Lucas Heights were substantially lower than those commonly accepted by members of the public for a wide range of activities. It found that the presence of the wastes did not present a major constraint on long term land use in the surrounding area, and that there was no risk of radioactive contamination of nearby beaches, rivers or water supplies. However, it recommended that a more effective long-term method be developed to deal with medium-level liquid wastes, such as solidification of the waste.

823
Canadian Council of Ministers of the Environment, Winnipeg, Manitoba, Canada

National Contaminated Sites Remediation Program: Annual Report 1990-91

SSC-CCME-EPC/CS14; 12 pp. (1991)

In October 1989, the Council initiated a plan of action to deal with high-risk contaminated sites by establishing the National Contaminated Sites Remediation Program. This report presents the following: (1) results from the first year, including bilateral agreements established, (2) a description of 10 sites at which remediation or technology demonstration activities have been initiated, (3) the development of a national site classification system and national environmental quality criteria, (4) funding, and (5) future activities.

824
Canadian Council of Ministers of the Environment, Winnipeg, Manitoba, Canada

The National Contaminated Sites Remediation Program

CCME-EPC/C514; 6 pp. (1991)

This report summarizes the first year of the Canadian National Contaminated Sites Remediation Program, a program of remedial action at sites contaminated with hazardous materials that is parallel to the Superfund in the United States. The program depends on a bilateral agreement between the individual province or territory and the federal government. Technology development and demonstration are two of the primary goals of the program. The program is seeking a national approach to deal with contaminated sites in Canada through the development of a National Site Classification System and a National Environmental Quality Criteria.

825
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Handling Low-Level Waste

Ascent 8(4):16-19 (Winter 1990)

Work at AECL on management of low-level waste is featured. A few details of the IRUS, which is being developed at Chalk River Laboratories, are provided. The cleanup of contaminated soil and sediment at Port Hope is also considered.

826
J. Sims, WasteChem Limited, Bramhall, United Kingdom

WasteChem Cleans Up in Europe

Nuclear Engineering International 36(441):37-38 (April 1991)

Details are given of WasteChem's work in Germany and in the United Kingdom related to cleaning of radioactively contaminated buildings. WasteChem recently completed a project in Hanau, Germany, in which a tritium laboratory was decommissioned. In the United Kingdom, WasteChem has recently completed a project which entailed clearing radioactive contamination from a building and surrounding land. The contamination involved was Ra-226 from past instrument luminizing operations.

827
T. Baca, U.S. Department of Defense, Deputy Assistant Secretary of Defense (Environment), Washington, DC

Defense Environmental Restoration Program Annual Report to Congress for Fiscal Year 1991

Report; 250 pp. (February 1992)

The primary focus of the Defense Environmental Restoration Program (DERP) continued to be the investigation and cleanup of contaminated Department of Defense (DOD) sites and formerly used properties. To this end, over 94 percent of the funds authorized by Congress for DERP in Fiscal Year 1991 were used for Installation Restoration Program (IRP) efforts. During this past year, DOD has established a long-term goal for completing IRP work, and has focused considerable efforts on moving sites quickly from the study phase to remediation. DOD has established a cleanup goal to initiate remedial actions at all sites where they are needed by the year 2000. DOD continues to pursue vigorous research and development and hazardous waste minimization programs aimed at fostering quicker, more cost-effective remedial solutions and reducing the amount of the waste generated at DOD installations. These waste-minimization efforts will reduce DOD's potential for generating new hazardous waste sites.

828
V. Houseman, Science Applications International Corporation, Falls Church, VA

Mining Sites on the National Priorities List: NPL Site Summary Reports - Volume 5 (Teledyne Wah Chang to Wayne Interim Storage Facility/W.R. Grace)

EPA/530/SW-91/065E; 615 pp. (June 21, 1991)

Volume 5 of the Mining Sites on the National Priorities List (NPL) contains the following NPL site summary reports: Teledyne Wah Chang, Tex-Tin Corporation, Torch Lake, United Nuclear Corporation/Churchrock Site, U.S. Tatanium, Uravan Uranium Mill, Whitewood Creek, and Wayne Interim Storage Facility/W.R. Grace.

829
V. Houseman, Science Applications International Corporation, Falls Church, VA

Mining Sites on the National Priorities List: NPL Site Summary Reports - Volume 4 (Oronogo-Duenweg Mining Belt to Tar Creek)

EPA/530/SW-91/065D; 974 pp. (June 21, 1991)

Volume 4 of the Mining Sites on the National Priorities List (NPL) contains the following NPL site summary reports: Oronogo-Deunweg Mining Belt, Palmerton Zinc, Sharon Steel/Midvale Tailings, Silver Bow Creek/Butte Area Site, Silver Mountain Mine, Smuggler Mountain, St. Louis Airport/Hazelwood Interim/Futura Coatings, Sulphur Bank Mercury Mine, and Tar Creek.

830
V. Houseman, Science Applications International Corporation, Falls Church, VA

Mining Sites on the National Priorities List: NPL Site Summary Reports - Volume 3 (Kerr-McGee Chemical Corporation/Soda Springs Plant to Ormet Corporation)

EPA/530/SW-91/065C; 907 pp. (June 21, 1991)

Volume 3 of the Mining Sites on the National Priorities List (NPL) contains the following NPL site summary reports: Kerr-McGee Chemical Corporation (Soda Springs Plant), Lincoln Park, Martin Marietta Reduction Facility, Midvale Slag (Valley Materials Slag), Milltown Reservoir Sediments, Monsanto Chemical Company, Monticello Mill Site, Monticello Vicinity Properties, Mouat Industries, and Ormet Corporation.

831
V. Houseman, Science Applications International Corporation, Falls Church, VA

Mining Sites on the National Priorities List: NPL Site Summary Reports - Volume 2 (Commencement Bay Nearshore/Tideflats to Kerr McGee, Kress Creek, Reed-Keppler Park, Residential Areas, Sewage Treatment Plant)

EPA/530/SW-91/065B; 850 pp. (June 21, 1991)

Volume 2 of the Mining Sites on the National Priorities List (NPL) contains the following NPL

site summary reports: Commencement Bay Nearshore/Tideflats, Denver Radium, Eagle Mine East Helena Smelter, Eastern Michaud Flats Contamination Area, Glen Ridge/Montclair/West Orange/US Radium, Homestake Mill, Iron Mountain Mine, Johns-Manville Coalinga Asbestos Mill, Kerr-McGee (Kress Creek, Reed-Keppler Park, Residential Areas, Sewage Treatment Plant).

832
E.F. Millano and R.O. Ball, Environmental Resources Management, Inc., Deerfield, IL

Storage, Disposal, Remediation, and Closure

Research Journal of the Water Pollution Control Federation 62(4):524-537 (June 1990)

A literature review is presented to provide up-to-date information on all aspects of the storage, disposal, and remediation of hazardous wastes. Issues discussed include the following: (1) design and siting of new sites; (2) sampling, monitoring, and evaluation of sites; (3) fate and migration of compounds; (4) environmental regulations; (4) cleanup limits; (5) cost estimates; (6) demonstration of technologies; and (7) selection and application of remedial actions.

833
National Technical Information Service, Springfield, VA

Department of Defense Installation Restoration Program: Remedial Action on Waste-Disposal Sites - Report for January 1984-October 1989

PB-91-800821/XAB; 54 pp. (August 1991)

The bibliography contains citations concerning the Department of Defense Installation Restoration Program for remedial action on Department of Energy waste-disposal sites. The program identifies past Department of Defense waste-disposal sites and proposes plans to eliminate associated hazards to public health and the environment. Identification of defense installations, waste-disposal sites, confirmation (through environmental surveys) of environmental contamination or hazard, recommendations regarding remedial actions, and research into remedial technology and hazardous waste toxicology are discussed. Most sites discussed are currently at the point of confirmation of contamination. Superfund Records of Decision reports on civilian sites are referenced in a related publication.

834
National Technical Information Service, Springfield, VA

Abandoned Sites: January 1988-February 1992 - Citations from the NTIS Data Base

PB-92-802461/XAB; 54 pp. (January 1992)

This bibliography contains citations concerning the identification, assessment, and decontamination of foreign and domestic sites of pollution. Topics include hazardous materials, mill tailings, radioactive wastes, regulations, remedial action, and pollution.

835
St. Michael's Workshop on Residual Radioactivity and Recycling Criteria - Summary and Panel Discussion

EPA/520/1-90-013; CONF-8909236; Residual Radioactivity and Recycling Criteria, A.B. Wolbarst, H. Terada, and A.C.B. Richardson (eds.), Proceedings of a Workshop, St. Michaels, MD, September 27-28, 1989, 311 pp.; (pp. 293-305) (September 1989)

This transcript of a tape-recorded discussion briefly summarizes the papers presented at the St. Michaels Workshop on Residual Radioactivity and Recycling Criteria, and includes questions and comments from participants. Anthony B. Wolbarst moderates the discussion. Rob Coppock, author of "Improving Risk Communication," speaks first and emphasizes that good communication skills must accompany technical competence if an agency is to ensure protection and instill public confidence. Next, the chairmen of each session of the conference summarize and comment on the papers presented. Andrew Wallo, chair of the session on

"Impacts of Cleanup Technologies and Economics on Criteria," describes the six papers presented in the session. Topics covered include limits and methods of cleanup technologies, measuring residual radiation, release criteria for low-level radioactive waste, waste volume reduction, waste disposal capacity, and cost impacts of various decontamination methods and standards. Wallo emphasizes the importance of a complete site characterization before cleanup and thorough documentation of cleanup procedures and measurement methods used to certify compliance with standards. Donald A. Cool, chair of the "Health Effects" session, reviews three papers dealing with radiation risks and health prediction, radiation doses during decontamination and reuse of a nuclear facility, and radiation exposure models. Cool points out the comparative advantages and disadvantages of site-specific and generic models. Allan C.B. Richardson, chair of the "Desirable Characteristics for Criteria" session, summarizes 12 papers concerning topics such as regulatory decision making; radiation protection; dose limits; concentration, quantity, and surface contamination limits; radionuclide categories; and the concepts of "below regulatory concern (BRC)" and "exemption levels." Masao Oshino, chair of the session on "Recycling of Materials and Equipment," mentions recycling experiences at the Japan Power Demonstration Reactor, effects of residual radioactivity in recycled materials, and the attempt by the International Atomic Energy Agency (IAEA) to develop exemption principles and limits for recycling and reuse of extremely low level radioactive waste materials. Some of the issues discussed during the question and comment session are: (1) the need for an individual dose limit for residual radioactivity; (2) the development of generic and site-specific criteria for unconditional release for reuse/recycling; (3) the possibility that BRC levels developed for low-level waste may be too restrictive for decontamination and decommissioning projects; (4) problems associated with choosing a generally accepted exposure model; (5) concerns about setting and communicating BRC limits in a way acceptable to the public; and (6) the problem of "grandfathering," or the possibility that if stringent limits are set, many previously remediated sites will require further cleanup.

836
B.M. Thomson, University of New Mexico, Albuquerque, NM

Radioactive Wastes

Research Journal of the Water Pollution Control Federation 62(4):519-524 (June 1990)

A literature review on all aspects of radioactive wastes is presented in order to provide up-to-date information on administrative, legal, regulatory, and technical aspects of handling, transportation, and disposal of radioactive wastes. Topics of discussion include the following: (1) waste repositories; (2) waste processing and decommissioning; (3) environmental occurrence and transport of radionuclides; and (4) remedial actions and treatment.

837
T.M. Yegulalp and K. Kim, Columbia University, Henry Krumb School of Mines, New York, NY

Environmental Issues and Waste Management in Energy and Minerals Production

CONF-9008109; Proceedings of the First International Conference, Secaucus, NJ, August 27-29, 1990. Battelle Press, Columbus, OH, 602 pp. (1992)

This book includes the following topics: (1) water management in the minerals industry; (2) management of radioactive wastes in the energy industry; (3) the U.S. high-level radioactive waste program; (4) acid mine drainage; (5) health risks from uranium mill tailings; (6) alternate energy sources, such as hydrogen; (7) superconductive magnetic energy storage; and (8) nuclear waste.

REMEDIATION OF CONTAMINATED SOIL AND GROUNDWATER

838
W. Isherwood, D. Rice Jr., J. Ziagos, and E. Nichols, Lawrence Livermore National Laboratory, Livermore, CA

"Smart" Pump and Treat

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 559-566) (September 1991)

Lawrence Livermore National Laboratory (LLNL) is approaching the final phase of the Superfund decision-making process for site restoration and will soon initiate full-scale cleanup. Despite some well-publicized failings of the pump and treat approach, the decision was made that intelligent application of this strategy is the best choice for groundwater restoration at LLNL. The proposed approach is sufficiently different from traditional pump and treat methods that it can be called "smart" pump and treat. Smart pump and treat consists of four distinct, but interrelated, elements: three preremediation strategies and one modification to pump and treat itself. Together, these techniques are an integrated program that utilizes an understanding of crucial aspects of contaminant flow and transport to speed up the remediation of contaminated aquifers. The four elements are: (1) a spatially detailed site characterization, linked with regional hydrogeologic models, and taking into account hydraulic conductivity, degradation, and sorption measurements; (2) directed extraction, where the extraction and recharge locations are controlled by field-determined hydrogeologic parameters; (3) field-validated modelling that matches the complexity of the collected data; and (4) adaptive pumping, which optimizes ground water extraction by varying pumping patterns over both time and space to reduce the effects of stagnation and interference zones. Together, these techniques minimize the cost and time to reach cleanup goals required by regulations, and maximize the rate of contaminant removal.

839
D.B. Blowes, Lawrence Livermore National Laboratory, Livermore, CA

Application of Monte Carlo Simulation to Estimate Probabilities for the Best and Health Conservative Estimates of Receptor Well Concentrations

UCRL-CR-107493; 80 pp. (August 1989)

This report presents a Monte Carlo Simulation analysis of the fate and transport of contaminants in groundwater at the Lawrence Livermore National Laboratory, Livermore Site. The result of this analysis is the cumulative distribution function (CDF) of the maximum 70-year average and peak concentrations of the four chemicals of concern (TCE, PCE, chloroform, and other volatile organic compounds) at the near-field wells and at three far-field wells. These concentration CDFs can be used to estimate the probability of occurrence of the concentrations that were previously predicted using the deterministic model, and to conduct an enhanced exposure-and-risk assessment for the Remedial Investigation and Feasibility Study (RI/FS). This report provides a description of the deterministic fate and transport model (PLUME), which was linked to the Monte Carlo Shell to estimate the CDF of the receptor-well chemical concentrations.

840
S.R. Cater, K.G. Bircher, and R.D Stevens, Environment Canada, Wastewater Technology Centre, Burlington, Ontario, Canada

Rayox: A Second Generation Enhanced Oxidation Process for Groundwater Remediation

EC/WTC-CE03685; CONF-9006374; Advanced Oxidation Processes for the Treatment of Contaminated Water and Air, Proceedings of a Symposium, Toronto, Ontario, Canada, June 4-5, 1990; (pp. 1-21) (1990)

The use of enhanced oxidation (ENOX) processes to clean up contaminated groundwater and industrial process wastewater streams is becoming increasingly common. Enhanced oxidation offers considerable advantages over traditional treatment approaches such as air stripping, activated carbon, or reverse osmosis, which do not destroy the pollutants but merely transfer them to another

media. Enhanced oxidation results in the destruction of waterborne contaminants in a cost-effective manner with no secondary disposal requirements. The Rayox system comprises one or more vertical cylindrical reactors containing a Solarchem propriety, high-power ultraviolet lamp, a quartz sleeve, a transmittance controller to prevent the sleeve from fouling, and a stainless steel outer wall. Provision is made for the injection of ozone, hydrogen peroxide, or proprietary, rate-enhancing ENOX additives. Solarchem has carried out several laboratory and on-site treatments of contaminated ground water in both Canada and the United States. Flowthrough test rates range from 20 L/minute to 200 L/minute. The system reduced concentrations of phenols, volatile organic compounds, polychlorinated biphenyls, trichloroethylenes and trichlorobenzenes to below detectable limits (less than 1 part per billion). Groundwater contaminated with refractory compounds, including up to 25 parts per million of dichloroethane (DCE), was successfully treated, with the DCE destroyed to discharge levels of less than 25 parts per billion, or 99.9% destruction.

841

H. Mauberu, E. Schulte, and A. Jouve, Commissariat a l'Energie Atomique, Centre d'Etudes Nucleaires de Cadarache, Saint-Paul-lez-Durance, France

RESSAC: Rehabilitation of Soils and Surfaces after an Accident - A European Research Program for Remediation of Radioactive Contamination

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 713-716) (September 1991)

Although France has taken every precaution during the design, construction and operation of nuclear reactors, there still exist the possibility of accidents that result in a considerable discharge of radioactive material into the atmosphere. Therefore, it is necessary to create emergency plans to protect the population against the effects of such discharges. In Europe, emergency plans are already operational for the accident phase and the period immediately following a nuclear accident. These is an on-site emergency plan for each nuclear facility, directed by the plant manager, and an off-site emergency plan for the vicinity around each plant, directed by a representative of the local government. In France, the authorities have also drawn up a post-accident action plan for a longer period after an accident. The post-accident plan will facilitate a return to normal living conditions in the affected areas. Actions taken under the post-accident plan will (1) reduce external exposure to deposits of radionuclides and (2) reduce internal exposure from the ingestion of contaminated products. In keeping with these post-accident plan goals, the program for rehabilitation of soils and surfaces after an accident (RESSAC), begun in 1985, collects technical data about radionuclide migration and kinetics, and defines methods of reducing internal and external exposures. RESSAC is supported at the French national level by the Institute of Nuclear Protection and Safety (IPSN), which provides most of its funding. At the international level, it is one of the principal radioprotection programs of the Commission of the European Communities. Countries involved in the RESSAC program include France, Belgium, Italy, Spain, Great Britain, and Germany. A collaboration with former Soviet organizations is under way, and research is being done in the Chernobyl and Kyshtym-Cheliabinsk areas. This paper presents cleanup techniques that were developed through the RESSAC program for the remediation of various contaminants. These techniques include: (a) top soil removal, (b) soil and surface treatment with polyurethane foams and strippable paints, (c) decontaminating vegetal networks, (d) soil stabilization with gels of organic polymers, and (e) the biological degradation of radioactive organic wastes.

842

L.G. Urlings, C.M. Tauw, H.B. Vree, and R.J. Van Der Galien, INFR Consut BV, Deventer, Netherlands

Application of Biotechnology in Soil Remediation

Proceedings of the 1990 ENVIROTECH Symposium, Vienna, Austria, September 20-25,

1990. International Society for Environmental Protection, Vienna, Austria; (pp. 238-251) (1990)

In evaluating approaches to soil remediation, both financial and technical feasibility must be assessed. In this context, biotechnology offers cost-effective treatment technologies for certain applications, and it has been analyzed for wider use in the Netherlands. Its application is limited by the small bioavailability of the contaminant and lack of oxygen. Its applicability to groundwater treatment appears to be good.

843

J.D. Miller, J. Hupka, and J.R. Weidner, EG&G Idaho, Inc., Idaho Falls, ID

Particle Characterization of Contaminated Soil

EGG-WTD-9736; 36 pp. (May 1991)

Samples collected from Test Reactor Area Warm Waste Pond sediments at the Idaho National Engineering Laboratory were characterized in the test facilities in the Metallurgy Department, University of Utah. The sediments were characterized in terms of several physical, chemical, and mineralogical properties that were judged to be most important for separating radioactive materials and hazardous metals from the sediment matrix. The properties include particle size, distribution, effects of heating at 600 deg C, electrophoretic properties, magnetic separation, acid leaching, and analyses using ultra-violet light, infra-red, and x-ray diffraction. The results show that most radioactive and hazardous metals are present in the less-than-150-micron size fraction and that 80% of the sediments occur in the greater-than-150-micron size fraction. No significant concentration of hazardous metals was found to be related to magnetic properties. Organic matter, probably as a thin film, was shown to be present. The mineralogy of the samples include quartz, chlorite, kaolinite, illite, calcite, and dolomite.

844

G. Powell, L.M. Smith, and M. Frank, U.S. Environmental Protection Agency, Atlanta, GA; Roy F. Weston, Inc., Louisville, KY

Groundwater Recovery and Treatment as a Superfund Remedial Action

CONF-9007232; Hazardous and Industrial Wastes, J.P. Moore, S.C. Cheng, and M.A. Susavidge (eds.), Proceedings of the 22nd Annual Mid-Atlantic Industrial Waste Conference, Philadelphia, PA, July 24-27, 1990. Technomic Publishing Company, Lancaster, PA, 800 pp.; (pp. 438-452) (1990)

The Distler Brickyard Site is located near the Ohio River, approximately one-half mile south of Wet Point, Kentucky and 17 miles southwest of Louisville, Kentucky. The site is located within a 50 acre abandoned brick manufacturing facility. Approximately 2350 waste drums were stored within a three-acre area on the property from 1976 to 1979. A Superfund removal was initiated by U.S. Environmental Protection Agency in 1982, in which the drummed wastes and highly contaminated soils were removed. Subsequent monitoring and subsurface investigations determined that groundwater and soil contamination consisting of various metals and volatile and semi-volatile organics had occurred on-site. Remedial actions were implemented on-site to reduce the existing contamination and to prevent its migration off-site. The chosen remedial action proposed excavation, removal, and off-site disposal of the contaminated soil, which occurred in late 1988. The remedial action plan for groundwater treatment included extracting the groundwater using a system of pumping (recovery) wells, treatment of the contaminated water onsite, and returning the treated water to the aquifer using injection wells. The injection wells provide additional hydraulic head to drive the contaminated groundwater toward the recovery wells. This action was selected based on its effectiveness in achieving complete plume capture while minimizing the quantity of uncontaminated groundwater removed for treatment.

845

B. Travis and B. Trent, Los Alamos National Laboratory, Los Alamos, NM

Three-Dimensional Computer Simulations of Bioremediation and Vapor Extraction

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 533-541) (September 1991)

Numerical simulations of two remediation strategies are presented. The simulations use the TRACR3D computer code, which solves equations describing unsaturated and saturated flow and multi-component transport in one, two, or three dimensional heterogenous porous media. These calculations are significant since they play a major role in the actual field implementation of two very different techniques. The first set of calculations simulates an actual event at Sandia National Laboratories in which nearly 60,000 gallons of diesel fuel oil spilled and subsequently flowed toward the water table for 13 years. Hydrogen-peroxide saturated water-flooding was performed and bioremediation of the organic material by native bacteria was then calculated. The second set of calculations describes the vacuum extraction of organic vapors subject to various assumed formation properties and boundary conditions. It models the proposed remediation of Area L at Los Alamos National Laboratory, which served for decades as a disposal site for many different organic liquids. Numerical models such as TRACR3D, which couple chemical and biological processes to traditional models of flow and transport in porous media, can be useful tools for designing remediation strategies for contaminated sites. Simulations of the bioremediation strategy estimated the time course and spatial extent of bacterial action on diesel fuel. Keeping in mind the limits of present models of biological activity in complex environments, it appears that bioremediation simulations can be helpful in designing strategies for removing subsurface organics. The bacterial action can be controlled through careful monitoring of injected oxygen and nutrients. Simulations of vacuum extraction show it to be a very economic and efficient means of greatly reducing in situ concentrations of volatile and other contaminants.

846

I. Bogardi, W.E. Kelly, W. Woldt, and A. Bardossy, University of Nebraska, Department of Civil Engineering, Lincoln, NE

Evaluation and Design of Geophysical Monitoring Network for Ground-Water Contamination - Final Report

PB-91-162842/XAB; 304 pp. (1990)

Ground water contamination has emerged as one of the nation's primary environmental concerns. Reliable, rapid and cost-effective detection and remedial action can contribute to minimizing the adverse environmental and economic impacts of ground water contamination. The report contributes to aquifer remediation by developing a set of planning tools for detection, mapping, monitoring and remediation of contaminated aquifers. The report is divided into three main sections that correspond to a typical sequence of actions resulting in a final remedial action plan for handling contamination at a particular site. The first section develops a methodology for detecting and mapping suspected contamination using multiple sources of data. A decision support system for observation network design is presented in the second section. Network design is approached from a multiple-objective decision-making perspective. The objective is to identify the preferred network design while considering the trade-off between performance and cost. A remedial action design support system is described in the third section. Three-dimensional geostatistical simulation and analytical ground water modeling are used to assess the need for further remedial action planning. Each of the methods developed in the report have been demonstrated using data collected from the site of a low-level radioactive industrial-waste-reprocessing facility near Wood River Junction, Rhode Island.

847

J.C. Corey, B.B. Looney, and D.S. Kaback, Savannah River Laboratory, Aiken, SC

In-Situ Remediation System for Contaminated Groundwater

U.S. Patent A7,236,438; 15 pp. (August 1988)

A system is described for removing volatile contaminants from a subsurface plume of contamination comprising two sets of wells, a well for injecting a fluid into a saturated zone on one

side of the plume and an extracting well for collecting the fluid together with volatilized contaminants from the plume on the other side of the plume. The fluid enables the volatile contaminants to be volatilized and carried through the ground to the extracting well. Injecting and extracting wells are preferably horizontal wells positioned below the plume in the saturated zone and above the plume in the vadose zone. The fluid may be air or other gas or a gas-and-liquid mixture, depending on the type of contaminant to be removed, and it may be preheated to facilitate volatilization. Treatment of the volatilized contamination may be by filtration, incineration, atmospheric dispersion or the like.

848

A.E. Adenekan, K. Pruess, and R.W. Falta, Lawrence Berkeley Laboratory, Berkeley, CA

Removal of Trichloroethylene Contamination from the Subsurface: A Comparative Evaluation of Different Remediation Strategies by Means of Numerical Simulation

LBL-30273; 31 pp. (December 1990)

Volatile organic compounds, such as petroleum hydrocarbons and halogenated hydrocarbon solvents, are common contaminants of the subsurface environment. Although immiscible with water, many of these organics have large enough aqueous-phase solubilities to significantly degrade the quality of groundwater with which they come in contact. In addition, many of these substances exhibit high vapor pressures, causing them to partition strongly into the gas phase in their surroundings. Because of these properties, a volatile organic compound (VOC) introduced into the subsurface may be transported as a solute, a vapor, or as a constituent in a non-aqueous phase liquid (NAPL). This implies that, at some sites, an adequate description of the migration of these contaminants in the subsurface would necessarily involve three phases: gas, aqueous and NAPL. For example, to design an effective aquifer-remediation scheme for a site where NAPL is present, it would be wrong to focus solely on the aqueous phase while ignoring either the gas phase or the NAPL phase. In the present work, we use a simulator developed by Falta et al. (1990a), known as "STMVOC," which models true three-phase flow. In the STMVOC simulation, NAPL, gas and aqueous phases can move in response to pressure, capillary and gravitational forces. STMVOC is capable of handling three-dimensional, three-phase fluid flow with strong heat transport and the associated, phased, change effects.

849

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Process Development for Remediation of Phenolic Waste Lagoons

Journal of Hazardous Materials 29(1):97-125 (1991)

Aqueous phenolic wastes from a phenolic resin production process were disposed in lagoons on the production site. Groundwater contamination in the area has exceeded state limits and thus mandated remedial action. Representative core samples from within and around the highly contaminated soil regions were collected. These samples were physically and chemically characterized to better determine the extent and nature of contamination. Both in situ and on-site remediation scenarios were considered. The most promising scenario was in situ forced leaching with above-ground aerobic microbial treatment of the leachate. The treatment could be carried out in six months at a cost of approximately $170 per ton of treated soil, with the capability of reaching a final residual soil phenol concentration less than 20 mg/kg dry soil.

850

E.A. Ayer, University of Houston, Houston, TX

In Situ Remediation of Hazardous Wastes

CONF-9107139; Environmental Engineering, Proceedings of the 1991 Specialty Conference, Reno, NV, July 8-10, 1991. American Society of Civil Engineers, New York, NY; (pp. 557-566) (1991)

Numerous releases of hazardous substances have occurred at uncontrolled sites all around the United States. These sites pose toxic threats to public health and our environment, and threaten potential loss of natural resources. The traditional remedial approaches of site isolation or excavation and disposal of the contaminated soil, or both, do not provide a permanent solution. The challenge facing environmental engineers and technicians is to restore the land to an environmentally safe and reusable state, while reducing the amount of resultant hazardous wastes. In situ soil remediation offers the attractive alternative of leaving the soil in place, thereby reducing the amount of hazardous material to be destroyed. The remedial-action community must actively investigate the in situ option and continue to develop the technology to implement it.

851

R.N. Block, B.R. Genes, and D.J. Finkel, Remediation Technologies, Inc., Concord, MA

Development of Effective Remediation Criteria

CONF-9107139; Environmental Engineering, Proceedings of the 1991 Specialty Conference, Reno, NV, July 8-10, 1991. American Society of Civil Engineers, New York, NY; (pp. 511-516) (1991)

Cleanup criteria for remediation of hazardous waste sites take several forms. These forms of cleanup criteria range from simple sensory parameters (e.g., visual evidence of contamination) to specific numerical criteria to methodological criteria. The specific form of the criteria has a significant effect upon the successful implementation of a given remedial action. This paper explores the various types and forms of cleanup criteria and discusses the impact of these criteria on achieving compliance.

852

J.J. Cudahy and W.L. Troxler, Focus Environmental, Inc., Knoxville, TN

1990 Thermal Remediation Industry Contractor Survey

Journal of the Air and Waste Management Association 41(8):1178-1182 (August 1990)

The treatment of soil contaminated with organics and inorganics is becoming a major industry in the United States and Europe. The types of sites in the U.S. that will require soil treatment can be broken down into the following categories: CERCLA (Superfund) Actions; RCRA Corrective Actions; RCRA Closures; Underground Storage Tanks; Real Estate Transfers; and Spill Clean-ups. The cleanup of wastes in each of these categories, with the exception of the Real Estate Transfer category, is being driven by different sets of Federal regulations. Real Estate Transfer-type regulations were first instituted in New Jersey and have now been promulgated in a number of other states. The eventual cleanup cost for the Superfund sites will be close to $200 billion. Estimated costs for the industrial sector Superfund are $25 to $50 billion and the estimated cost for the Department of Energy sites is over $150 billion. The potential magnitude of the cleanup costs has resulted in the development and implementation of many technologies for the decontamination of soils. Of the available remedial technologies, thermal treatment has perhaps had the most field testing. The purpose of this paper is to focus on the full-scale site remediations which have been, or are being, conducted using thermal processing equipment. Projects which have been completed, are on-going, or have been contracted for through January of 1990 are described.

853

T.B. Culver, Cornell University, Ithaca, NY

Dynamic Optimal Control of Groundwater Remediation with Management Periods: Linearized and Quasi-Newton Approaches

Thesis; 146 pp. (1991)

Several modifications of the linear-quadratic regulator (LQR) optimization algorithm are developed, and the computational efficiency of each algorithm with respect to groundwater remediation is evaluated. In each case, the optimization model is combined with a finite element groundwater flow and transport simulation model to determine the optimal time-varying

pump-and-treat policy. The first modification of the LQR algorithm incorporated management periods, which are groups of simulation time steps during which the pumping policy remains constant. Management periods reduced the total computational demand, as measured by the CPU time, by as much as 85% compared to the time needed for the LQR solution without management periods. Complexity analysis revealed that computational savings of equal or greater magnitude can be expected in general for groundwater remediation applications and for many other applications of dynamic control. The LQR algorithm with management periods was further modified by assuming steady-state hydraulics within a management period (SSLQR), which simplifies the derivatives of the transition equation. A quasi-Newton differential dynamic programming (QNDDP) was formulated by approximating the complicated second derivatives of the transition equation using a Broyden rank-one approximation. QNDDP converged to the optimal policy for the test problem significantly faster than the LQR algorithm, requiring approximately half the computational time. With the test problem expanded to include the capacity of the treatment facility as a state variable, QNDDP with management periods can determine the optimal treatment facility capacity. With many management periods, the addition of the capital costs of the treatment facility changed the optimal policy so that the required treatment facility capacity was reduced.

854

C.B. Doty, Automated Sciences Group, Inc., Oak Ridge, TN

The Effectiveness of the Pump and Treat Method for Aquifer Restoration

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 403-406) (September 1991)

This paper characterizes the effectiveness of the pump and treat approach to the remediation of contaminated groundwater. Recent theoretical studies and field experience indicate that aquifer restoration using the pump and treat approach is not feasible. Results of the analysis presented in this paper suggest that groundwater pumping is ineffective in permanently reducing levels of aquifer contamination to meet health-based goals for groundwater. The primary factors contributing to the ineffectiveness of pumping contaminated groundwater for treatment are physical and chemical processes that affect the behavior of contaminants in the subsurface environment, such as: (1) contaminant sorption, (2) the existence of non-aqueous phase liquids, and (3) zones of low permeability. The limitations of the pump and treat approach need to be recognized before progress can be made toward developing more feasible alternatives.

855

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Selection of a Preferred Remedial Well Configuration Using Groundwater Modeling Techniques

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 789-792) (September 1991)

The alternative screening process of a remedial investigation/feasibility study (RI/FS) at a California location was assisted through use of numerical modeling techniques to evaluate several groundwater pumping and injection schemes. Computer modeling (the GWFL3D code for groundwater flow and the GWTR3D for contaminant transport) was used to winnow the alternatives down to a recommended well configuration. The final scheme was a further refinement based on operational considerations. The remedial pumping rate was 200 gallons per minute, and the initial concentration of the contaminant, trichloroethylene (TCE) was estimated to be less than 300 parts per billion (ppb). The pumped groundwater was projected to reach a TCE concentration of 5 ppb after approximately 8 years of operation. When the 95

percent upper confidence limit on the arithmetic mean TCE concentration of 15 monitoring wells is used to indicate compliance with the applicable or relevant and appropriate requirements (ARARs), the TCE plume should be remediated after 6 years of operation. Aquifer tests at the site have reduced the uncertainty in aquifer hydraulic parameters. However, uncertainties in TCE plume definition, natural TCE degradation, and TCE retardation with groundwater movement dominate the concentration estimates and projected cleanup times.

856

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Remediation and Mitigation Associated with Contamination of Water by Irrigation Drainage

Urban and Regional Conflict Resolution in Water Related Issues, Proceedings of the ASCE National Convention, Orlando, FL, October 21-22, 1991; (pp. 25-26) (1991)

Inorganic trace-constituent or pesticide contamination problems associated with irrigation drainage from federally constructed or managed irrigation projects have been identified in several western states. Selenium is the constituent most frequently detected at elevated concentrations in water, bottom sediment, and biota. Remediation has been accomplished and mitigation is underway for Kesterson Reservoir in California; a remediation plan has been prepared for the western San Joaquin Valley in California. Planning for possible remediation has begun for four other areas in California, Nevada, Utah, and Wyoming. Remediation and mitigation issues discussed include legal authority for remediation; repayment of remediation costs; and National Environmental Policy Act compliance.

857

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Groundwater and Soil Remediation R, D and D

Proceedings of the First Symposium, Ottawa, Ontario, Canada, 1991; 227 pp. (1991)

These proceedings include papers presented at the 1991 symposium that describe research and development (R&D) in soil and groundwater remediation that has been recently conducted by the Canadian Petroleum Products Institute, the Canadian Petroleum Association Environment Research Advisory Council, the American Petroleum Institute, and the U.S. Environmental Protection Agency. Topics covered by the proceedings include: (1) state-of-the-art in situ bioremediation; excavation and treatment technologies; (2) treatment and recovery of petroleum hydrocarbons from soil and groundwater; (3) volatilization technologies; (4) iron pre-treatment for pump and treat systems; (5) sour gas contamination; and (6) statistical evaluation.

858

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Numerical Simulation of Two-Dimensional Steam-Remediation Experiments

LBL-29700; 197 pp. (June 1991)

Significant multidimensional effects occur during the injection of steam into subsurface formations. In particular, gravitational forces tend to make the injected steam rise to the top of the formation. This phenomenon, known as steam override, can result in a premature breakthrough of steam at the producing location. The usefulness of steam injection as a method for remediating contaminated aquifers largely depends on the ability of the steam to completely sweep the contaminated region. In cases where severe steam override causes an early breakthrough of steam at the producing location, the efficiency of the steam in removing contaminants from the formation will be greatly reduced. One of the major motivations for the development of the STMVOC simulator at Lawrence Berkeley Laboratory was recognition of the need for a comprehensive model that could be used to aid in the design of field-scale steam-injection remediation systems. For such a

model to be useful, it must be demonstrated that the model accounts for the important physical processes taking place in the real situation. This article describes the use of the STMVOC simulator to model a series of two-dimensional, laboratory-scale steam-injection experiments conducted by Basel and Udell (1989) in a clean sand. These experiments included the effects of gravity and were conducted with a variety of different initial and boundary conditions. The simulator was then used to model a two-dimensional xylene-displacement experiment.

859

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Vapor Extraction Technology for the Remediation of a Large Gasoline Spill

CONF-910697; HazMat '91 International, Proceedings of the Ninth Annual International Hazardous Materials Management Conference, Atlantic City, NJ, June 12-14, 1991. Tower Conference Management Company, Wheaton, IL, 1135 pp.; (pp. 452-467) (1991)

Petroleum hydrocarbon recovery and remediation has received considerable attention in the last few years, especially with the advent of more stringent petroleum storage tank laws and an increased legislative awareness of the risks of uncontrolled releases to public health and the environment. Over this same time period, the engineering and science world has become increasingly aware of the shortcomings of groundwater pump-and-treat technologies in the remediation of petroleum fuel releases. Two factors have led engineers and scientists to seek alternative technologies for the treatment of petroleum in the saturated zone: (1) the tendency of petroleum constituents to preferentially adsorb to the soil, and (2) the difficulty in exchanging groundwater pore volumes quickly. At the same time, the engineering community has realized the importance of soil treatment to remove residual contamination in the vadose zone, which may become a continuing source of groundwater contamination if not removed. This recognition has occurred simultaneously with the development of Vapor Extraction Technology (VET) as a practical petroleum hydrocarbon remediation technique. This paper describes the design, limitations, and effectiveness of VET.

860

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Anion Retention in Soil: Possible Application to Reduce Migration of Buried Technetium and Iodine

NUREG/CR-5464 (1991)

This report summarizes a literature review of the present knowledge of the anion exchange (AEC) properties of a number of soils and minerals that may be used as anion exchangers to retard migration of such anions as iodide (I), iodate (IO3), and pertechnetate (TcO4) away from the disposal site, thus preventing contamination of ground water. The amorphous clays allophane and imogolite, derived from volcanic parent material, are found to be among the most important soil components capable of developing appreciable amounts of positive charge for anion exchange, even at about neutral pH. The magnitude of the surface charge of these amphoteric materials depends on the ration of SiO2/Al2O3, soil pH and concentration of electrolyte. Decreases in the SiO2/Al2O3 ratio and soil pH result in an increase in soil AEC. Allophane- and imogolite-rich soils have an AEC ranging from 18 meq/100 g at pH about 6. Highly weathered soils dominated by Fe and Al oxides and kaolinite may develop a significant amount of AEC as soil pH falls. On a wide range of these soils, AEC ranges from 0 to 2 meq/100 g at about 6 pH. The retention of the radionuclides of iodine (I) and technetium (Tc) by soils is associated with both soil and organic matter, and Fe and Al oxides, whereas sorption on layer silicate materials is negligible. Fe and Al oxides become more important in the retention of anionic I, IO3, and TcO4 as pH falls, since more positive charge is developed on the oxide surfaces. Although few studies, if any, have been conducted on I and Tc sorption by soil allophane and imogolite, it is estimated that a surface plough soil (2 million pounds soil per acre) with 5 meq/100 g AEC, as is commonly found in andisols, would retain approximately 5900 kg of I and 4500 kg of

Tc, respectively, by the ion exchange mechanism. It is conceivable that an ion exchanger such as an andisol could be used to modify the near field environment of a radioactive waste disposal facility. This whole disposal system would then offer similar migration resistance to anions as is normally afforded to cations by usual and normal soils. Future studies on this subject are recommended.

861

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In-Situ Remediation of a Chlorinated Solvent Contaminant Plume Using Vacuum Extraction Technology

CONF-9007232; Hazardous and Industrial Wastes, J.P. Moore, S.C. Cheng, and M.A. Susavidge (eds.), Proceedings of the 22nd Annual Mid-Atlantic Industrial Waste Conference, Philadelphia, PA, July 24-27, 1990. Technomic Publishing Company, Lancaster, PA, 800 pp.; (pp. 269-289) (1990)

A pilot-scale test of the Terra Vac Vacuum Extraction System (VES) was carried out at a hazardous waste site located in New York. The site is slated for redevelopment and has previously been used for a number of different purposes. These include a salvage area for scrap metal, a concrete batch plant, and an oil storage tank farm. An environmental investigation determined that a small portion of the site contained soil and groundwater contaminated with volatile organic compounds (VOC's). This paper shows the contaminated portion of the property. The ability of the VES to remove VOC's from soil pores, soils, and groundwater at the site was investigated during the Pilot Study. Because groundwater was only 3-4 feet below the surface, while contamination was believed to exist at depths of up to 20 feet below the surface, a dual extraction system was used at the site. This involved pumping groundwater to depress the water table at the site to create an artificial vadose zone.

862

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Destruction of Complexants Used in Groundwater Decontamination

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 555-557) (September 1991)

A supported liquid membrane process is being developed to remove uranium from aqueous solutions. The uranium is concentrated in a strip solution containing either vinylidene-1,1-diphosphonic acid (VDPA) or 1-hydroxyethane-1,1-diphosphonic acid (HEDPA). VDPA and HEDPA are thermally unstable complexants (TUCs), a group of compounds possessing recently discovered unique properties (such as forming aqueous soluble metal ion complexes and decomposing into innocuous substances when heated) which prove useful in decontamination efforts. This study compares the degradation of HEDPA and VDPA under similar conditions. These conditions include temperature change (25, 60, and 95 deg C), presence of an oxidant (hydrogen peroxide) with sodium orthovanadate catalyst at 25 and 60 deg C, and adjustment of pH to less than one by adding nitric acid. The possible decomposition products of HEDPA and VDPA were phosphoric acid and carbon dioxide. Ion chromatography was used to characterize the decomposition of the complexants. For the duration of the tests in this study (3 hours), the maximum amount of HEDPA destroyed was 83.5% using the hydrogen peroxide. The maximum amount of VDPA destroyed was 64.6% using nitric acid.

863

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Ecophysiological Screening for Chlorinated-Hydrocarbon Degrading Bacteria from Contaminated Groundwater - Physiological and Technological Test for Remediation of Groundwater - Final report

BMFT 02-WT-456; 216 pp. (1990)

The subject of this project was the isolation of efficient CHC-degrading bacteria from contaminated sites. Operational tests of the isolated strains for biological remediation of contaminated groundwater were also included. Mixed and pure cultures capable of degrading most of the technically used CHC were isolated from samples collected from contaminated sites. Pure cultures were characterized, and their degrading capacity was estimated. The complete mineralization of degraded CHC was proved. For the degradation of some xenobiotics, development of technically usable bioreactors was achieved. Furthermore, contaminated groundwater from an organic-solvent spill site (a complex mixture of aliphatic, aromatic and chlorinated hydrocarbons) has been treated in a laboratory-scale sewage reactor, and the mineralization of CHC was balanced with released chloride ions. Additional experiments revealed the conditions of reductive dechlorination by bacteria and chemical production of vinylidenechloride from tri- and tetrachloroethylene.

864
J.F. Keely

Performance Evaluations of Pump-and-Treat Remediations

EPA/540/4-89/005; 21 pp. (October 1989)

The report contains an overview of the processes affecting the mobility of contaminants through the subsurface, and the ability to pump the contaminants from the subsurface for treatment. It points out the limitations of pump-and-treat remediation techniques and stresses the importance of proper site characterization and the relevance of computer modeling as a performance-evaluation technique.

865
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Biological Activity and Potential Remediation Involving Geotextile Landfill Leachate Filters

EPA/600/A-92/053; 14 pp. (1992)

The paper presents the results of a biological growth study in geotextile filters used in landfill leachate collection systems. After reviewing the first year's activity, a completely new experimental approach has been taken. Using 100-mm diameter columns for the experimental incubation and flow systems, the effects of six landfill leachates are evaluated. Aerobic and anaerobic states, four different geotextiles, and soil/no soil conditions above the geotextiles are involved in the testing program. In 96 individual test columns, flow data was measured regularly, and over the first six months of evaluation certain trends were observed. For two of the landfill leachates, backflushing was attempted to reinstitute flow. The procedure works well for the geotextile alone, while not as well for the geotextile/soil columns. The exception is the nonwoven heat-set geotextile. All tests are still ongoing and will be dismantled and further investigated at the end of 12 months exposure time. The experimental setup and procedure has been written up as a tentative ASTM test method and is currently in task-group review.

866
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Bioremediation, a Useful Tool for Remedial Actions

CONF-900225; WATTec '90: Global Competitiveness - Managing Technology, Proceedings of the 17th Annual Technical Conference and Exhibition, Knoxville, TN, February 20-23, 1990, 78 pp.; (pp. 65-66) (1990)

Over the past five years, bioremediation has been found to be a cost-effective and environmentally sound alternate to landfill and incineration for the treatment of contaminated soils and sludges. Where ground-water contamination is associated with the soil contamination, the two problems can be addressed concurrently. Lab and field data compiled in the process of feasibility assessment and full-scale remediation demonstrates that organic removal efficiencies in excess of 98% can be achieved in the treatment of soils, ground water,

and sludges contaminated with a variety of alkanes, aromatics, and polynuclear aromatics.

867
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Threshold Limited Kinetics of Aromatic Hydrocarbons in Shallow Soil Systems

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 691-696) (September 1991)

It is important to understand the kinetic limitations of microbial systems in the bioremediation of contaminated soils. Remediation of petroleum-contaminated soils by biological decomposition is rapidly becoming a preferred methodology at numerous sites, particularly gas stations. Experience has shown that excavating the affected soils and landfarming them in 4-inch to 8-inch lifts above grade is the most effective remediation method, as critical design parameters can be accurately controlled. A common misconception about this practice, however, is that, over a wide range of hydrocarbon concentrations, the rate of mineralization of the hydrocarbons is directly proportional to their concentration in the soil. It is likewise often assumed that microorganisms are able to metabolize, and presumably are able to grow on, low concentrations of organic compounds. Cleanup criteria for benzene in soils, typically set by state and federal regulators under the Resource Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Compensation and Liability Act (CERCLA), range from 100 ppm to less than 1 ppm. It was the objective of this study to assess the degradation kinetics of four landfarming plots that exhibited varying initial concentrations of organics, but had similar soil types. It was found that in benzene concentrations below 100 ppm, cell growth patterns and benzene losses suffered significant threshold kinetic restraints.

868
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Electrokinetic Remediation of Contaminated Soils

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 151-157) (September 1991)

Experiments using a novel transport visualization technique demonstrated the electrokinetic remediation of contaminated soil for saturated and unsaturated sand. Large anionic organic dyes were mixed with a portion of soil. The rate of electromigration of the dye in an imposed electric field was monitored photographically. One of the fastest current-normalized electromigration rates was measured in the driest sand, which contained 7 percent water by weight. This moisture content is typical of that in the unsaturated zone of subsurface soils native to New Mexico. The characteristics of the electromigration were similar in both the saturated and unsaturated sand. The leading edge of the dye migration front was diffuse, while the trailing edge was sharp and concentrated. This and other observed behavior may indicate a concentration effect, where the electromigration rate of dilute dye is greater than that of concentrated dye. In both the saturated and unsaturated soils, the soil left after the trailing edge of the dye migration passed seemed to contain no residual dye. This success in demonstrating electromigration of large molecules in unsaturated soil encourages environmental restoration efforts. It indicates that it may be feasible to use electrokinetic techniques to remediate, in situ, anionic heavy metals such as chromate from unsaturated soil.

869
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A Real-Time Approach to Groundwater Monitoring, Prediction, and Remediation

Hydraulic Engineering, M.A. Ports (ed.), Proceedings of the 1989 National Conference, New Orleans, LA, August 14-18, 1989. American Society of Civil Engineers, New York, NY; (pp. 422-427) (1989)

This paper outlines an integrated approach to the problem of predicting and controlling groundwater contamination. The key to this approach is to derive contaminant predictions by combining physically-based models with field observations. Models are updated in "real time," as new measurements become available. The updated models are then used to plan the next round of sampling or remediation. The authors are currently field testing a monitoring design algorithm based on real-time concepts.

870
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Plume Management for Groundwater Remediation

CONF-9107139; Environmental Engineering, Proceedings of the 1991 Specialty Conference, Reno, NV, July 8-10, 1991. American Society of Civil Engineers, New York, NY; (pp. 747-752) (1991)

This paper describes methods of remediating sites with contaminated ground water. Data for four sites were compiled to evaluate the effectiveness of pumping and treating contaminated ground water and recharging the treated ground water to the surficial aquifer. In general, remediation goals apparently were achieved, but contamination of deeper aquifers may be occurring at one of the sites.

871
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Bench-Scale Evaluation of Alternative Biological Treatment Processes for the Remediation of Pentachlorophenol- and Creosote-Contaminated Materials: Slurry-Phase Bioremediation

Environmental Science and Technology 25(6):1055-1061 (1991)

Performance data on slurry-phase bioremediation of pentachlorophenol (PCP)- and creosote-contaminated sediment and surface soil were generated at the bench-scale level. Aqueous slurries, containing 0.05% Triton X-100 to facilitate the soil washing process and to help stabilize the suspensions, were prepared from sediment and surface soil freshly obtained from the American Creosote Works Superfund Site at Pensacola, Florida. Excluding PCP, benzo(b)fluoranthene, benzo(k)-fluoranthene and indeno(123-cd)pyrene, slurry-phase bioremediation of highly contaminated sediment (pH adjusted) resulted in rapid and extensive biodegradation (3 to 5 days to biodegrade greater than 50% of targeted compounds) of monitored constituents. Data suggest that slurry-phase bioremediation strategies can be effectively employed to remediate creosote-contaminated materials.

872
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Feasibility of Hydraulic Fracturing to Improve Remedial Actions - Project Summary

EPA/600/S2-91/012; 8 pp. (August 1991)

Hydraulic fracturing, a technique commonly used to increase the yields of oil wells, could improve the effectiveness of several methods of in situ remediation. This project consisted of laboratory and field tests in which hydraulic fractures were created in soil. Laboratory tests conducted using a triaxial pressure cell showed that hydraulic fractures were readily created in clayey silt, even when saturated. Laboratory observations are explained using the parameters and analyses of linear elastic fracture models. Field tests were conducted during the summers of 1988 and 1989.

During the 1988 test, hydraulic fractures were successfully created from cemented casing at depths of 2 to 4 m. The tests were limited to one fracture per borehole, and shortcomings resulted from the use of oil well equipment too large for test purposes. During the 1989 test, injection grouting equipment was used with a new method of casing to create as many as four horizontally layered fractures from the same borehole. Following the tests, the vicinity of the boreholes was excavated to reveal details of the hydraulic fractures. In general, they were slightly elongate in plan view and highly asymmetric with respect to their parent borehole. In each case, there was a preferred direction of propagation. Maximum lengths of fractures in 1989 average 4.0 m and the average area was 19.0 sq m. Maximum thickness of sand in individual fractures ranged from 2 to 20 mm, averaging 11 mm. Results indicate that it should be feasible to monitor the growth of hydraulic fractures at shallow depths using injection pressure, surface uplift, and surface tilt. This project summary was developed to announce key findings of the hydraulic fracturing research project. The project is fully documented in a separate report of the same title.

873

National Technical Information Service, Springfield, VA

Soil Remediation - January 1985-January 1992 - Citations from the NTIS Database

Report; 27 pp. (December 1991)

This bibliography contains citations concerning restoration of polluted soils to a form that can be used as mulch, potting soil, etc. Topics include biological treatment, radiological surveys, waste disposal, and waste management. The specific treatments include vitrification, incineration, and biological treatment. Some of the toxic materials include heavy metals, microorganisms, radioactive materials, organic compounds, and water pollutants. The bibliography contains 62 citations with title list and subject index.

874

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Soil Clean-up Guidelines for Decommissioning of Industrial Lands: Background and Rationale for Development

ISBN-0-7729-8109-4; 184 pp. (1991)

In a number of cases since 1984, the phytotoxicology section of the Ontario Ministry of the Environment has been asked for guidelines on remediation of oil refinery lands. While some guidelines were developed in 1984, they were not all suitable. Guidelines were also requested for applications to agricultural situations. It was felt that the same guidelines could apply to both agricultural and oil situations. This document describes the rationale for the development of guidelines for soil pH, arsenic, cadmium, chromium, cobalt, copper, lead, mercury, molybdenum, nickel, selenium, silver, zinc, nitrogen, oil and grease, electrical conductivity, and sodium adsorption ratio. In addition, provisional guidelines for antimony, barium, beryllium, and vanadium are considered.

875

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Electrical Resistance Tomography to Monitor Vadose Water Movement

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 907-910) (September 1991)

This paper reports results of a test in which electrical resistance tomography (ERT) was used to map the changes in electrical resistivity in the vadose zone as a function of time while water infiltration occurred. The ERT images were used to infer shape and movement of the infiltration plume in the unsaturated soil. Researchers supplied a continuous water source at a point about ten feet below the surface (at the end of a shallow screened hole) for a short time (2.5 hours). This pulsed source introduced a "slug" of water whose infiltration was followed to about a 60-foot

depth during a 23 hour period. The ERT images show that resistivity decreased as the water content of the vadose zone increased while water was added to the soil; the resistivity of the soil later increased after the supply of water was cut off and the induced soil moisture began to subside.

876

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Model for the Future: Innovative Combination of Technologies for Soil and Groundwater VOC (Volatile Organic Compound) Remediation

Report (1989)

Elevated levels of carbon tetrachloride and chloroform were detected in 1982 in a public water supply serving a small agricultural community in the Midwest. The U.S. Environmental Protection Agency subsequently initiated an "expedited response action" (ERA) and identified the contaminant source as a former grain storage facility where carbon tetrachloride had been used as a fumigant from 1955 to 1965. An innovative remedial system, operating at the facility site since early 1988, simultaneously removes volatile organic compounds from extracted groundwater by air stripping and reduces subsoil source contamination by in situ vapor extraction. This paper presents a case history of the contamination and the remedial action and discusses plans to expedite cleanup operations and increase their cost-effectiveness.

877

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Biotechnology Workgroup for Department of Defense Soil and Ground-water Decontamination Applications - Final Report for Period Ending March 1989

AD-A-237956/8/XAB; 47 pp. (June 1991)

This report contains materials used in and generated by the Department of Defense (DOD) Biotechnology Workshop on Soil and Groundwater Decontamination Applications. Various bioremediation techniques for treating soil and water contaminated with sludges, solvents, toxins, acids, bases, and heavy metals were discussed, as well as the overall place of biotechnology in DOD Installation Restoration programs. Among the specific applications discussed were: (1) biochemical sensors to determine environmental stress in organisms; (2) in-situ detoxification and biodecontamination of pollutants in soils and waste streams; (3) sequestration, removal, and recovery of metals in waste streams with metal-binding proteins; and (4) the use of vegetation to limit the transport of contaminants and/or to remove contaminants from soil or water.

878

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Contaminant Sorption/Desorption Rates: Implications for Groundwater Restoration

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 401-402) (September 1991)

It is widely recognized that contaminants sorb appreciably to solids during groundwater treatment. Most early attempts to model the transport of sorbin solutes were restricted by assuming that local equilibrium prevailed with respect to sorption and desorption. More recent evidence from both field and laboratory experiments demonstrates that both sorption and desorption are rate-limited, and that the local equilibrium assumption is untenable as a basis for exact simulation of groundwater transport. The rate limitation can be explained in terms of physical diffusion processes. Diffusional mass transfer resistances are believed to exert substantial effects on a range of scales: microporous solids, aggregates, and layers. This paper presents data that quantify the magnitude of such diffusional resistances in terms of effective times to achieve equilibrium, and demonstrates how slow equilibrium influences the performance of aquifer restoration.

879
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Control of Water Infiltration into Near Surface LLW Disposal Units: Progress Report on Field Experiments at a Humid Region Site, Beltsville, Maryland

NUREG/CR-4918 (Vol. 5) (October 1991)

The project objective is to assess means for controlling water infiltration through waste disposal unit covers in humid regions. Experimental work is being performed in large scale lysimeters (70 ft x 45 ft 10 in) at Beltsville, Maryland, and results of the assessments are applicable to disposal of low-level waste, uranium mill tailings, hazardous waste, and sanitary landfills. Three concepts are under investigation: (1) resistive barrier layer, (2) conductive barrier layer, and (3) bioengineering water management. The resistive layer barrier consists of compacted earth (clay). The conductive layer barrier is a special case of the capillary barrier and it requires a flow layer (e.g., fine sandy loam) over a capillary break. As long as unsaturated conditions are maintained, water is conducted by the flow layer to below the waste. This barrier is most efficient at low flow rates and is thus best placed below a resistive layer barrier. Such a combination of the resistive layer over the conductive layer barrier promises to be highly effective, provided there is no appreciable subsidence. It consists of impermeable panels which enhance run-off and limit infiltration. Vegetation is planted in narrow openings between panels which enhance run-off and limit infiltration. Vegetation is planted in narrow openings between panels to transpire water from below the panels. This system has successfully dewatered two lysimeters, thus demonstrating that this procedure could be used for remediating ("drying out") existing water-logged disposal sites at low cost.

880
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U.S. National Issues on Environmental Hydrology and Hydrogeology - Local and Emerging Global Perspectives

CONF-900629; Environmental Hydrology and Hydrogeology, J.E. Moore, R.A. Kanivetsky, J.S. Rosenshein, C. Zenone, and S.C. Csallany (eds.), Proceedings of the First USA/USSR Joint Conference, Leningrad, USSR, June 18-21, 1990. Kendall/Hunt Publishing Company, Dubuque, IA, 463 pp.; (pp. 89-93) (1991)

Hydrologic considerations have risen to the forefront in a number of important national issues in the United States. These issues focus on aspects of water availability and quality, but also impact other environmental, economic, and social situations. Surface water resources in the U.S. have been allocated, and new socio-environmental concerns may limit further surface-water exploitation. Groundwater use is increasing, but availability is not uniform. Some areas suffer from groundwater depletion and associated social and economic hardships. The quality of U.S. coastal waters, rivers, lakes, and groundwater resources has seriously deteriorated in the last fifty years. New methods for the disposal of sewage, industrial wastes, nuclear wastes and for water treatment must be developed. Furthermore, the widespread agricultural contamination of groundwater is just now being documented. This is leading to the development of well-head protection criteria, a small but important venture into land-use planning. It is in comprehensive land-use planning that hydrology and hydrogeology should be of greatest value. The loss of prime agricultural lands and wildlife habitat, as well as localized problems such as flooding, subsidence, and pollution of water resources are problems which require immediate attention.

881
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Groundwater Remediation via Four Case Studies

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 159-162) (September 1991)

In this paper, a review of the pertinent design philosophy for groundwater treatment is followed by the principal design features of four operating groundwater remediation projects in the American Southwest. Hazardous chemicals for which the groundwater is being treated are chlorinated and non-chlorinated organics and heavy metals. Treatment processes include air stripping (with and without air emission controls), activated carbon adsorption, ion exchange, and biological processes. Flow rates of the units vary from 20 to 5100 gpm. Operating concerns that occurred during the initial operating periods are discussed.

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Cone Penetrometer/Hydropunch [trademark]: An Efficient Approach for Delineating Subsurface Lithology and Ground Water Quality

CONF-9010166; Waste Management and Environmental Restoration, Proceedings of the 1990 DOE Model Conference, Oak Ridge, TN, October 29-November 2, 1990, 343 pp.; (14 pp.) (1990)

In the development of a remedial investigation strategy, a fundamental objective is the quantification of contaminants, both vertically and horizontally, within the subsurface. This task becomes quite complex when working with aquifers that are discontinuous laterally and stratigraphically, because this discontinuity also controls the distribution of the contaminants. To solve this dilemma and determine the most sensitive well locations, two state-of-the-art screening methods were chosen for initial site characterization. The first method, cone penetration (CPT), uses a steel point equipped electronically with a pressure transducer and load cells to measure pore pressure and geotechnical properties. It provides a continuous interpretive log of the soil penetrated, thus allowing for discrimination between aquifer and nonaquifer zones without coring. The second method involves the use of Hydropunch [TM]. This device combines well-point and check-valve bailer technology, allowing the collection of groundwater at discrete depths. Over 130 such CPT/Hydropunch [TM] tests proved to be an efficient and cost-effective means of delineating contaminant and aquifer distribution at this California National Priorities List site. The study described in this paper focuses on the methods and results obtained from comprehensive use of the CPT/Hydropunch [TM] screening methodology.

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U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, DC

Suggested ROD Language for Various Ground-Water Remediation Options - Directive

PB-91-921325/XAB; OSWER Directive 9283.1-03; 10 pp. (October 10, 1990)

This OSWER directive provides supplemental guidance to the October 18, 1989, OSWER Directive 9355.4-03, titled "Consideration in Ground Water Remediation at Superfund Sites," which examined the role of ground water remediation in Superfund cleanups and recommends modifications to the current approach. It offers suggested language for Records of Decision corresponding to the recommendations (1) and (2) from the OSWER Directive. The recommendations are: (1) initiation of early or interim response measures; and (2) provision for changes in the remedy during implementation of the Record of Decision. The directive offers standard language that may be employed, when appropriate, to correspond to site-specific remediation scenarios. Language is suggested for final actions, contingency measures/goals, and interim actions.

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U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, DC

Guide to Pump-and-Treat Ground-Water Remediation Technology - Fact Sheet

PB-91-921356/XAB; 6 pp. (November 1990)

The fact sheet summarizes how to use available hydrogeological and chemical data to determine when, where, and how pump-and-treat technology can be used successfully to contain and remediate contaminant plumes. It is based on the U.S. Environmental Protection Agency's Office of Research and Development's "Basics of Pump-and-Treat Ground-Water Remediation Technology," EPA/600/8-90/003.

885
U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, DC

Considerations in Ground-Water Remediation at Superfund Sites

PB-91-238584/XAB; OSWER Directive 9355.4-03; 10 pp. (October 18, 1989)

This OSWER directive transmits findings from a study of several sites where ground water extraction is being conducted to contain or reduce levels of contaminants in the ground water. The memorandum also presents several recommendations for modifying the Superfund approach to ground water remediation.

ENVIRONMENTAL DATA MEASUREMENTS, MANAGEMENT, AND EVALUATION

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A Quality Assurance Program for Environmental Data Operations Involving Waste Management Processes

CONF-9005178 (Vol. 1); Quality Control of Radioactive Waste Packaged for Removal: Requirements for Waste Acceptance and Quality Control, Proceedings of the Second International Seminar, Juelich, Federal Republic of Germany, May 28-June 1, 1990, Vol. 1, 741 pp.; (pp. 77-92) (1990)

This paper describes the "core" elements needed in an effective quality program for environmental data operations involving nuclear, mixed, or non-nuclear wastes. For each core element, this paper examines the minimum components needed for an effective quality program for experimental development operations (EDOs), and compares approaches to quality programs currently required by the U.S. Department of Energy (DOE) and the U.S. Environmental Protection Agency. The comparison suggests how the quality program requirements used at DOE, and defined by NQA-1 and its supplements, and those used by EPA through its QAMS program guidance, may provide a basis for developing a harmonized quality program for EDOs involving any waste management processes, nuclear, non-nuclear, or mixed.

887
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Harmonization of QA Procedures for Environmental Data Operations: Development of a National Consensus Standard for Quality Assurance for Environmental Programs

EPA/600/D-91/221; Proceedings of the 19th Annual Energy Division Conference of the American Society for Quality Control, October 1991. Bechtel Environmental, Inc., San Francisco, CA, and MAC Technical Services, Germantown, MD; 21 pp. (October 1991)

Decisions on where and how to clean-up federally-owned facilities contaminated by mixtures of hazardous chemical and radioactive wastes require that quality environmental data be obtained. The federal government is currently using several different standards or sets of requirements for establishing the quality assurance and quality control (QA/QC) procedures associated with environmental data operations for these sites. These standards define the criteria for the QA activities and documentation required, the content and format of the documentation, and who is responsible for QA implementation. Shortcomings in these standards of requirements led, in 1989, to efforts by several public and private sector groups to "harmonize" the multiple sets of standards and requirements into a single set. These efforts are being conducted under the auspices of the American Society for Quality Control (ASQC) and involve participation by the Environmental Protection Agency (EPA), Department of Energy (DOE), Department of Defense (DOD), Nuclear Regulatory Commission (NRC), and others in the contractor and regulated communities. The paper describes the progress toward establishing a national consensus standard for QA for environmental programs through the ASQC standard-setting process.

888
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A Project Manager's Primer on Data Validation

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 717-722) (September 1991)

Environmental project managers must carry out their central responsibility, conducting an environmental investigation in a high-quality,

timely, and cost-effective manner, while facing a significant challenge from the many uncertainties inherent in characterizing and remediating a site. They must minimize the uncertainty of making decisions about health and financial risks, and about technical, professional, and legal defensibility and credibility, that are based on environmental data. A key objective for project managers is to produce sufficient data of known and acceptable quality to make this decision-making more certain. The level of confidence that can be given to the collected data is dependent on: (1) determination, in advance of, the required types and uses of the data (this in turn determines the required quality of the data); (2) ongoing verification that the prescribed methods of gathering and analyzing the data are being followed; and (3) validation of the verified data to determine that the prescribed objectives of data quality have been met (this guarantees that the data are adequate to their intended use or uses). This paper focuses on the third element, the validation of data quality. The paper assumes that the first two elements, planning and verification, have been accomplished. The "who, why, when, and how" of data validation are discussed in general terms.

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A New Method for the Analysis of Small Peaks in Gamma Ray Spectra, and a Detector System for Monitoring Gamma Activity in Land Areas

CONF-891077; Decommissioning of Nuclear Installations, Proceedings of the 1989 International Conference, Brussels, Belgium, October 24-27, 1989, K. Pflugrad, R. Bisci, B. Huber, and E. Skupinski (eds.). Elsevier Applied Science, Barking, United Kingdom, 858 pp.; (pp. 325-334) (1990)

The report describes a collection of techniques, based on a Bayesian approach, that can be used to make inferences about spectral peak area, and hence about source activity, for radionuclide spectra in general, and for the spectra of gamma emitting radionuclides in particular. Also described is a data-adaptive moving array detector system for monitoring gamma activity remaining on the surface of a land area from which a nuclear installation has been removed or monitoring gamma activity buried in the land area.

890

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Evaluation of a Rapid Headspace Analysis Method for Analysis of Volatile Constituents in Soils and Sediments

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 919-926) (September 1991)

Contamination of the subsurface by volatile organic solvents is a common and significant environmental problem. A critical component of developing an accurate assessment of a site that is contaminated by these solvents is the acquisition of closely spaced, high quality contaminant-concentration data. Many volatile organics are relatively mobile in the subsurface. This mobility requires characterization of both horizontal and vertical contaminant migration. The volatile nature of these analytes, combined with the cost and effort typically required to perform quantitative analysis of them, has often compromised the number and quantity of analyses used in characterization studies. A headspace-analysis method was developed by Savannah River Laboratory to facilitate accurate and rapid delineation of the vertical and horizontal extent of volatile organic contamination in the subsurface. The method was designed to reduce sample handling, laboratory preparation, and analytical complexity. The headspace analysis method consists of four steps: (1) subsample the split spoon core immediately after opening the barrel, using a small tube/plunger system; (2) place the subsample into a 22.5 ml headspace vial; (3) add 5 ml of distilled water, and cap with a teflon-lined septum; and (4) analyze on a gas chromatograph. This method was developed and

modified as a result of multiple site investigations and has been applied to over 1500 samples. To evaluate the headspace analysis method, we collected over 100 samples from four borings at depths ranging from 5 to 140 feet. Samples were analyzed using the headspace method, and the results were compared to adjacent samples analyzed on site using U.S. Environmental Protection Agency (EPA) methods that were modified to minimize the loss of volatile constituents. The modified EPA method consisted of penthane extraction in a sealed vial after collection, weighing, and transfer to an on-site laboratory. The comparison analyses were performed by an independent organization. Despite the precautions incorporated in the modified EPA method, the analytical results indicate that sample transfers in the field and laboratory resulted in volatilization of most of the volatile solvents in the sediment samples. One limitation of the headspace method is that the sample cannot be diluted; thus very high concentrations are truncated by an upper limit of detection. In most cases, this truncation is not of practical significance because it occurs at relatively high concentrations (e.g., 100,000 ng/g). The results indicate that the headspace method minimized loss of volatiles associated with sample handling and provided large amounts of closely spaced data in a cost-effective manner. The headspace results can be generated rapidly and transferred to the field, such that informed decisions can be made during site characterization.

891

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Improved Techniques for Monitoring Well Screen Placement and Well Location

CONF-9010166; Waste Management and Environmental Restoration, Proceedings of the 1990 DOE Model Conference, Oak Ridge, TN, October 29-November 2, 1990, 343 pp.; (8 pp.) (1990)

Two of the most common problems encountered by a hydrogeologist during the design and scoping of a remedial investigation for a hazardous waste site are (1) the determinations of appropriate well location and (2) depth of the screened interval in the saturated zone. To compensate for the lack of sufficient information about a site, a hydrogeologist will commonly use a random approach to well placement. The random approach has several drawbacks that increase both the cost and time required to complete the remedial investigation. First, although the wells may provide initial information as to the absence or presence of contamination at a particular location and depth, their continued usefulness is purely dependent on their location with regard to potential contamination. Second, the random approach usually presumes that a certain percentage of the wells are sacrificial, because these wells completely miss the mark and additional wells will have to be installed to correct for the error. Third, many sponsors become agitated and aggressive when, after a very large initial drilling and sampling program, a second phase is necessary to fill data gaps that are the result of the evaluation of the first event. Last, the random approach usually requires more than one iteration of drilling. This process significantly delays any type of remedial alternative selection. This conference paper describes the remedial investigation at a site that incorporated field screening techniques to allow for optimum well location. The information gained from each well provided definition of the contaminant(s) and the location of contamination in the groundwater. This information was obtained in one field event rather than a series of successive phases.

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Automation of Geophysical Surveys Used in Assessment of Hazardous Waste

PNL-SA-18876;CONF-891053;Environmental Monitoring, Restoration and Assessment: What Have We Learned?, R.H. Gray (ed.), Proceedings of the 28th Hanford Life Sciences

Symposium, Richland, WA, October 16-19, 1989, 340 pp.; (pp. 67-74) (1989)

Researchers at Oak Ridge National Laboratory recently merged two technologies to automate the geophysical survey process. They used a Geonics EM-31 [TM] terrain conductivity meter to measure subsurface conductivity and to detect anomalies like water-filled trenches or buried water or gas lines. An ultrasonic ranging and data system was developed to locate a surveyor in a specified area, using triangulation with ultrasonic, time-lapse positioning. The surveyor's position was transmitted once per second to a microcomputer in the field. Simultaneously, the instantaneous measurement taken by the surveyor's portable instrument was transmitted to the microcomputer, using a radiofrequency link. Up to 3600 paired measurements and locations can be stored in the microcomputer for hourly analysis. This is a significant advance over conventional techniques, because more data can be stored with fewer errors. Furthermore, the data can be analyzed in the field. Output from the analysis includes report-ready tables, two dimensional contour plots, and the three-dimensional mesh plots. These plots show areas of subsurface conductivity while investigators are in the field. Additional data can be obtained quickly and cost-effectively.

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SOLID: A Computer Model for Calculating the Effective Dose Equivalent from External Exposure to Distributed Gamma Sources in Soil

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 889-890) (September 1991)

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

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Utilization of the Magnetic Induced Polarization Technique in Environmental Remediation Problems

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 583-588) (September 1991)

The magnetic induced polarization (MIP) method derives information relating to the induced polarization characteristics of the subsurface through measurements of the magnetic field. It can provide much greater resolving power than the conventional electrical induced polarization (EIP) method, which measures the electric field. The MIP method can be much more effective than the EIP method at providing information on buried targets in areas where there is a highly conductive overburden. Other advantages of the MIP method over the EIP method are: (1) less attenuation of signal strength with depth to the target area; (2) ease of field operation due to use of a magnetometer in place of two potential electrodes with accompanying cables and receiver; (3) absence of capacitive and electromagnetic coupling problems; and (4) avoidance of the problem of poor ground contact in dry, sandy, or gravelly soil. This paper reviews the MIP method and examines the applicability of the method to environmental remediation (ER) problems. Two identified areas

of application of the method in ER problems are: (a) monitoring leakage of heavy metals from recovery or treatment ponds of industrial waste water, and (b) detection of geologic faults under proposed sites for hazardous waste repositories or nuclear power plants. Further research is needed to study the effect of various nonmetallic contaminants on the membrane polarization effect of soil or rocks. Results of such a study will determine the applicability of the MIP technique to broad ER problems.

895
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National QA Standard for Environmental Programs for Hazardous Waste Management Activities

EPA/600/D-91/140; Proceedings of the Seventh Waste Testing and Quality Assurance Symposium, Washington, DC, July 9, 1991; (10 pp.) (May 15, 1991)

The cleanup of federally-owned facilities contaminated by mixtures of hazardous chemical and radioactive wastes involves critical decisions based on environmental data. Federal agencies are currently using several different standards or sets of requirements, including U.S. Environmental Protection Agency (EPA) guidance, for establishing the quality assurance and quality control (QA/QC) procedures for these sites. Shortcomings in these standards have led to efforts by several public- and private-sector groups to develop a uniform, consistent standard that produces the needed type and quality of environmental data in a more cost-effective manner. These efforts are being conducted under the auspices of the American Society for Quality Control (ASQC) and involve participation by EPA, the Department of Energy (DOE), Department of Defense (DOD), Nuclear Regulatory Commission (NRC), and others in the contractor and regulated communities. This paper describes the progress which has been made toward establishing a consensus standard and associated requirements for use by DOE, EPA, and others for hazardous waste management activities. It is expected that the proposed standard will provide the basis for a needed revision and expansion of EPA guidance.

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Effective Sample Labeling

PNL-SA-18876;CONF-891053;Environmental Monitoring, Restoration and Assessment: What Have We Learned?, R.H. Gray (ed.), Proceedings of the 28th Hanford Life Sciences Symposium, Richland, WA, October 16-19, 1989, 340 pp.; (pp. 327-330) (1990)

Ground-water samples collected for hazardous-waste and radiological monitoring have come under strict regulatory and quality assurance requirements as a result of laws such as the Resource Conservation and Recovery Act. To comply with these laws, the labeling system used to identify environmental samples had to be upgraded to ensure proper handling and to protect collection personnel from exposure to sample contaminants and sample preservatives. The sample label now used as the Pacific Northwest Laboratory is a complete sample document. In the event other paperwork on a labeled sample were lost, the necessary information could be found on the label.

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A Comparison of Shallow Electromagnetic and Magnetometer Surface Geophysical Techniques to Effectively Delineate Buried Wastes

CONF-9010166; Waste Management and Environmental Restoration, Proceedings of the 1990 DOE Model Conference, Oak Ridge, TN, October 29-November 2, 1990, 343 pp.; (24 pp.) (1990)

During the ground preparation for the construction of a building, buried drums were encountered and the construction was halted. Geophysical techniques were used to rapidly

delineate the location and extent of the waste. The results of the geophysical survey were used immediately to direct waste excavation. The primary objective of this paper is to compare two surface geophysical techniques, an electromagnetic conductivity meter (Geonics EM-31) and a proton precession magnetometer (Geometrics 856AA), and their use at a hazardous waste site containing paint and paint process wastes. The instrument responses were compared using statistics. Combined responses lead to an improved interpretation of the subsurface. The EM-31 was less affected by man-made surface features. This paper compares the anomalies seen in the geophysical data with field-verified physical and chemical features. The intent is to help the reader determine which instrument to use, given knowledge of the field conditions, and to aid in interpretation of anomalies.

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New Technique Lowers Costs of Environmental Sampling

DOE News (920701):1-2 (July 1, 1992)

Researchers at Oak Ridge National Laboratory have developed a versatile new analytical technique that can significantly lower the high cost of environmental sampling. The new technique is known as direct-sampling ion-trap mass spectrometry. The instrumentation involved fits in a standard passenger-size van, thus creating a sophisticated, portable laboratory. Using this technique, contaminants can be detected as the field sampling is being performed, resulting in significant savings. Pilot studies at the Savannah River Laboratory proved the field applications for water and soil testing.

899

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Efficiency-Based Groundwater Monitoring Design Using the Monitoring Efficiency Model (MEMO)

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 915-917) (September 1991)

An analytical Monitoring Efficiency Model (MEMO) has been developed to assist in the design of monitoring well networks at hazardous waste sites. The method simulates the migration of hypothetical contaminant plumes from a site and quantifies the efficiency of alternative well network designs in detecting the plumes. The computed efficiency provides a quantified basis for optimizing the design. Maps of the site are produced, showing areas where releases would or would not be detected by a given well network. This map-making function adds insight into the benefits of adding, deleting, or moving specific wells. MEMO is applied using a menu-driven computer program.

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Use of Models as a Rationale for the Design of Environmental Monitoring Programs

WSRC-RP-89-1352; CONF-900679; Proceedings of the 35th Annual Health Physics Society Meeting, Anaheim, CA, June 24-28, 1990; (20 pp.) (1989)

This discussion describes methods for using the output of comprehensive dose-assessment models to assist in developing a defensible rationale for determining environmental sample locations, sampling media, and radionuclides for analyses. Methods for using models and examples for a power reactor and a large diversified nuclear complex are included. The discussion focuses on thermoluminescent dosimeters and air, liquid, and groundwater monitoring. The use of modeling techniques serves as the basis for reducing empirical measurements.

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Results from the 1988 Quality Assurance Task Force Hanford Intercomparison Program

PNL-SA-18876;CONF-891053;Environmental Monitoring, Restoration and Assessment: What Have We Learned?, R.H. Gray (ed.), Proceedings of the 28th Hanford Life Sciences Symposium, Richland, WA, October 16-19, 1989, 340 pp.; (pp. 277-281) (1989)

Cooperative environmental sampling along the Columbia River at Hanford was conducted in September 1988. Sample collections included river sediment and water from the river and selected shoreline springs. Participants included the states of Washington and Oregon, the Washington Public Power Supply System, the Hanford Education Action League (represented by Search Technical Services), the U.S. Environmental Protection Agency, the U.S. Department of Energy (represented by Pacific Northwest Laboratory). This paper presents the sampling and analysis protocols and data analysis from the Columbia River sampling. Sampling results generally showed good agreement among the participants. This annual sampling and laboratory intercomparison activity have encouraged communication and promoted cooperation among the various organizations involved in environmental radiation monitoring at Hanford and has improved public confidence in these programs.

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Addressing Data Heterogeneity: Lessons Learned from a Multimedia Risk Assessment

ANL/CP-71902;CONF-910659;Proceedings of the 84th Annual Air and Waste Management Association Meeting and Exhibition, Vancouver, British Columbia, Canada, June 16-21, 1991; (27 pp.) (1991)

Cleanup activities are currently being conducted by the U.S. Department of Energy (DOE) at a former chemical plant site, the Weldon Spring Site, that has been inactive for more than 20 years. The Army produced nitroaromatic explosives at the 220-acre site during the 1940s, and radioactive materials of the uranium and thorium series were processed there by DOE's predecessor agency during the 1950s and 1960s. Chemical and radioactive contaminants are present in soil, surface water, sediment, and groundwater at the site as a result of both past releases and disposal activities and subsequent contaminant migration. Samples have been collected from these media over a number of years under both DOE's environmental monitoring program and the site characterization program of the Superfund process. Results of samples analyses have been compiled in a computerized data base. These data are being evaluated in the context of potential exposure pathways that are currently present at the site or that may be present in the future, in order to estimate possible adverse impacts to human health and the environment in the absence of cleanup. This paper discusses the methodology used to address associated tasks and the lessons learned during the assessment process. Statistical issues and recommended future directions for dealing with technical aspects of this project and with similar multimedia risk assessment projects are addressed in the final discussion.

903

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A Multiyear Quality Control Study of Alpha-Track Radon Monitors

Health Physics 62(1):87-90 (January 1992)

Since early 1987, quality control exposures of commercial alpha-track radon monitors have been conducted approximately weekly at the U.S. Department of Energy (DOE) Grand Junction Projects Office in support of DOE remedial action programs. The results of these exposures provide a historical record of the comparative performances of these radon monitors.

904

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Quality Assurance Elements in Environmental Restoration Procedures at Mixed-Waste Sites

CONF-910603; Proceedings of the 1991 American Nuclear Society Annual Meeting, Orlando, FL, June 2-6, 1991; Transactions of the American Nuclear Society 63:51-52 (1991)

Federal agencies require detailed quality assurance (QA) documentation in procedures for environmental restoration (ER) at mixed-waste sites. Quality assurance is a system for assuring the reliability of measurements which form the basis of ER decisions. The ER activities at mixed-waste sites include the collection of environmental samples which are analyzed for radioactivity and/or hazardous substances. Analytical results are compared with naturally occurring or ambient levels, or appropriate regulatory guidelines, to identify hazardous materials. Positive analytical results influence criteria for site remediation and Environmental Protection Agency (EPA)-mandated, human-health risk assessments. Since maximum allowable exposure is specified by federal law or agency directive, it follows that environmental measurements are closely scrutinized. Consistent application of QA principles to environmental measurements is vital. An easy-to-use protocol to select QA elements for inclusion in standard operating procedures (SOPs) for ER activities was developed. Two single-page tables are presented, which together propose paragraph headings and associated QA elements. Writers of SOPs should thoroughly review the functions to be prescribed and carefully select QA elements for inclusion.

REMEDIAL ACTION ASSESSMENT AND DECISION-MAKING

905
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Strategy for Integrated CERCLA/NEPA Risk Assessments

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 853-860) (September 1991)

The U.S. Department of Energy (DOE) has established a policy whereby, for remedial actions, the procedural and documentational requirements of the National Environmental Policy Act (NEPA) are integrated with those of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended. However, the objectives of risk assessment under NEPA and CERCLA differ somewhat. Until its recent application to contaminated sites, NEPA analysis has typically been applied to impacts from actions at clean sites (e.g., for construction activities), and a somewhat loosely structured process has historically been used to estimate relative risks for NEPA. Decisions such as cleanup levels were not made on the basis of risk estimates, and therefore tended to be conservative and not detailed. In contrast, risk estimates for Superfund (CERCLA) sites are used to focus the decision-making process for those sites and support national prioritization for cleanup. The U.S. Environmental Protection Agency (EPA) has developed a detailed framework for preparing baseline health-risk assessments for these sites. The purpose of this paper is to discuss the issues relating to integrating the CERCLA and NEPA approaches into the risk assessments that have been prepared for a DOE remedial action project at the Weldon Spring Site near St. Charles, Missouri. These issues are grouped into three basic categories: general assumptions for the impact evaluation, data management, and presentation of the methodology and results. This paper is not intended to represent DOE policy and guidance, nor does it represent the only approach that can be used for integrated risk assessments. It merely discusses the process that was used for the Weldon Springs project, articulating the issues that were encountered and how they were addressed.

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Expert Reasoning within an Object-Oriented Framework

PNL-SA-19779; CONF-9110269; Proceedings of the 1991 Northcon Conference, Portland, OR, October 1-3, 1991; (7 pp.) (October 1991)

A large number of contaminated waste sites across the United States await site remediation efforts. These sites can be physically complex, composed of multiple and possibly interacting contaminants that are distributed throughout one or more media. The Remedial Action Assessment System (RAAS) is being designed and developed to support decisions concerning the selection of remediation alternatives. The goal of this system is to broaden the consideration of remediation alternatives, while reducing the time and cost of making these considerations. The Remedial Action Assessment System was designed and constructed using object-oriented techniques. It is a hybrid system which uses a combination of quantitative and qualitative reasoning to consider and suggest remediation alternatives. The reasoning process that drives this application is centered around an object-oriented organization of remediation technology information. This paper briefly describes the waste remediation problem and then discusses the information structure and organization that RAAS utilizes to address it.

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Cooperative Expert System Reasoning for Waste Remediations

PNL-SA-18836; CONF-911289; Expert Systems, Proceedings of the World Congress Conference, Orlando, FL, December 16-19, 1991; (10 pp.) (December 1991)

The U.S. Department of Energy (DOE) is facing a large task in completing Remedial Investigations and Feasibility Studies (RI/FS) for hazardous waste sites across the nation. One of the primary objectives of an RI/FS is the specification of viable sequences of technology treatment trains which can provide implementable site solutions. Presented is a methodology which integrates expert system technology within an object-oriented framework to create a cooperative reasoning system designed to provide a comprehensive list of these implementable solutions. The system accomplishes its goal of specifying technology trains by utilizing a "team" of expert-system objects. The system distributes the problem solving among the individual expert objects, and then coordinates the combination of individual decisions into a joint solution. Each expert object possesses the knowledge of an expert in a particular technology. An expert object can examine the parameters and characteristics of the waste site, seek information and support from other expert objects, and then make decisions concerning its own applicability. This methodology has at least two primary benefits. First, the creation of multiple expert objects provides a more direct mapping from the actual process to a software system, making the system easier to build. Second, the distribution of the inferencing among a number of loosely connected expert objects allows for a more robust and maintainable final product.

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Remedial Action Assessment System (RAAS) - A Computer-Based Methodology for Conducting Feasibility Studies

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 783-787) (September 1991)

Because of the complexity and number of waste sites requiring cleanup, the U.S. Department of Energy (DOE) is supporting the development of a computer-based methodology to streamline the remedial investigation/feasibility study process required for DOE operable units. DOE operable units are generally complex in nature because of the existence of multiple waste sites within many of the units and the presence of mixed radioactive and hazardous chemical wastes. Consequently, Pacific Northwest Laboratory is developing the Remedial Action Assessment System (RAAS) which is intended to screen, link, and evaluate established technology process options to support the conduct of feasibility studies under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). It is also intended to do the same in support of studies of corrective measures required by the Resource Compensation and Recovery Act (RCRA). The computer interface with the user in the RAAS project is designed to be friendly, intuitive, and interactive. It employs menus, windows, help features, and graphical information. During operation, each waste technology process option is represented by an "object" module. For example, the concentration of a contaminant exiting a treatment process, such as an incinerator, will be determined in the object module as a function of the input concentration, the residence time in the unit process, and the operating temperature. Object-oriented programming is then used to link these unit processes into remedial action alternatives. In this way, various object modules representing technology process options can communicate with each other to develop a linked set of compatible processes forming an appropriate remediation alternative. Once the remedial alternatives are formed, they can be evaluated in terms of effectiveness, implementability, and cost, RAAS will access a user-selected risk assessment code to determine the reduction of risk after remedial action by each recommended alternative. The methodology will also help determine implementability of the remedial alternatives at the site and access cost estimating tools to provide estimates of capital, operating, and maintenance costs. This paper presents the characteristics of two RAAS prototypes being developed. These include the RAAS Technology Information System, which accesses information on 88 remedial technologies in graphical, text, and tabular forms, and the main RAAS methodology, which screens, links, and evaluates appropriate remedial processes.

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Baseline Risk Assessment Methodology for Mixed Waste

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 295-299) (September 1991)

The presence of mixed chemical and radioactive waste introduces several complex issues into a baseline risk assessment. A five-stage, serial methodology consistent with Department of Energy orders and Environmental Protection Agency regulations is available for the evaluation of risk at these disposal sites. The five stages are: (1) release scenario, (2) source term definition, (3) constituent transport, (4) exposure assessment, and (5) risk characterization. The model considers a variable level of detail (simple to complex) when determining risk, depending on the constituent concentration and exposure levels found. This approach minimizes the effort needed to determine constituent exposure by avoiding complicated models requiring detailed input and complex computation when that level of sophistication is not necessary. While many questions remain concerning the combined effects of radiation and chemicals on cancer, this paper proposes preliminary guidelines for the assessment of combined radiological and nonradiological risk.

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Innovative Investigation Methodologies and Techniques for Site Characterization

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 413-414) (September 1991)

During the past five years, increased emphasis has been placed on the cost of hazardous waste investigations, the length of time of the investigations, and the validity of investigation data after the field work is completed. For example, on average, 50 percent or more of the cost of these investigations is related to chemical analysis of the various media. Remedial investigations of sites on the National Priorities List average over three years long. Once a field program is planned and identified, the regulators usually require that all data collected be of the highest quality. This means that all data must be collected and analyzed using Contract Laboratory Protocols and Level IV data validation procedures. This level of data quality often increases the cost of the field investigation, the number of samples required, and the length of the field program. The Hazardous Waste Remedial Action Program (HAZWRAP) has developed an investigatory program that incorporates new field methods, new technologies, and new approaches to address these issues. This paper describes certain components of this program and how they were implemented. The HAZWRAP program includes effective use of (1) groundwater sampling through the HydroPunch (Registered Trademark) and screened auger; (2) piezometers and open borehole sampling for site characterization; (3) a mobile cone penetrometer coupled with groundwater sampling from a HydroPunch; (4) subsurface soil or vadose zone sampling through the Terra Probe (Registered Trademark); and (5) the Rotosonic (Registered Trademark) drilling method, which collects a 3 meter long disturbed core of consolidated or unconsolidated material in less than 10 seconds. Other technologies that HAZWRAP has used, but has not yet determined their effectiveness, include (a) the SEAMIST (Registered Trademark) vadose zone and groundwater sampling system; (b) horizontal well construction for groundwater remediation; (c) a field gas chromatograph/mass spectrometer with ion trap, for more accurate identification and quantification of contaminants; (d) dual-wall, reverse, air-rotary drilling techniques; and (e) the collodial boroscope, for the in situ determination of hydrogeologic properties, including groundwater flow direction and hydraulic conductivity.

911
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Object Reasoning for Waste Remediation

PNL-SA-19490; Proceedings of the National American Institute of Chemical Engineers Summer Meeting, Pittsburgh, PA, August 20-22, 1991; 21 pp. (August 1991)

A large number of contaminated waste sites across the United States await sizeable remediation efforts. These sites can be physically complex, composed of multiple, possibly interacting, contaminants distributed throughout one or more media. The Remedial Action Assessment System (RAAS) is being designed and developed to support decisions concerning the selection of remediation alternatives. The goal of this system is to broaden the consideration of remediation alternatives, while reducing the time and cost of making these considerations. The Remedial Action Assessment System is a hybrid system, designed and constructed using object-oriented, knowledge-based systems, and structured programming techniques. RAAS uses a combination of quantitative and qualitative reasoning to consider and suggest remediation alternatives. The reasoning process that drives this application is centered around an object-oriented organization of remediation technology information. This paper describes the information structure and organization used to support this reasoning process. In addition, the paper describes the level of detail of the technology related information used in RAAS, discusses required assumptions and procedural implications of these assumptions, and provides rationale for structuring RAAS in this manner.

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Remedial Action Assessment System: Decision Support for Environmental Cleanup

PNL-SA-19511; CONF-9111176; Artificial Intelligence, Proceedings of an International Symposium, Cancun, Mexico, November 13-15, 1991; (10 pp.) (November 1991)

A large number of hazardous waste sites across the United States await treatment. Waste sites can be physically complex entities composed of multiple, possibly interacting contaminants distributed throughout one or more media. The sites may be active as well, with contaminants escaping through one or more potential escape paths. Treatment of these sites requires a long and costly commitment involving the coordination of activities among several waste treatment professionals. In order to reduce the cost and time required for the specification of treatment at these waste sites, the Remedial Action Assessment System (RAAS) was proposed. RAAS is an automated information management system which utilizes a combination of expert reasoning and numerical models to produce the combinations of treatment technologies, known as treatment trains, which satisfy the treatment objectives of a particular site. In addition, RAAS supports the analysis of these treatment trains with regard to effectiveness and cost so that the viable treatment trains can be measured against each other. The Remedial Action Assessment System is a hybrid system designed and constructed using object-oriented tools and techniques. RAAS is advertised as a hybrid system because it combines, in integral fashion, numerical computing (primarily quantitative models) with expert-system reasoning. An object-oriented approach was selected due to many of its inherent advantages, among these the naturalness of modeling physical objects and processes.

913
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Determining the Number of Samples Required for Decisions Concerning Remedial Actions at Hazardous Waste Sites

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 195-198) (September 1991)

An important consideration for every risk analyst is how many field samples should be taken so that scientifically defensible decisions can be made concerning the need for remediation of a hazardous waste site. Since any plausible remedial action must, at minimum, satisfy the condition of protectiveness of human and environmental health, this paper suggests a risk-based approach for determining the number of samples to take during remedial investigations, rather than using more traditional approaches such as considering background levels of contamination or federal or state cleanup standards. A statistical methodology is developed and tested for deriving a risk-based sample size. The approach relates maximum mean concentration for each contaminant in a sample area to a criterion concentration and a minimum detectable relative difference. The methodology was tested using soil sample data collected at a hazardous waste site in the Oak Ridge Reservation contaminated with cyanide, mercury, nickel, barium, and zinc. The sample size is calculated in terms of minimum acceptable confidence and power levels. Assumptions are based on U.S. Environmental Protection Agency reference doses for each contaminant and estimates for soil ingestion.

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Remedial Action Decision Process

CONF-900225; WATTec '90: Global Competitiveness - Managing Technology, Proceedings of the 17th Annual Technical Conference and Exhibition, Knoxville, TN, February 20-23, 1990, 78 pp.; (p. 36) (1990)

Although the Superfund remedial-action decision process is a complex process involving a variety of technical, political, and public-health issues, the primary goal of remedial action is the protection of public health. The author performed an in-depth analysis of 50 post-SARA Records of Decision in order to characterize the role of risk assessment in the decision-making process and determine whether decisions are being made in an effective and environmentally protective manner. Findings indicate that the majority of decisions to remediate Superfund sites are based on the existence of contamination per se and not on actual public health risk. Although hypothetical risk is an essential consideration, this gray area is not well-defined in the current decision-making process. The lack of an assessment of the degree of risk reduction that is associated with the remedial alternatives evaluated and the lack of support that indicates the effectiveness of the remedial alternatives selected also constitute major weaknesses in the majority of decisions. These inadequacies undermine rationales regarding the protectiveness and cost-effectiveness of the remedial alternatives selected. The fact that objectives which go beyond addressing public health risk are often unclear in the decision-making process also weakens the rationale of the cost-effectiveness of the selected remedies.

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Comparison of Statistical Methods for Estimating Plutonium Inventories in Soil

PNL-SA-18876;CONF-891053;Environmental Monitoring, Restoration and Assessment: What Have We Learned?, R.H. Gray (ed.), Proceedings of the 28th Hanford Life Sciences Symposium, Richland, WA, October 16-19, 1989, 340 pp.; (pp. 241-248) (1990)

Several statistical methods have been used to estimate the total plutonium inventory in contaminated surface soil on the Nevada Test Site, including systematic sampling, importance sampling, stratified random sampling, and two forms of kriging. In computer simulation experiments to compare these methods, systematic sampling using regular and preferential grids gave accurate and precise inventory estimates. However, the difficulty in estimating sampling variance from a single sample is a major drawback in field applications. Although importance sampling and stratified random sampling allowed estimation of sampling error, these methods gave less precise results than grid samples, and were harder to use. Inventory estimates from kriging were biased, and kriging variances were not representative of true sampling variability. Kriging

may not be appropriate where contaminant levels change rapidly over short distances.

916
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Release Criteria and Pathway Analysis for Radiological Remediation

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 265-270) (September 1991)

Site-specific activity concentrations were derived for contaminated soils at four different sites using the U.S. Department of Energy (DOE) pathway analysis computer code RESRAD. The first two sites had been contaminated with mixed fusion products (Cesium-137 and Strontium-90), and had undergone remediation. The activity concentrations and other radiological parameters, such as limits on background-subtracted gamma-exposure rate, were used as the basis to arrive at release criteria for these two sites. Valid statistical parameters, calculated for the distribution of radiological data obtained from site surveys, were then compared with the criteria to determine releasibility or need for further decontamination. The other two sites contained residual contamination from uranium ore and ore processing residues. For these sites, RESRAD was used as a preremediation planning tool to derive residual material guidelines for uranium.

917
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The Use of Chemical and Radionuclide Risk Estimates in Site Performance Evaluation of Mixed Waste Sites

CONF-880839; Site Performance Assessment - Session 2, Proceedings of the Tenth Annual Department of Energy Low-Level Waste Management Conference, Denver, Colorado, August 30-September 1, 1988, 161 pp.; (pp. 148-161) (December 1988)

Many radioactive-waste sites contain not only radioactive material but also varying amounts of chemical waste. The use of procedures necessary to remediation of these wastes implies some risk at any exposure level, and thus requires that an exposure level be determined that corresponds to an acceptable risk to an individual or a population. Although the uncertainties and limitations of these risk assessment methods are of concern, the assumption has been generally adopted that the human dose response for all carcinogens is linear, with no threshold occurring at low levels of exposure. With the move toward decontamination programs and clean-up of various mixed waste sites throughout the U.S., there is interest in the possibility that risk estimates calculated individually for radionuclides and for chemicals may be combined to reflect the total risk for each site. The purpose of this paper is to examine the feasibility of combining risk estimates during risk/benefit analyses. For a variety of reasons, the state of radiation risk assessment is more advanced than that of chemical risk assessment. The reasons for this disparity are summarized in this paper. Quantitative radiation risk assessment is currently being performed, but involves a high degree of uncertainty. Chemical risk assessment in general does not allow quantitative results bracketed by uncertainty analysis. Therefore, it is concluded that it is currently not possible to develop a useful, quantitative, combined risk assessment for a mixed waste-site, but that it may be possible to develop such a capability in the future.

918
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The Additivity of Radionuclide and Chemical Risk Estimates in Performance Evaluation of Mixed-Waste Sites

PNL-SA-18876;CONF-891053;Environmental Monitoring, Restoration and Assessment: What Have We Learned?, R.H. Gray (ed.), Proceedings of the 28th Hanford Life Sciences Symposium, Richland, WA, October 16-19, 1989, 340 pp.; (pp. 207-218) (1989)

Methods for assessing radioactive waste sites that contain chemical constituents are in the formative stages. In evaluating these sites, a key concern will be the hazard to personnel involved in cleanup work and to the general population. This paper focuses on what researchers have learned from pathway analysis and risk assessment about providing a combined estimate of risk from exposure to both chemicals and radionuclides. Quantitative radiation risk assessment involves a high degree of uncertainty. Chemical risk assessment generally does not provide quantitative results. Thus currently it is not possible to develop a useful, quantitative, combined risk assessment for mixed-waste sites.

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Assessing Exposures and Risks in Heterogeneously Contaminated Areas: A Simulation Approach

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 871-876) (September 1991)

The U.S. Department of Energy (DOE) is responsible for cleanup activities at a number of facilities under its Environmental Restoration and Waste Management Program (EM), including the Weldon Spring Site in Missouri. The major goals of the EM program are (1) to eliminate potential hazards to human health and the environment that come from contamination at these sites and (2) to make surplus real property available for other uses. The assessment of baseline health risks and ecological impacts that may come from a contaminated site is an important component of the remedial investigation/feasibility study (RI/FS) process, which is required at all Superfund sites. This paper describes one phase of the baseline assessment through the example of the characterization of human health risks associated with exposure to chemical contaminants in air and on interior building surfaces in a contaminated structure on the Weldon Spring Site. The model combines data on human activity patterns in a particular microenvironment within a building, a 60 meter by 110 meter one-story cinderblock structure, with data on contaminant concentrations in that microenvironment to calculate personal exposure profiles and risks within the building. The results of the building assessment are presented as probability distribution functions and cumulative distribution functions, which show the variability and uncertainty in the risk estimates.

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Stochastic Model for Estimating Personal Exposures in Contaminated Buildings at Superfund Sites

ANL/CP-71887;CONF-910659;Proceedings of the 84th Annual Air and Waste Management Association Meeting and Exhibition, Vancouver, British Columbia, Canada, June 16-21, 1991; (13 pp.) (1991)

A hazardous waste site can pose threats to human health via transport of on-site contaminants through environmental media to human receptors. The U.S. Environmental Protection Agency (EPA) has developed a framework for assessing these potential threats in order to support Superfund cleanup decisions on the basis of risk. Cleanup activities are currently being conducted by the U.S. Department of Energy (DOE) at a contaminated site consisting of a chemical plant area that has been inactive for more than 20 years and a noncontiguous quarry that was used for waste disposal. An integral part of the CERCLA/NEPA process is the preparation of a comprehensive

baseline assessment of human health and environmental impacts to support decision making for site cleanup. This paper focuses on one component of the baseline assessment prepared for the site in order to highlight the potential effects on exposure estimates that result from varying the exposure assumptions. This component is the characterization of human health risks associated with potential exposure to PCBs in one of the contaminated buildings. Because of the heterogeneous nature of the PCB contamination, a stochastic approach was used to account for the variability in possible exposures. This paper describes the mathematical model that was used to quantify human exposures and risks associated with ingestion, inhalation, and dermal absorption of PCBs in air, dust, and spills on floors and benches in the building. The model explicitly accounts for contaminant heterogeneity and simulates the movement of a person through several microenvironments within the building.

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A Framework for Evaluating Innovative Statistical and Risk Assessment Tools to Solve Environmental Restoration Problems

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 271-275) (September 1991)

Environmental restoration activities at the U.S. Department of Energy (DOE) Hanford Site face complex problems due to a history of varied past contaminant disposal practices. Data collection and analysis required for site characterization, pathway modeling, and remediation-method selection decisions must deal with inherent uncertainties and unique problems associated with the restoration. This paper presents a framework for selecting appropriate statistical and risk assessment methods that can be applied to the restoration problem. Using an example, it follows the selection process from option identification to statistical tools identification and selection. The paper makes several points. Pathway modelers and risk assessors often refer to statistical methods but do not include tools selection in the early planning phases of a project. Statistical tools selection and development are problem-specific and often site-specific. The right tool, applied correctly, can minimize sampling costs, get as much information as possible out of existing data, provide consistency and defensibility for the results, and give structure and quantitative measures to decision risks and uncertainties. A framework for selecting and applying the right tools consists of developing an options matrix for evaluating a set of potential remediation options. Knowing these options and setting objectives for the quality of the data to be collected, a statistical tools matrix for tools selection can be developed. Applying the tools and iterating through the steps in the framework allows the remediation project manager to make a decision, at a quantifiable risk level, and be able to statistically defend the decision.

922

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A Risk-Based Cleanup Criterion for PCE in Soil

CONF-9010166; Waste Management and Environmental Restoration, Proceedings of the 1990 DOE Model Conference, Oak Ridge, TN, October 29-November 2, 1990, 343 pp.; (12 pp.) (1990)

The most important attribute of a chemical contaminant at a hazardous-waste site that decision makers must consider when they evaluate cleanup strategies for that contaminant is the potential risk resulting from human exposure to the contaminant. For this reason, researchers at Lawrence Livermore National Laboratory have developed a strategy for establishing a risk-based cleanup criterion for chemicals in soil. In this paper, they describe this strategy by presenting a cleanup criterion for tetrachloroethylene (PCE) in soil associated with a representative California landscape. They begin by discussing the environmental-fate and transport mode that they

used to predict the equilibrium concentration of PCE in five environmental media from a steady-state source in soil. Next, they explain the concept and application of (1) pathway-exposure factors (PEFs), (2) the hazard index, and (3) cancer-potency factors (CPFs) for translating the predicted concentrations of PCE into estimated potential risk for hypothetically exposed individuals. Finally, they define the relationship between contaminant concentration and an allowable level of risk, and discuss the societal and financial implications of this relationship.

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Role of Risk Assessment in Remediation of Contaminated Sites

ANL/CP-72892; CONF-9106239; Proceedings of the Eleventh International Association for Impact Assessment Annual Meeting, Champaign, IL, June 7-11, 1991; (8 pp.) (1991)

Even though risk assessment is an essential consideration in remediation projects involving radioactive or hazardous waste sites, its role is often unclear and it is not fully utilized in the decision-making process. Risk assessment is an integral part of the remediation process and should play an important role from beginning to end, i.e., from planning stages to verification survey after the cleanup. A conceptual model with complete pathways of exposure and based on site-specific conditions is key to a successful risk assessment. A baseline comparison with existing standards determines, along with other factors, whether a site requires remediation. Risk assessment plays a role in setting priorities between sites and in setting cleanup standards for certain contaminants at a site. Matching the extensiveness and effectiveness of remediation to the degree of risk is important in the decision-making process. Often, the applicable technologies can be screened through risk assessment, and the potential remedial alternatives evaluated in terms of risk reduction. After a remedial action is complete, its effectiveness can be judged via verification surveys, and any predicted future risk from residual concentrations of contaminants can be left at the site. This paper provides an overview of the risk-assessment process, its role in remediation projects, and the generic methodology for risk assessment.

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A Risk Computation Model for Environmental Restoration Activities

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 261-264) (September 1991)

A risk computation model useful in environmental restoration activities was developed for the U.S. Department of Energy. This model, the Multimedia Environmental Pollutant Assessment System (MEPAS), can be used to evaluate effects of potential exposures over a broad range of regulatory issues, including radioactive carcinogenic, nonradioactive carcinogenic, and noncarcinogenic effects. MEPAS integrates risk computation components. Release, transport, dispersion, deposition, exposure, and uptake computations are linked in a single system for evaluation of air, surface water, ground water, and overland flow transport. MEPAS uses standard computation approaches. Whenever available and appropriate, U.S. Environmental Protection Agency guidance and models were used to facilitate compatibility and acceptance. MEPAS is a computational tool that can be used at several phases of an environmental restoration effort. At a preliminary phase in problem characterization, potential problems can be prioritized. As more data become available, MEPAS can provide an estimate of baseline risks or evaluate environmental monitoring data. In the feasibility phase, MEPAS can compute risk from alternative remedies. However, MEPAS is not designed to replace a detailed risk assessment of the selected remedy. For major problems, it is appropriate to use a more detailed risk computation tool for a detailed, site-specific evaluation of the selected remedy.

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Recent Developments in Health Risks Modeling Techniques Applied to Hazardous Waste Site Assessment and Remediation

CONF-9010166; Waste Management and Environmental Restoration, Proceedings of the 1990 DOE Model Conference, Oak Ridge, TN, October 29-November 2, 1990, 343 pp.; (1 p.) (1990)

Remediation of hazardous and mixed-waste sites is often driven by assessments of human health risks posed by exposures to the hazardous substances released from these sites. The methods used to assess potential health risk involve, either implicitly or explicitly, models for pollutant releases, transport, human exposure and intake, and characterizing health effects. Because knowledge about pollutant fate and transport processes at most waste sites is quite limited and data costs are quite high, most of the models currently used to assess risk that are endorsed by regulatory agencies are quite simple. The models employ many simplifying assumptions about pollutant fate and distribution in the environment, human pollutant intake, and toxicologic responses to pollutant exposures. An important consequence of data scarcity and model simplification is that risk estimates are quite uncertain. Estimates of the magnitude uncertainty associated with risk assessment has been very difficult. A number of methods have been developed to address the issue of uncertainty in risk assessment in a manner that realistically reflects uncertainty in model specification and data limitations. These methods include (1) definition of multiple exposure scenarios, (2) sensitivity analyses, and (3) explicit probabilistic modeling of uncertainty. Recent developments in this area will be discussed, along with their possible impacts on remediation programs and remaining obstacles to their wider use and acceptance by the scientific and regulatory communities.

926
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The Application of Quantitative Risk Assessment to Assist in Evaluating Remedial Action Alternatives

Hazardous Materials Control, Hazardous Materials Control Research Institute, Silver Spring, MD, 98 pp.; (pp. 34-37) (1990)

This paper reports on the application of a quantitative risk assessment employed to evaluate the cost-effectiveness of remedial action alternatives. A four-stage cancer model was employed to evaluate the risk of ingesting groundwater contaminated with four carcinogenic chemicals to the exposed population. Three remedial actions were evaluated (including no-action) to assess the level of risk reduction following implementation. Baseline risk was evaluated as the equivalent of 14 excess cancers over the 30-year exposure period studied during the analysis. Under the implementation of the remedial alternatives, the baseline risk was reduced by 58% using a groundwater treatment system and 72% using a containment wall and groundwater treatment system. The net present value costs for each system are calculated, and the marginal costs for implementation are compared with the incremental reduction in cancer risk. The results suggest that the marginal costs for implementing the more costly alternative should be examined carefully in terms of expenditures per number of incidents avoided.

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Finding a Compromise Between Chemical and Radiological Risk Assessment Methods for Mixed Waste Sites

CONF-9010166; Waste Management and Environmental Restoration, Proceedings of the 1990 DOE Model Conference, Oak Ridge, TN, October 29-November 2, 1990, 343 pp.; (1 p.) (1990)

The purpose of this paper is to: (1) outline the fundamental similarities and differences between the presently accepted radiological and chemical

risk-assessment methods; (2) examine the significant differences in analytical results and decision making that can result if either method is used to the exclusion of the other; and (3) to suggest a hybrid method that utilizes the strong points of each to arrive at a balanced contaminant-impact data base for decision making. The approach taken to facilitate these comparisons is to quantitatively assess the collective risk at a simplified site that is contaminated with a short list of chemicals and radionuclides. The site is first assessed using the suggested Superfund toxic chemical methodology for both chemicals and radionuclides, followed by the same analysis using accepted radiological methods for both contaminant categories. Both the methods and the results of these calculations are compared and contrasted. Logical mitigation decisions that might result from each set of calculations are examined. The same site is finally analyzed using a method that incorporates the best of both of the previously used methods, and the results are analyzed on the basis of the decision-making utility of the results. Conclusions are drawn relative to topics of prime importance. These topics are: (1) acceptable risk bases, (2) key assumptions, (3) statistical inputs, (4) prioritizing contaminants, (5) environmental models, (6) cumulative risk, and (7) risk assessments for non-human receptors.

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Health-Based Cleanup Goals at Hazardous Waste Sites: Implications for Risk Management

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 389-392) (September 1991)

The challenge of setting realistic and well-defined remediation goals at hazardous waste sites is not being met. The majority of remedial alternatives are being selected without adequate evidence of their effectiveness and permanence. Remediation goals are being set that are not technically achievable. To correct this situation, the U.S. Department of Energy should focus on the fundamental areas of setting priorities in the remediation process and developing and selecting effective and permanent remedial alternatives.

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U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, DC

Risk Assessment Guidance for Superfund - Volume 1: Human Health Evaluation Manual - Part B, Development of Risk-Based Preliminary Remediation Goals - Interim Report

OSWER Directive 9285.7-01B; 66 pp. (December 1991)

The document is one of a three-part series. Part B provides guidance on using U.S. Environmental Protection Agency toxicity values and exposure information to derive risk-based preliminary remedial goals (PRG) for a Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) site. Initially developed at the scoping phase using readily available information, risk-based PRGs generally are modified based on site-specific data gathered during the remedial investigation/feasibility study. The guidance does not discuss the risk management decisions that are necessary at a CERCLA site. The potential users of Part B are those involved in the remedy selection and implementation process, including risk assessors, risk assessment reviewers, remedial project managers, and other decision-makers.

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U.S. Environmental Protection Agency, Washington, DC

Superfund Exposure Assessment Manual

EPA/540/1-88/001; OSWER Directive 9285.5-1; 168 pp. (April 1988)

The analytical process outlined in the Superfund Exposure Assessment Manual provides a

framework for the assessment of exposure to contaminants at or migrating from uncontrolled hazardous waste sites. The application of both monitoring and modeling procedures to the exposure assessment process is outlined. This process considers all contaminant releases and exposure routes and assures that an adequate level of analytical detail is applied to support the human health risk assessment. The analytical process is structured in five segments: (1) analysis of contaminant releases from a subject site into environmental media; (2) evaluation of the transport and environmental fate of the contaminants released; (3) identification, enumeration, and characterization of potentially exposed populations; (4) integrated exposure analysis; and (5) uncertainty analysis. This manual supports the development of exposure assessments that are consistent from site to site, and provides a means of documenting that each site receives adequate evaluation. The procedures presented reflect state-of-the-art methods for conducting an exposure assessment. However, it is important for the analyst to realize that exposure assessment is a developing science. Although the overall protocol for conducting exposure assessments at Superfund sites will not change significantly over time, and the parameters needed as input to the analysis are not likely to change, alternative analytical methods may be developed for many parts of the assessment. The methods presented in this manual can serve as a benchmark against which such new methods can be compared.

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Standardized Radiological Hazard Analysis for a Broad-Based Operational Safety Program

LA-UR-91-3501; CONF-920501; Proceedings of the Eighth International Radiation Protection Association Conference, Montreal, Quebec, Canada, May 17-22, 1992; (5 pp.) (1992)

The Radiological Hazard Analysis (RHA) Manual provides a methodology and detailed guidance for the systematic analysis of radiological hazards which may be encountered over a broad spectrum of program functions that are housed in a wide variety of facilities. Radiological programs at Los Alamos National Laboratory include: (1) research and experimentation, (2) routine materials operations, (3) production, (4) non-destructive examination or testing, (5) isotope and machine-produced radiations, (6) chemistry, and (7) metallurgy. The RHA permits uniform evaluation of hazard types over a range of several orders of magnitude of hazard severity. The results are used to estimate risk, evaluate types and level or resource allocations, identify deficiencies, and plan corrective actions for safe working environments.

932

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RESRAD Analysis of the Validity of Generic Limits on Residual Uranium-238 Radioactivity in Soil

CONF-910603; Proceedings of the 1991 American Nuclear Society Annual Meeting, Orlando, FL, June 2-6, 1991; Transactions of the American Nuclear Society 63:54-56 (1991)

Unrestricted use of sites contaminated by radioactive material requires that an acceptable level of residual radioactive contamination (in picocuries per gram of soil) be determined. Acceptable levels often are stated by regulatory bodies as residual isotope concentrations generic across all sites. For example, the past U.S. Nuclear Regulatory Commission position on residual depleted uranium in soil was 35 pCi/g for unrestricted site release. The goal of this study is to show, using calculational methods typically employed in cleanup studies, that generic residual contamination limits may not provide consistent levels of protection to future site residents. Site-specific analysis containing conservative site use assumptions should be performed to ensure minimal future health risks. This study investigated three different sites contaminated with equal U-238 concentrations (35 pCi/g of soil). Results were calculated using the U.S. Department of Energy code RESRAD, which employs pathway analysis methods to determine radionuclide uptake, performs dose calculations using ICRP-30

methods, and provides output at user-selected time intervals. The dose calculations used dose conversion factors that would, for each pathway, maximize the dose received from that pathway. The output selected for this study was the annual effective dose equivalent (AEDE) to the maximally exposed individual.

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Effect of Radon Dose on Cleanup Criteria and Using RESRAD for Chemical Risk Assessment

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 833-837) (September 1991)

The U.S. Department of Energy has used RESRAD, a pathway analysis program developed at Argonne National Laboratory, in conjunction with the as-low-as-reasonably achievable (ALARA) principle to develop site-specific residual radioactive material guidelines (cleanup criteria) for radionuclides in soils at many sites. This study examines the effects of the radon pathway, recently added to the RESRAD program, on the calculation of uranium, radium, and thorium cleanup criteria. The results show that the derived uranium guidelines will not be affected by radon ingrowth considerations. The effect of radon on radium and thorium generic guidelines are more significant, but the model does indicate that at the generic soil limits used for radium and thorium, the indoor radon decay-product concentrations would be below the 0.02 working level standard. This study also examines the feasibility of applying RESRAD to chemical risk assessment. The results show that RESRAD can perform risk assessment of toxic chemicals after simple modifications. Expansion of the RESRAD database to include chemical compounds will increase its capability to handle chemical risk assessments.

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Methodology for Conducting a Performance Assessment of an Engineered Disposal Facility

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 283-289) (September 1991)

A performance assessment of an engineered disposal facility (EDF) or a waste storage facility (WSF) can be performed in such a way that the results are easily used to meet design, maintenance, and overall planning requirements. The information acquired in a performance assessment can be applied to existing systems or new designs to provide the necessary information for evaluating cost, benefits, and risks posed to workers and the public. This paper describes a method for conducting a performance assessment on an EDF at the Fernald Site (FS), located near Cincinnati, Ohio. The method incorporates a probability-based risk assessment for the EDF and potential releases with an EPA-based risk approach for ultimate exposure and risk analysis. The results of the performance assessment methodology are provided in the form of risk estimates for failure and the associated impacts of such a failure. The impacts of a release and the resulting risks can be represented in a number of ways, from the probability of cancer incidence or fatalities to the long-term costs of reducing exposures. Utilizing the probability-based methodology coincident with the typical EPA approach provides results in the form of probability and risk curves. These curves illustrate the range of possible outcomes along with estimates of the probability of a specific result. The potential impacts are then categorized in terms of both the probability of occurrence and the probability of a specific consequence.

TECHNOLOGY DEVELOPMENT AND EVALUATION

935
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In Situ Vitrification Program at the Idaho National Engineering Laboratory

CONF-910603; Proceedings of the 1991 American Nuclear Society Annual Meeting, Orlando, FL, June 2-6, 1991; Transactions of the American Nuclear Society 63:68-69 (1991)

A program to demonstrate the viability of in situ vitrification (ISV) technology in remediating a buried mixed transuranic (TRU) waste site is under way at the Idaho National Engineering Laboratory (INEL). The application of the technology to buried waste is being evaluated as part of a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) feasibility study. The ISV thermal treatment process converts contaminated soil into a chemically inert and stable glass-and-crystalline product. The process uses joule heating, accomplished by applying electric potential to electrodes that are placed in the soil to initiate and maintain soil melting. Organic contaminants in the soil are destroyed or removed while inorganic contaminants, including radionuclides, are incorporated into the stable, glass-like product or volatilized. Off-gases are collected in a confinement hood over the melt area and processed through an off-gas treatment system. The paper illustrates and describes the ISV process.

936
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Engineering-Scale Test 4: In Situ Vitrification of Toxic Metals and Volatile Organics Buried in INEL Soils

PNL-7611; 51 pp. (June 1991)

An engineering-scale in situ vitrification (ISV) test was conducted on soils containing a mixture of buried waste materials expected to be present at the Idaho National Engineering Laboratory (INEL) subsurface disposal area (SDA). The test was part of a Pacific Northwest Laboratory (PNL) program to assist INEL in treatability studies of the potential application of ISV to mixed transuranic wastes at the INEL SDA. The purpose of this test was to determine the feasibility of using ISV to vitrify soils containing a mixture of buried hazardous heavy metals (Ag, As, Ba, Cd, Cr, Hg, Pb, Se) with stainless and carbon steels, nonhazardous combustibles, and organics in the form of cemented sludge/grease mixtures. Specific objectives included are: (1) determining the destruction and removal efficiency of hazardous volatile organics; (2) determining the distribution of hazardous heavy metals between vitrified components, soils, and the ISV off-gas system; (3) determining the leachability of the vitrified product; and (4) evaluating electrode coatings. Actual site soil from INEL was used in the test, and a basalt block was placed at a depth of 66 cm (26 in.) below the soil surface. The basalt was included to simulate basalt layers below the SDA and to evaluate bonding of the glass to basalt and possible contaminant transport into the basalt.

937
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Proposed Plan for Vitrification Demonstration of Low-Level Radioactive Wastes at the Fernald Environmental Management Project

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 485-489) (September 1991)

Roman glassware found in ancient shipwrecks has eroded less than 0.5 mm in over 2500 years. This low erosion rate for crude glass in corrosive salt water implies that low-level radioactive wastes dissolved in molten glass should remain entombed for long periods (10,000 years plus). The extremely low leach rate for such a glass should keep concentrations in the environment below regulatory limits and provide indefinite protection of the environment. Vitrification is considered by

many to be a most effective treatment method for disposal of radioactive and numerous inorganic hazardous wastes. However, vitrification of low-level radioactive wastes at large production/commercial rates has not been accomplished and needs to be demonstrated to justify vitrification as a competitive alternative to other treatment methods such as solidification. This paper describes a proposed plan to demonstrate vitrification of low-level radioactive wastes at the Fernald Site, located near Cincinnati, Ohio. Demonstrations will progress from laboratory to on-site bench-scale, to pilot size, then to full-sized vitrifiers (glass melters). The bench-sized unit will mainly prove the process and develop glass mixes using various waste forms and glass formers. The pilot scale unit will evaluate and develop operational requirements and processes. Potential advantages of vitrification include waste volume reduction, especially if certain waste forms (e.g., fly ash, soils) can be used as glass formers for other types of wastes. The vitrification demonstration project will be part of the Fernald Site Environmental Remedial Action project.

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Results of Vitrifying Fernald K-65 Residue

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 703-706) (September 1991)

Two silos, designated the K-65 silos, at the Feed Materials Production Center (FMPC) in Fernald, Ohio, contain residues from the processing of pitchblende ores. K-65 material totals about 8.6 million kg. The gamma radiation from the residue results in an average of about 200 mrem/hr outside the silo dome. Radon concentration of the silo headspace is about 30 million pCi/L. The K-65 residue, which contains radium (4 kg), thorium (2 kg), uranium (11,000 kg), uranium daughter products, and heavy metals (primarily lead), was vitrified in a bench-scale system that allowed the volume and composition of the off-gas to be determined. Both the vitrified and non-vitrified residues were subjected to chemical analyses, including the Environmental Protection Agency's (EPA's) Toxicity Characteristic Leachate Procedure (TCLP) and its Extraction Procedure (EP) for toxicity testing. The radon emanation rates and the specific gravity of the vitrified and nonvitrified residues were also measured. The nonvitrified K-65 residue tested "hazardous" by the EP, and the radon emanation rate (52,400 pCi/sq m/s) was over 2500 times the EPA limit of 20 pCi/sq m/s. After vitrification, the K-65 residue tested "non-hazardous" by the TCLP; the waste volume was 35 percent of the original, nonvitrified residue (a 65 percent reduction). The radon emanation rate was reduced by a factor of more than 33,000, from 52,400 pCi/sq m/s to 1.56 pCi/sq m/s, which is an order of magnitude below the EPA limit. The bench-scale vitrification demonstrated that the full-scale vitrification of the K-65 residue is an attractive option.

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Lessons Learned in Fixation and Storage of Radioactive Mixed Waste

CONF-9010166; Waste Management and Environmental Restoration, Proceedings of the 1990 DOE Model Conference, Oak Ridge, TN, October 29-November 2, 1990, 343 pp.; (1 p.) (1990)

Sludges from two radioactive mixed waste ponds are being stored outside in drums at the Oak Ridge Gaseous Diffusion Plant (ORGDP). The majority of these sludges have been processed through the ORGDP Sludge Fixation Facility for fixation in a grout matrix. The remainder are stored as raw sludges. Recent problems with drum corrosion and the presence of free water in the drums led to an investigation of the causes thereof, and an evaluation of available options for the future. This paper presents a brief history of the fixation project, a description of the current problems, lessons learned from the experience, and the possibilities for the future.

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Utilization of Uranium Industry Technology and Relevant Chemistry to Leach Uranium from Mixed-Waste Solids

CONF-910849; Proceedings of the International Mixed Waste Symposium, Baltimore, MD, August 26-29, 1991; (29 pp.) (1991)

Methods for the chemical extraction of uranium from a number of refractory uranium-containing minerals found in nature have been in place and employed by the uranium mining and milling industry for nearly half a century. These same methods, in conjunction with principles of relevant uranium chemistry, have been employed at the Oak Ridge National Laboratory (ORNL) to chemically leach depleted uranium from mixed-waste sludge and soil. The removal of uranium from what is now classified as mixed waste may result in the reclassification of the waste as hazardous, which may then be delisted. The delisted waste might eventually be disposed in commercial landfill sites. This paper generally discusses the application of chemical extractive methods to remove depleted uranium from a biodenitrification sludge and a storm sewer soil sediment from the Y-12 weapons plant in Oak Ridge. Some select data obtained from scoping leach tests on these materials are presented along with associated limitations and observations which might be useful to others performing such test work.

941
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In Situ Vitrification of Radioactive Underground Tanks

PNL-SA-19225; CONF-911040; Proceedings of an International Waste Management Conference, Seoul, Republic of Korea, October 21-26, 1991; (9 pp.) (October 1991)

In situ vitrification (ISV) is a treatment process with great potential for remediating underground tanks previously used for storing radioactive and hazardous chemical wastes at U.S. Department of Energy sites. Tests at several scales have demonstrated the utility of ISV for these tanks. An engineering-scale test vitrified a 30-cm-diameter, buried, steel-and-concrete tank that contained simulated tank sludge. Hazardous components of the tank sludge were immobilized or removed and captured in the off-gas treatment system, and the tank walls were melted or incorporated into the ISV block. A pilot-scale ISV test vitrified a 1-m, simulated underground tank that contained a simulated refractory sludge. The ISV process completely vitrified the tank, its contents, and the soil below the tank to a depth of 2.4 m, producing a uniform glass and crystalline monolith with an estimated mass of 30 tons. A large-scale underground tank test is scheduled for early 1991.

942
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A Product Evaluation Strategy for the Evaluation of In Situ Vitrification Waste Forms

CONF-910430; Proceedings of the 93rd American Ceramic Society Annual Meeting and Exposition, Cincinnati, OH, April 28-May 2, 1991, 475 pp.; (p. 162) (1991)

A strategy is proposed for the evaluation of in situ vitrification (ISV) waste forms. The strategy was developed to produce data that meet regulatory requirements and which are technically relevant and defendable. Evaluation of the ISV waste form is divided into three general categories: (1) sampling and bulk description, (2) chemical and physical properties, and (3) durability testing. Durability testing is further divided into three types of leaching tests.

943
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Technical Baseline Description for In Situ Vitrification Laboratory Test Equipment

EGG-WTD-9672; 36 pp. (September 1991)

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

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Remediation of Contaminated Underground Tanks by In Situ Vitrification

CONF-9010166; Waste Management and Environmental Restoration, Proceedings of the 1990 DOE Model Conference, Oak Ridge, TN, October 29-November 2, 1990, 343 pp.; (1 p.) (1990)

Contamination associated with underground tanks at U.S. Department of Energy (DOE) and other sites may be effectively remediated by application of the in situ vitrification (ISV) process. ISV converts the tank, tank contents, and associated contaminated soil to a glass-and-crystalline block. Compared to current retrieval and treatment options, in-place vitrification may reduce remediation costs, risk of environmental releases, worker exposure, and secondary waste generation by an order of magnitude. To prepare ISV technology for this use, DOE is funding development activities at the Pacific Northwest Laboratory. Testing to date has included simulated wastes vitrified in scaled-down tanks. During a radioactive engineering-scale test, a 30-cm-diameter buried steel and concrete tank containing simulated tank sludge from Oak Ridge National Laboratory was vitrified, producing a solid block. Hazardous components of the tank sludge, including cesium, strontium, technetium, uranium, lead, mercury, chrome, and cobalt were immobilized, or removed and captured, in the off-gas treatment system. The steel tank was converted to ingots near the bottom of the block and concrete walls were dissolved into the resulting glass-and-crystalline block. The block produced was shown to pass Toxic Characteristic Leach Procedure and other Environmental Protection Agency tests. In a pilot-scale test planned for summer 1990, a 1-m-diameter tank containing simulated waste will be vitrified.

945

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In Situ Vitrification of Soils Containing Various Metals

Nuclear Technology 96(2):178-184 (November 1991)

In situ vitrification (ISV) converts contaminated soil into a glass and crystalline product by melting it with electrical energy. Pacific Northwest laboratory, the developer of ISV, is currently conducting research to extend the technology to buried wastes and underground tanks for the U.S. Department of Energy. Since these types of wastes are anticipated to contain high concentrations of metals, new processing techniques are being developed and tested. In addition, the effects of metals on melt shape and on the solubility of heavy metals are being studied and tested. This paper reports on an electrode feeding technique that has been developed and tested for processing high concentrations of metals. Instead of predrilling casings for electrode installation into the contaminated soil to be vitrified, electrode feeding allows the electrodes to be inserted as the vitrified soil melts downward. This concept has been successfully tested four times on engineering-scale equipment, which is 1/100th the capacity of large-scale equipment.

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In Situ Vitrification Application to Buried Waste: Final Report of Intermediate Field Tests at Idaho National Engineering Laboratory

EGG-WTD-9807; 304 pp. (August 1991)

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

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A Thermodynamic Analysis of Melt Immiscibility and its Implications During Vitrification

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 115-117) (September 1991)

This paper examines and defines the thermodynamic conditions conducive to the spontaneous separation of an initially homogeneous silicate melt generated during vitrification of contaminated soil or other wastes into immiscible phases. Immiscible phase development is shown to have potentially important implications regarding melter operation and contaminant immobilization. Development of a molten immiscible iron phase is shown to be dependent upon the oxidation/reduction chemistry of iron and the presence of electrochemically reducing constituents, specifically organic carbon. Immiscible molten iron can concentrate other selected native phase metallic contaminants, drastically impacting their long-term immobilization, and can impact optimal melter selection. Depending upon melt redox conditions, an immiscible sulfate or sulfide melt may also develop during vitrification of sulfur-rich wastes. Although potentially minimal melter operational impacts result from immiscible sulfur phase formation, contaminants partitioned into the immiscible sulfur phase may be very poorly attenuated, potentially resulting in failure for various leach test criteria. Potential mitigative measures are discussed.

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A Graphical Interface for Robotic Remediation of Underground Storage Tanks

Visualization '90, Proceedings of the 1990 IEEE International Conference, San Francisco, CA, October 23-26, 1990; (pp. 449-456) (1990)

Experimental investigations into the application of intelligent robot control technology to the problem of removing waste stored in tanks is discussed. The authors describe the experimental environment used, with particular attention to the hardware and software control environment and the graphical interface. Intelligent system control is achieved through the integration of extensive geometric and kinematic world models with real-time, sensor-based control. All operator interactions with the system are through fully animated graphical representations which validate all operator commands before their execution to

provide for safe operation. Sensing is used to add information to the robot system's world model and to allow sensor-based servo control during selected operations. The results of an initial critical features test are reported, and the potential to apply advanced intelligent control concepts to the removal of waste in storage tanks is discussed.

949
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New Technologies to Meet Regulations

CONF-910603; Proceedings of the 1991 American Nuclear Society Annual Meeting, Orlando, FL, June 2-6, 1991; Transactions of the American Nuclear Society 63:75 (1991)

The U.S. Department of Energy's (DOE's) Office of Environmental Restoration and Waste Management has set the ambitious goal of having all of its facilities cleaned up and in compliance with applicable environmental laws and regulations by the year 2019. This goal is ambitious both because of the magnitude of the effort required and because, in many cases, the means for attaining the goal do not now exist. The DOE's strategy for reaching its goal is based on applied research and development, education, and cooperation with regulators. The Office of Technology Development (OTD) within the Office of Environmental Restoration and Waste Management has instituted a program to assess the magnitude of the cleanup effort and to evaluate the potential technologies to be used. The OTD has program responsibility for providing new and more effective technologies for meeting DOE's goal for compliance and cleanup. Included are research and development of new technologies; demonstration, testing, and evaluation of technologies developed elsewhere; transportation; and educational programs to produce the scientists and engineers needed to maintain the momentum of research, development, demonstration, testing, and evaluation (RDDT and E) until the job is complete.

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Joint DOE/EPA Initiatives to Facilitate International Environmental Technology Transfer

CONF-910603; Proceedings of the 1991 American Nuclear Society Annual Meeting, Orlando, FL, June 2-6, 1991; Transactions of the American Nuclear Society 63:64 (1991)

The Office of Environmental Restoration and Waste Management (EM) is responsible for the management and the cleanup of radioactive, hazardous, and mixed wastes generated by U.S. Department of Energy (DOE) operations. The Office of Technology Development (OTD) within EM is responsible for the identification, development, and implementation of technologies that will ensure compliance with all applicable regulations, including the U.S. Environmental Protection Agency's (EPA's) safety criteria, which focus on hazardous wastes. The DOE and EPA are cooperating to identify and transfer international technologies that will expedite cleanup activities. The OTD is pursuing the use of integrated demonstrations as a primary mechanism for international technology transfer. Integrated demonstrations utilize a system-engineering approach to evaluate comparable technologies in solving a single, well-defined problem. Multiple technologies can be rigorously compared in terms of safety, cost, and effectiveness in each demonstration. As a result of this approach, international collaboration among governments and the private sector is anticipated to effectively transfer technologies upon successful completion of the demonstrations. International, cooperative, integrated demonstrations will provide a basis for selecting preferred remediation approaches and for directing additional technology research and development.

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Thermal Stress Modeling of In Situ Vitrified

Barriers for Hazardous Waste Containment

PNL-SA-19347; CONF-910945; Focus '91: Nuclear Waste Packaging, Proceedings of a Conference, Las Vegas, NV, September 29-October 4, 1991; (10 pp.) (September 1991)

Development of in situ vitrification technology has included the concept of subsurface barriers. Structural integrity of vitrified soil bodies is important to barrier performance. Analytical methods are under development for predicting thermal-structural performance during melt cool-down. A thermal modeling capability has been developed for predicting the cooling transient of subsurface molten masses using the finite element method. A computationally efficient "instant freezing model" was demonstrated to give qualitative agreement for predicted stresses with a more sophisticated creep model. A method for predicting stress relief due to cracking, as a preliminary step to predicting crack densities, has been demonstrated.

952
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Treatment of Heavy Metal Contaminated Soils by In Situ Vitrification

CONF-910477; HazMat '91 Central, Proceedings of the Fourth Annual Hazardous Materials Management Conference, Rosemont, IL, April 3-5, 1991. Tower Conference Management Company, Wheaton, IL; (pp. 185-196) (1991)

Contaminated soil site-remediation objectives call for the destruction, removal and/or immobilization of contaminant species. Destruction is applicable to hazardous compounds (e.g., hazardous organics such as PCBs, and hazardous inorganics such as cyanide); however, it is not applicable to hazardous elements such as the heavy metals. Removal and/or immobilization are typical objectives for heavy metal contaminants present in soil. Many technologies have been developed specifically to meet these needs. One such technology is in situ vitrification (ISV), an innovative mobile, on-site, in situ solids-remediation technology that has been available on a commercial basis for about two years. ISV holds potential for the safe and permanent treatment/remediation of previously disposed or current-process solid waste (e.g., soil, sludge, sediment, tailings) contaminated with hazardous chemicals and/or radioactive materials. This paper focuses on the application of ISV to heavy metal-contaminated soils.

953
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Influence of Natural Convection on Melt Shape During In Situ Vitrification

EGG-M-90460; CONF-910739; Heat Transfer in Geophysical Media, Proceedings of the 28th Annual National Heat Transfer Conference, Minneapolis, MN, July 28-31, 1991. American Society of Mechanical Engineers, Heat Transfer Division, New York, NY; (pp. 1-7) (1991)

A study of natural convection during in situ vitrification (ISV) is presented. ISV is a hazardous waste remediation process in which contaminated soil and/or buried waste is treated in place by direct application of electrical power to the contaminated region via submerged electrodes. The magnitude of the resulting electrical resistance heating is sufficient to cause soil melting. As the molten region grows, natural convection motion of the molten soil occurs. This paper presents numerical results obtained by considering natural convection melting when solving the strongly coupled momentum and energy equations using finite element methods. A local heat source is calculated by solving the electric field equation and calculating a Joule heat source term. Melt shapes obtained from runs with various values of the coefficient of volume expansion (beta) in the buoyancy terms of the momentum equations are presented. Results of a pure conduction model are also presented. The melt fronts calculated from the fluid flow model melt more uniformly downward, whereas the melt front from the conduction model melts faster in the center and slower near the electrodes. Melt volumes for all models are approximately the same for a specified time period.

954
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Trying Transmutation

Scientific American 266(5):36,53 (May 1992)

A proposed system that uses a proton accelerator to transmute high-level nuclear waste into low-level waste and simultaneously to produce heat, which drives a power-generating turbine, is being developed at the U.S. Department of Energy's Brookhaven National Laboratory in Upton, New York, while parallel research on transmutation using an accelerator is going on at Los Alamos National Laboratory in New Mexico. In a similar program at Argonne National Laboratory in Illinois, researchers are using the Integral Fast Reactor to irradiate its own waste so that the waste can be recycled, thus eliminating the reactor's need for new fuel and reducing its volume of high-level waste. With minor modifications, the Integral Fast Reactor could transmute high-level waste from other reactors into low-level waste. The Department of Energy's official position on the transmutation of nuclear waste is neutral; a spokesman for the Department's waste-disposal research program emphasized that transmutation can at best only complement, not replace, burial in waste repositories. Cost is one of the major drawbacks to transmutation as a waste disposal alternative: using transmutation, the elimination of all the fuel from the current generation of nuclear reactors would cost $84 billion; the current projected cost of a high-level nuclear waste repository is about one-third of that amount.

955
M.A. Langerman and R.J. MacKinnon, Idaho National Engineering Laboratory, Idaho Falls, ID; U.S. Geological Survey, Towson, MD; Idaho Department of Water Resources, Boise, ID; U.S. Geological Survey, Idaho Falls, ID

Scaling Considerations for Modelling the In Situ Vitrification Process

Applied Mathematical Modelling 15(10):542-549 (1991)

Thermal-electric field interactions occur in many areas of engineering. An example is the in situ vitrification process, a relatively new technology for remediating hazardous wastes. Mathematical and physical modelling of this process requires knowledge of the similarity constraints involving thermal-electric fields. This paper addresses this issue and derives the scaling relationships for modelling the remediation process from fundamental principles. Requirements for maintaining temperature and electric potential field similarity between the model and the prototype are determined, as well as requirements for maintaining similarity in off-gas generation rates. A scaling rationale for designing reduced scale experiments is presented, and the results are assessed numerically.

956
S.C. Liikala, Pacific Testing Laboratory, Seattle, WA

Engineering-Scale Tests of In Situ Vitrification to PCB and Radioactive Contaminated Soils

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 119-122) (September 1991)

In situ vitrification (ISV) is a thermal treatment technology applicable to the remediation of sites with hazardous chemically- and radioactively-contaminated soil and sludge. The ISV process utilizes electricity, through joule heating, to melt contaminated soil and form an inert glass and microcrystalline residual product. Applications of ISV to polychlorinated biphenyls (PCBs) and radionuclides have been demonstrated at engineering scale in numerous tests. An updated evaluation of ISV applicability to treatment of PCBs and radionuclides, and recent test results, are presented here.

957
J. Luey and T.D. Powell, Pacific Northwest Laboratory, Richland, WA

In Situ Vitrification of Buried Waste: Containment Issues and Suppression Systems

PNL-SA-19974; 14 pp. (March 1992)

Pacific Northwest Laboratory and Idaho National Engineering Laboratory are developing a remedial action technology for buried waste through the adaptation of the in situ vitrification (ISV) process. The ISV process is a thermal treatment process originally developed for the U.S. Department of Energy to stabilize soils contaminated with transuranic waste. ISV tests with buried waste forms have demonstrated that the processing of buried waste is more dynamic than the processing of soils. This paper focuses on the issue of containment of the gases released during the processing of buried waste, and on engineered suppression systems to alleviate transient events associated with dynamic off-gassing from the ISV melt.

958
B.P. McGrail and S.O. Bates, Pacific Northwest Laboratory, Richland, WA

Aqueous Dissolution of Laboratory and Field Samples from the In-Situ Vitrification Process

PNL-SA-19786; CONF-910874; Physics of Non-Crystalline Solids, Proceedings of the Seventh International Conference, Cambridge, MA, August 4-9, 1991; (16 pp.) (August 1991)

In-situ vitrification (ISV) is being evaluated in several countries as a remediation technology for immobilizing both hazardous and radioactive buried wastes. A combination of laboratory data and modeling results are presented that establishes the scientific basis for predicting the long-term stability of an ISV glass in the environment. Laboratory experiments included tests with ISV samples obtained from pilot- and intermediate-scale field tests, a nuclear waste glass, and a natural obsidian.

959
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Simulation of Heat Conduction and Electric Fields During In Situ Vitrification of Soil

CONF-910739; Heat Transfer in Geophysical Media, Proceedings of the 28th Annual National Heat Transfer Conference, Minneapolis, MN, July 28-31, 1991. American Society of Mechanical Engineers, Heat Transfer Division, New York, NY; (pp. 63-68) (1991)

A computer program has been developed to simulate heat conduction and electric fields which occur during in situ vitrification (ISV) of soil. The code is based on a finite element solution of the governing equations of heat conduction and electrostatic potential. A three dimensional simulation of soil melting using four electrodes is presented.

960
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In Situ Vitrification Laboratory-Scale Test Work Plan

EGG-WTD-9194; 38 pp. (May 1991)

The Buried Waste Program was established in October 1987 to accelerate the studies needed to develop a long-term management plan for the buried mixed waste at the Radioactive Waste Management Complex at Idaho Engineering Laboratory. The In Situ Vitrification Project is being conducted in a Comprehensive Environmental Response, Compensation, and Liability Act feasibility study format to identify methods for the long-term management of mixed buried waste. To support the overall feasibility study, the in situ vitrification treatability investigations are proceeding along the three parallel paths: (1) laboratory-scale tests, (2) intermediate field tests, and (3) field tests. Laboratory-scale tests are being performed to provide data to mathematical modeling efforts, which, in turn, will support design of the field tests and to the health and safety risk assessment. This laboratory-scale test work plan provides overall testing program direction to meet the current goals and objectives of the in situ vitrification treatability investigation.

961
G.F. Piepel and J.W. Shade, Pacific Northwest Laboratory, Richland, WA

In Situ Vitrification and the Effects of Soil Additives - A Mixture Experiment Case Study

Journal of the American Ceramic Society 75(1):112-116 (January 1992)

This paper presents a case study involving in situ vitrification (ISV), a process for immobilizing chemical or nuclear wastes in soil by melting-dissolving the contaminated soil into a glass block. One goal of the study was to investigate how viscosity and electrical conductivity were affected by mixing CaO and Na-2O with soil. A three-component constrained-region mixture experiment design was generated and the viscosity and electrical conductivity data collected. Several second-order mixture models were considered, and the Box-Cox transformation technique was applied to select property transformations. The fitted models were used to produce contour and component effects plots.

962

V.S. Rezendes, U.S. General Accounting Office, Resources, Community, and Economic Development Division, Washington, DC

Cleanup Technology - DOE's Management of Environmental Cleanup Technology

GAO/T-RCED-92-29; 6 pp. (February 26, 1992)

In this statement to the Subcommittee on Environment of the U.S. House of Representatives' Committee on Science, Space, and Technology, Victor S. Rezendes, Director of Energy Issues for the Resources, Community, and Economic Development Division of the General Accounting Office (GAO), addresses the U.S. Department of Energy's (DOE) management of improved cleanup technologies to be used in environmental restoration of the DOE nuclear weapons complex. DOE has begun a technology development program for improved cleanup methods; it has funded eight integrated research-and-development (R&D) projects. DOE's focus has been on setting up the program, not on the program's future management. DOE needs to develop key management tools to ensure the effectiveness of the technology development program. These management tools include: (1) measurable performance goals, (2) overall project cost estimates and schedules, and (3) major decision points for when and whether to continue a project. GAO will issue a report summarizing these findings, and in it will make specific recommendations to DOE for improving the management of the cleanup technology development program.

963

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Potential for Using a Six-Phase Alternating Current Power Supply for In Situ Vitrification

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 123-127) (September 1991)

In situ vitrification (ISV) has been identified as a potential treatment technology for stabilizing underground tanks at Hanford and other U.S. Department of Energy sites. A key requirement for this application is an electrical system that can supply the power needed to vitrify a tank in a single setting. This paper describes an engineering-scale test conducted at Pacific Northwest Laboratory to assess the efficiency of a six-electrode, six-phase energy supply system in melting soil. The test was conducted with a 30 kW(e), six-phase system. Based on the test results, a six-electrode, six-phase system shows potential for scaleup to larger systems.

964

J.W. Shade, L.E. Thompson, and C.E. Kindle, Pacific Northwest Laboratory, Richland, WA

In Situ Vitrification Processing of Buried Waste Sites

CONF-910430; Proceedings of the 93rd American Ceramic Society Annual Meeting and Exposition, Cincinnati, OH, April 28-May 2, 1991, 475 pp.; (p. 162) (1991)

Engineering-scale and pilot-scale in situ vitrification tests have been conducted on

simulated buried waste sites containing ferrous metals, Environmental Protection Agency Toxic metals, semivolatiles, and organics. Vitrified blocks from about 400 kg to several tons are produced. Melt properties discussed include melt size, temperature distribution, rate of movement, and volatility. The product is primarily glass, partially devitrified, with a metallic phase at the bottom. The distribution of contaminants among glass, metal phase, and surrounding soil is presented along with Toxicity Characteristics and Leachate Procedures test results. Organics are pyrolyzed and combusted in the off-gas system.

965

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Comparison of In Situ Vitrification and Rotary Kiln Incineration for Soils Treatment

EPA/600/J-91/255; 8 pp.; Journal of the Air and Waste Management Association 41(9):1259-1264 (1991)

In the hazardous-waste community, the term "thermal destruction" is a catch-all phrase that broadly refers to high-temperature destruction of hazardous contaminants. Included in the thermal-destruction category are treatment technologies such as rotary-kiln incineration, fluidized-bed incineration, infrared-thermal treatment, wet-air oxidation, pyrolytic incineration, and vitrification. Among them, conventional rotary-kiln incineration is the most established, having been a disposal method for many years, and therefore often serves as a barometer by which the relative success of similar technologies may be gauged. Public sentiment on environmental issues and increasingly stringent environmental regulations has spurred the design and development of innovative thermal treatment processes that are directed at reducing harmful emissions and residuals that may require further treatment or disposal. In situ vitrification (ISV), a technology that combines heat and immobilization, is one such innovative and relatively new technology. The paper presents a comprehensive overview of ISV as compared with rotary kiln incineration in the areas of process performance, process residuals, process limitations, applicable or relevant and appropriate regulations, criteria and limitations, and costs.

966

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A Preliminary Study of the Controls on Melting During In Situ Vitrification

ORNL/ER-30; 39 pp. (December 1991)

In situ vitrification (ISV), developed by Pacific Northwest Laboratory and patented for the U.S. Department of Energy, is one method used to stabilize contaminated soils in place. ISV involves inserting four electrodes in a square array into contaminated soil and applying an electrical potential to the electrodes. The soil is heated to above its melting point, and the molten zone expands with time to encompass the contaminated zone. After cooling, the resulting solid material is usually a mixture of glass and crystalline material that has a significantly higher resistance to leaching than did the original soils. Nonvolatile elements (most radionuclides and metals) are dissolved into the melt or encapsulated in glass if their solubility in the melt is low. Organic compounds tend to be pyrolyzed, with the decomposition products diffusing to the surface and combusting on exiting the molten zone. A hood is placed over the vitrification zone to collect off-gas particulates and volatiles into a processing trailer that scrubs contaminants from the off-gas. The current study identified key parameters and processes in the ISV melt cycle and developed an improved understanding of ISV. Analytical approximations for several properties of molten soil were determined from available data. Using a simplified geometrical approximation for melt geometry, an analytical approximation for the rate of melting (depth) vs. time was derived that is consistent with data from field experiments. At small times, the depth of melting increases linearly with time. After approximately 10 hours in large-scale tests, however, the depth increases as the square root of time. Existing data is also consistent with a relationship that shows the volumetric growth rate of the melt to be directly proportional to time.

These conclusions suggest that heat transfer processes controlling the ISV process may be at the transition between weak convection and conduction.

967
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In Situ Vitrification: Technology Status and a Survey of New Applications

PNL-SA-20508; CONF-920220; In Situ Treatment of Soil and Water, Proceedings of an International Specialty Conference, Cincinnati, OH, February 4-6, 1992; (10 pp.) (February 1992)

Pacific Northwest Laboratory (PNL) is developing a thermal treatment process called in situ vitrification (ISV) for remediating contaminated soils, underground structures such as tanks, and buried wastes. ISV was initially developed for contaminated soil applications in 1980 and has since become a mature technology for these applications. Relatively new applications of ISV to underground structures and buried wastes are currently in the development stages. This paper will outline the development progress of the ISV technology, including the results of demonstrations and other field-scale testing performed to date, and examine the key remaining issues associated with new ISV applications.

968
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Vitrification of Underground Storage Tanks: Technology Development, Regulatory Issues, and Cost Analysis

PNL-SA-20547; CONF-920307; Waste Management '92, R.G. Post (ed.), Proceedings of a Conference, Tucson, AZ, March 1-5, 1992; (18 pp.) (March 1992)

In situ vitrification (ISV), developed by the Pacific Northwest Laboratory (PNL) for the U.S. Department of Energy (DOE), is a thermal treatment process for the remediation of hazardous, radioactive, or mixed waste sites. The process has been broadly patented both domestically and abroad. Since the inception of ISV in 1980, developmental activities have been focused on applications to contaminated soils, and more recently the potential for application to buried wastes and underground structures (tanks). Research performed to date on the more advanced ISV applications (i.e., application to buried wastes and underground tanks) shows that significant technical and economic potential exists for using ISV to treat buried wastes and underground structures containing radionuclides and/or hazardous constituents. Present ISV applications are directed to the treatment of contaminated soils; the likelihood of using ISV to treat underground tanks depends on the resolution of significant technical and institutional issues related to this advanced application. This paper describes the ISV process and summarizes the technical progress of underground tank vitrification (UTV), discusses pertinent regulatory issues facing the use of UTV, and presents the potential cost of UTV relative to other remedial action alternatives.

969
U.S. Department of Energy, Office of Environmental Restoration and Waste Management, Washington, DC

Technology Integration Branch FY 1991 Program Plan, Office of Technology Development

DOE/EM-0012P; 31 pp. (May 1991)

The U.S. Department of Energy (DOE) is committed to a 30-year goal to clean up and restore the environment at its nuclear sites. The Office of Technology Development (OTD) was established to help achieve this goal. Its mission is to rapidly develop and apply existing and innovative environmental restoration and waste management technologies in a way that meets applicable regulations. This document provides an overview of the Technology Integration Programs (TIPs) that support the mission the Office of Technology Development. It serves as a guide for the TIP for FY 91. This plan has been discussed with the field at complex-wide management

meetings, and comments have been incorporated. The TIPs were established to facilitate applications of technologies through collaborative partnership with U.S. industry, the national laboratories, other federal agencies, universities, and appropriate international participants.

970
U.S. Department of Energy, Office of Environmental Restoration and Waste Management, Washington, DC

Long-Range Plan for Technology Integration Programs, Office of Technology Development

DOE/EM-0011P; 60 pp. (May 1991)

This long-range plan describes the Technology Integration Programs (TIP) that support the mission of the Office of Technology Development (OTD), within the US Department of Energy's (DOE) Office of Environmental Restoration and Waste Management (EM). TIP will provide the structure to facilitate applications of innovative environmental technologies through collaborative partnerships with U.S. industry, the National laboratories, other Federal agencies, universities, and appropriate international participants. The TIP mission is to transfer information, knowledge, concepts, and technology in, out, and among interested users. The TIP will provide the structure to infuse faster, better, safer, and cheaper technology across DOE sites to accomplish its 30-year clean-up goal, while maintaining and achieving compliance. In addition, TIP will successfully transfer OTD-developed environmental technology to potential users.

971
U.S. Department of Energy, Office of Environmental Restoration and Waste Management, Washington, DC

Technology Integration Division - FY 1992 Technology Integration Programs Plan, Office of Technology Development

DOE/EM-0062P; 50 pp. (December 1991)

This plan describes Technology Integration Programs (TIPs) missions and activities to be initiated and implemented in Fiscal Year (FY) 1992, to support the mission of the Office of Technology Development (OTD), Environmental Restoration and Waste Management (EM), U.S. Department of Energy (DOE). This document, to serve as a guide for TIP's program planning and implementation, provides information on TIP's goals and missions, planning assumptions, and program benefits. This plan also describes TIP's concept of operations, TIPs participants' roles and responsibilities, FY 1992 program implementation activities, program management controls, and planning/evaluation mechanisms. OTD, as the support organization for EM's Offices of Environmental Restoration and Waste Operations, is to develop and apply innovative environmental technology systems to DOE Environmental Restoration (ER) and Waste Management (WM) site-specific needs. These OTD-initiated activities are to be conducted in a manner that will facilitate compliance with applicable laws, regulations, and agreements and minimize the generation of waste. To fulfill its mission requirements, OTD established TIPs to work with industry, universities, and other government agencies and programs to build public-private collaborative partnerships. TIP's three-part mission is to facilitate the transfer of EM-relevant information, knowledge, concepts, and technology into and out of DOE and among interested parties.

972
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Product Evaluation of In Situ Vitrification Field Tests at the Idaho National Engineering Laboratory

CONF-910430; Proceedings of the 93rd American Ceramic Society Annual Meeting and Exposition, Cincinnati, OH, April 28-May 2, 1991, 475 pp.; (p. 162) (1991)

The in situ vitrification process was field tested at Idaho National Engineering Laboratory using simulated waste in two separate test pits. The simulated waste consisted of cans and boxes filled with scrap metal, paper, cloth, wood, simulated sludge, and/or concrete. The first test produced 8,265 kg of very dark green glass with less than 1%

metal. The second test produced 17,426 kg of product that consisted of similar glass in the outer regions that cooled more rapidly, and a partially devitrified mixture of augite and glass in the central region of the monolith that cooled more slowly. Metal was present adjacent to the electrodes. The results of a detailed study of the chemical, mineralogical, and durability properties of the products will be presented.

973

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Process Evaluations for Uranium Recovery from Scrap Material

CONF-920305; Proceedings of the 121th Annual Minerals, Metals and Materials Society Meeting and Exhibition, San Diego, CA, March 1-5, 1992. The Metallurgical Society, Inc., Warrendale, PA (1992)

The integral fast reactor concept, being developed by Argonne National Laboratory, is based on pyrometallurgical processing of spent nuclear metallic fuel with subsequent fabrication into new reactor fuel by an injection casting sequence. During fabrication, a dilute scrap stream containing uranium alloy fines and broken quartz (Vycor) molds is produced. Waste characterization of this stream, developed by using present operating data and chemical analysis, was used to evaluate different uranium recovery methods and possible process variations for the return of the recovered metal. Two methods, comminution with size separation and electrostatic separation, have been tested and can recover over 95% of the metal. Recycling the metal to either the electrochemical process or the injection casting was evaluated for the different economic and process impacts. The physical waste parameters and the important separation process variables are discussed, along with their effects on the viability of recycling the material. Criteria used to establish the acceptable operating limits is also discussed.

974

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Robotics Subsurface Mapping Demonstration Technology Test Plan

EGG-WTD-9765; 32 pp. (June 1991)

The Subsurface Disposal Area (SDA) at the Radioactive Waste Management Complex contains an estimated 2 million cu ft of contaminated, hazardous, and radioactive buried waste. The waste was received in cardboard boxes, steel drums plywood boxes, and as loose material. Possible leaching of the buried waste may have created mixed hazardous fill dirt, with an estimated volume of 6 million cu ft. The Department of Energy has committed to clean up the SDA. Cleanup efforts will include characterizing and removing the waste. Waste characterization provides information on what, where, and how much waste is buried. This information will be used to determine how the waste will be removed and treated. Limited historical data of the waste buried within the SDA exist, but have not been verified and are believed to be incorrect or incomplete in many cases. There are two objectives to the Robotics Subsurface Mapping Demonstration. The first is to demonstrate the feasibility of using a remotely operated platform to perform characterization operations. In the demonstration, the Soldier Robot Interface Project platform will be equipped with multiple sensors to provide data for buried waste characterization and will be remotely controlled and tracked by the Ultrasonic Ranging and Data System. The second objective of the demonstration is to characterize the waste in locations within the SDA, as specified by the Buried Waste Integrated Demonstration Project.

975

U.S. Department of Energy, Office of Health and Environmental Research, Washington, DC

Subsurface Science Program - Program Overview

DOE/ER-0501T; 53 pp. (June 1991)

The Office and Health and Environmental Research (OHER) within the Department of Energy's (DOE's) Office of Energy Research conducts long-term fundamental research in the physical, chemical, and biological sciences. The OHER Subsurface Science Program, summarized

in this document, supports a university and national laboratory research program that is interdisciplinary, covering such disciplines as geochemistry, microbiology, and hydrology. Departmental needs in environmental restoration, a major issue that DOE will face for several decades, are emphasized. The Subsurface Science Program emphasizes research on subsoils and ground water, i.e., the natural subsurface environments that are most significantly affected by past DOE waste-disposal practices. More specifically, research is being conducted in hydrogeology, in subsurface microbiology, and on the biogeochemistry of chemical mixtures in the subsurface environment. The program is organized into interdisciplinary subprograms, or areas of research emphases, with each subprogram conducting basic research of interest to DOE. For example, fundamental scientific research in several subprograms on microbial distribution, function, and effects is laying a foundation for cost-effective in situ mitigation of contamination at DOE sites. Research on the behavior of organic-radionuclide mixtures in ground water will be used by DOE sites, other federal agencies, and the international community to assess environmental risks and to establish effective remedial procedures.

976

U.S. Department of Energy, Washington, DC

Environmental Assessment for Retech, Inc.'s Plasma Centrifugal Furnace Evaluation

DOE/EA-0491; 53 pp. (May 1991)

The U.S. Department of Energy (DOE) and the U.S. Environmental Protection Agency (EPA) are conducting a hazardous waste demonstration program in cooperation with the EPA Superfund Innovative Technology Evaluation (SITE) program. The program is testing Retech, Inc.'s Plasma Centrifugal Furnace (PCF) technology. Since shakedown/preliminary testing is nearly complete, DOE proposed to begin Phase I studies to examine the applicability of this technology to treatment/destruction of typical Idaho National Engineering Laboratory wastes and industrial water treatment sludges. Pending the results of the Phase I study, the EPA will decide their level of involvement. The timeframe for the EPA and Phase II of DOE testing will be decided at the conclusion of the Phase I study. This document focuses primarily on the environmental impact of the two DOE phases; however, impact analysis will also be performed for the EPA feedstock.

977

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Recent Field Trials of Directional Boring Equipment for Emplacing a Borehole Grid Around and Beneath a Simulated Waste Site

CONF-9010166; Waste Management and Environmental Restoration, Proceedings of the 1990 DOE Model Conference, Oak Ridge, TN, October 29-November 2, 1990, 343 pp.; (7 pp.) (1990)

Chemical/mixed-waste sites in the western United States are often found in arid regions where the unconsolidated alluvium contains multiple layers of various fines, gravel and cobbles. The transport of contaminants from the near-surface layers to deeper underlying aquifers proceeds either through the movement of gas-phase material or through, the capillary movement of formulation fluids driven by periodic episodes of precipitation. Developing in situ methods to characterize the site geology, place monitoring equipment, and isolate a problem waste site from the surrounding, uncontaminated formulation is essential. Since January 1990, the authors have been developing strategies, evaluating commercial equipment, and planning the adaptation and extension of existing directional-boring technology to cost-effectively enclose a waste site in a grid of vertical and horizontal boreholes. Further development of the grid concept will focus on (1) quality cores for precise determination of subsurface conditions and the location of contaminants; (2) access for the placement of monitoring equipment and the application of geophysical techniques to measure formation properties; (3) information for rank ordering of waste sites for remedial action; and (4) access for the placement of grouting and chemical retardants to build an in situ barrier to the spread

of contaminants. The application of this grid technology to the ventilation of radon in the soil beneath inhabited structures is a recent development in the project. This concept, along with the associated strategy for proper grid geometry, is being pursued with regulatory agencies. Also, a three-year joint development program has been negotiated with a major manufacturer of directional-boring equipment for the utilities industry. Additional applications for the borehole-grid concept continue to emerge.

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Removal of Heavy Metals and Radionuclides by Seeded Magnetic Filtration

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 527-530) (September 1991)

Removal of traces of heavy metal or radionuclide contamination from solution at high flow rate presents a considerable technical challenge. Low flow methods of treatment such as particle gravity settling require expensive large volume equipment, and traditional methods of filtration can cause significant energy costs. Magnetic filtration can be used to provide a low cost method of solid-liquid separation at high flow rate, provided contaminants can be selectively bound to a magnetic solid particle. This paper describes the use of such selective magnetic particles made up of inorganic particles coupled with organic polymers. Selective removal of metals from solution using seeded magnetic filtration is demonstrated in a laboratory setting. A demonstration program for the removal of lead, cadmium, and mercury from process effluents and contaminated groundwater is planned for the fall of 1991 at the Savannah River Site. Preliminary cost estimates indicate that magnetic filtration is very attractive ($1.89 to $2.80 per 1000 gallons) compared to other treatment technologies.

979

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Long-Reach Manipulation for Waste Storage Tank Remediation

CONF-911213; Modelling and Control of Compliant and Rigid Motion Systems, Proceedings of the Annual Winter Meeting of the American Society of Mechanical Engineers, Atlanta, GA, December 1-6, 1991. American Society of Mechanical Engineers, New York, NY; (pp. 67-73) (1991)

Remediation of large underground storage tanks containing hazardous waste provides an application for state-of-the-art technology in flexible-link manipulator design and control, and a need for additional research and development. Application requirements are described, and preliminary analyses associated with this problem are summarized. Inherent physical limitations of flexible manipulators are discussed. Potential kinematic configurations, drive-train elements, and control issues for both free-space motion and damping of forced vibration are addressed. Also included are future directions for research and development in mechanical components and control strategies.

980

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Robotics Technology Demonstration Program for Underground Storage Tank Remediation

CONF-911107; Proceedings of the American Nuclear Society Winter Meeting, San Francisco, CA, November 10-15, 1991; (12 pp.) (September 1991)

To address the technological problems associated with waste retrieval from underground storage tanks, the U.S. Department of Energy Office of Technology Development has created the Robotics Technology Demonstration Program for Underground Storage Tanks. The mission of this

program is to develop existing and emerging technologies for possible use in storage-tank remediation activities. In 1991, this program has created the Robotics Technology Test Bed at the Hanford Site, Washington. A waste-storage-tank mockup and multiple robotic manipulators, sensors, and surveillance systems have been installed in this test bed. The test and evaluation activities being performed in the test bed will lead to the development of faster and safer methods for waste retrieval, inspection, and surveillance.

981
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Bench Scale Studies and Pilot Scale Design of a Modified Volume Reduction-Chemical Extraction System for Radiation Contaminated Soils

EPA/520/1-90-013; CONF-8909236; Residual Radioactivity and Recycling Criteria, A.B. Wolbarst, H. Terada, and A.C.B. Richardson (eds.), Proceedings of a Workshop, St. Michaels, MD, September 27-28, 1989, 311 pp.; (pp. 122-131) (September 1989)

The U.S. Environmental Protection Agency (EPA) Superfund Program is directed toward remediation of sites on the National Priority List (NPL). The waste form at many of the radioactively contaminated NPL sites is soil. The only disposal strategy currently available for radioactive soils is burial. To investigate technologies that could reduce the volume of soil requiring burial, the EPA is conducting a Superfund project focused on the remediation of soil contaminated with radium. The Volume Reduction/Chemical Extraction (VORCE) Project at radium contaminated sites in Montclair and Glen Ridge, New Jersey, has two broad objectives: (1) reduce the activity level of a major portion of the soil to levels protective of public health and return reconstituted soil to the sites; and (2) reduce the volume of contaminated soil by use of physical or chemical techniques that can potentially be applied in residential areas. Laboratory studies are being conducted at the EPA National Air and Radiation Environmental Laboratory in Montgomery, Alabama. In the field demonstration phase of the VORCE project, a field treatability unit will be designed based on the results of the laboratory studies, and the unit will be constructed, tested, and evaluated. Laboratory scale tests and evaluations of techniques for reducing the volume of radium-contaminated soil for disposal have demonstrated that a significant portion of the contaminated soil can be cleaned by a vigorous water-wash technique and returned to the excavation site. The laboratory work has also demonstrated the importance of soil characterization and has provided preliminary results that indicate magnetic separation and chemical extraction techniques can provide additional volume reductions. A conceptual design for the field treatability pilot scale unit has been completed.

982
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Integrated Demonstration for the Removal of Uranium Substances from Soils

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 597-602) (September 1991)

The Integrated Demonstration (ID) at the Fernald Environmental Management Project (FEMP) is a three year program begun in 1991 which addresses the problem of removing uranium from contaminated soils. This paper presents an overview of the ID at Fernald, focusing on technological directions, management structure, schedules, and goals. The principal objective of this ID is to evaluate and compare in terms of versatility, efficiency, and cost various technologies and systems for removal of uranium from soils, especially soils of a high clay/silt content. The ID is broken down into six principal tasks: (1) characterization; (2) excavation; (3) soil decontamination; (4) waste stream disposal; (5) regulations; and (6) performance assessment. The management and organizational structure of the ID is explained and charted. Reduction of contaminated soil quantity through the coupling of

real time analysis (including gamma ray spectroscopy and inductively coupled plasma optical emission spectrometry) and precise excavation, along with decontamination techniques applicable to high clay/silt soils are the major technological areas for fiscal years 1992 and 1993. The focus on secondary waste treatment and disposal will begin to increase in mid 1992 after potential remediation technologies have been identified and secondary waste streams determined.

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Preliminary Systems Design Study Assessment Report

EGG-WTD-9594 (July 1991)

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

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Development, Testing, and Demonstration of Geotechnical and Cement-Based Encapsulant Materials for the Stabilization of Radioactive and Hazardous Waste Disposal Structures

WHC-SA-1039; CONF-920559; The Use of Fly Ash, Silica Fume, Slag, and Natural Pozzolans in Concrete, Proceedings of the Fourth Annual International Conference, Istanbul, Turkey, May 3-8, 1992; (12 pp.) (September 1991)

A zeolite fluidized-bed treatment system is being developed and tested for the treatment of radioactive and hazardous waste-contaminated subsurface disposal structures. Formulations of cement, fly ash, and slag slurries and sequestering agents also are being tested and evaluated. Leach resistance of radionuclides, heavy metals, and hazardous inorganic compounds in the solidified cement-based encapsulant has been determined. These results simulate the resistance to water leaching of the solidified product after it has been injected into an open and interstitial void volume in, and proximal to, liquid-waste-disposal structures. Micro- and macro-encapsulation of contaminants within, and geologic media surrounding, subsurface disposal structures is being demonstrated as an alternative technology for waste site remediation.

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Selection of Innovative Technologies for the Remediation of Soils Contaminated with Radioactive and Mixed Wastes

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 491-509) (September 1991)

The remediation of sites containing radioactive or mixed wastes is rapidly growing. The state of the art in remediation is progressing to handle the shortcomings of conventional pump-and-treat and disposal technologies. The objective of this paper

is to review the status of selected innovative technologies which treat soils contaminated with radioactive and mixed waste. Technologies are generally classified as innovative if they are fully developed, but lack sufficient cost or performance data for comparison with conventional technologies. The U.S. Environmental Protection Agency recommends inclusion of innovative technologies in the Remedial Investigation/Feasibility Study (RI/FS) screening process if there is reason to believe that they would offer advantages in performance, implementability, cost, etc. This paper serves as a compilation of the pertinent information necessary to gain an overview of the innovative technologies selected as potential aids in the RI/FS screening process. The innovative technologies selected for evaluation are: (1) soil washing and flushing; (2) electrokinetics; (3) ultrasound; (4) soil vapor extraction; (5) in situ hot air/steam extraction; (6) in situ radio frequency; (7) in situ soil heating; (8) low temperature thermal treatment; (9) infrared incineration; (10) in situ vitrification; (11) plasma torch slagging; (12) cyclone reactor treatment; and (13) vegetative radionuclide uptake. The information provided on each technology includes a technical description, status, summary of results (including types of contaminants and soils treated), technical effectiveness, feasibility and estimated cost.

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The Buried Waste Integrated Demonstration

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 603-604) (September 1991)

There are numerous locations throughout the U.S. Department of Energy (DOE) complex where wastes have been buried in the ground or stored for future disposal. Much of this buried waste is contaminated with hazardous or radioactive materials. An extensive research program has been initiated at the Idaho National Engineering Laboratory (INEL) to develop and demonstrate advanced remediation techniques for DOE complex buried waste. The purpose of the Buried Waste Integrated Demonstration (BWID) is to develop a scientifically sound and deployable remediation system consisting of advanced technologies which address the buried waste characteristics of the DOE complex. This comprehensive remediation system will include technologies for the entire remediation cycle (cradle-to-grave). Technologies developed and demonstrated within the BWID will be transferred to DOE complex sites with buried waste, to private industry, and to universities. Multidirectional technology transfer is encouraged by the BWID. Identification and evaluation of plausible technological solutions are an ongoing activity of the BWID. A number of technologies are currently under development throughout the DOE Complex, private industry, and universities. Technology integration mechanisms have been established by the BWID to facilitate collaborative research and demonstration of applicable remedial technologies for buried waste. Successful completion of the BWID will result in the development of a proven and reliable system at INEL and other buried waste sites, thereby supporting DOE's environmental restoration objectives.

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Demonstration Processing of Contaminated Scrap Metal for Beneficial Reuse - Phase 1 - Final Report

Report; 68 pp. (1987)

This is the final report of a demonstration conducted in response to the U.S. Department of Energy, Oak Ridge Operations Office proposal, "Processing 80,000 Tons of Contaminated Ferrous and Non-ferrous Scrap for Reuse Demonstration Program Phase 1," conducted by the Scientific Ecology Group, Inc. (SEG) as prime contractor, Westinghouse Waste Technology Services Division (WTSD) and Manufacturing Sciences Corporation (MSC) as subcontractors. The anticipated result of

the Phase 1 Demonstration, the beneficial reuse of material currently considered waste, was successfully accomplished. The SEG team devised and demonstrated a unique alternative method of beneficially reusing most of the metal which cannot be decontaminated or released because of low-level internal decontamination. SEG demonstrated the nonreleasable scrap metal can be used for the fabrication of radioactive waste containers - boxes or drums which can be used to package commercial and government radioactive waste. This report contains a description of the systems used to perform the decontamination demonstration and the survey instrumentation used to determine that release criteria have been satisfied. It also includes decontamination data used to determine costs for specific metal-wastes decontamination on a large-scale basis. Two methods of nickel purification are also briefly discussed. This report should be read in conjunction with Westinghouse R&D Center report, "Experimental Results for the Nickel Purification, Phase I, of the Oak Ridge Scrap Metal Decontamination Program" and Westinghouse Nuclear Services Integration Division, Decontamination, Disposal, and Recycle Services Facility report, "Test Results for Dry Abrasive Cleaning of Scrap Metal for Beneficial Use," which are described in separate records.

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Experimental Results for the Nickel Purification, Phase 1, of the Oak Ridge Scrap Metal Decontamination Program

Report; 81 pp. (March 16, 1987)

Approximately twenty million pounds of high purity nickel (greater than 99% Ni) have been contaminated with trace (less than 10 ppm) levels of transuranics and technetium-99 through use in Department of Energy (DOE) nuclear application systems. The nickel, in addition to significant inventories of aluminum, copper, and various grade steels, is stockpiled on four DOE Reservations controlled by the Oak Ridge Operations Office (DOE-ORO). The DOE-ORO Waste Management Research, Development and Demonstration Center has sponsored several Beneficial Reuse Programs (Phase I) to demonstrate technologies to recycle these metals. In a modest, Phase I, proof-of-principle program, the Westinghouse Research and Development Center demonstrated the technical feasibility of two technologies for beneficial nickel reuse: electrorefining, a novel approach; and melt refining, a proven technology. Melt refining with CaO/Fe2O3/SiO2 flux can reduce uranium to concentrations below detectable limits. It is not as successful in reducing technetium-99 contamination. Electrorefining not only reduces transuranic contamination to below detectable limits, it also has the potential of removing the technetium-99. Based on this technical advantage, commercial experience in nickel electrorefining, and the higher value of the cathodic nickel product, electrorefining is the recommended approach for Phase II of the scrap metal decontamination program. A fall-back or supporting position, based on melt-refining technology, should be developed in Phase II to address metals whose market values will not support the cost of electrorefining.

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Test Results for Dry Abrasive Cleaning of Scrap Metal for Beneficial Reuse - Phase 1 - Department of Energy Decontamination Program

Report; 39 pp. (1987)

The Department of Energy (DOE) operates several facilities which produce radioactively contaminated scrap metals. In the past, most or all of this scrap material, which included nickel, copper, aluminum, and various grades of steel, had been stored on the site where it was generated. This was considered a safe and inexpensive alternative to cleaning, disposal, or burial. Over the years, however, this stockpile of contaminated metals has grown to thousands of tons. In an attempt to dispose of this mountain of metal, DOE jointly contracted Westinghouse and Scientific

Ecology Group, Inc. to demonstrate the capability of various decontamination techniques to recover metal for beneficial use. This report details the efforts of the Westinghouse Nuclear Services Integration Division (NSID), Decontamination, Disposal and Recycle (DDR) Services Facility, to decontaminate this metal for unrestricted release. The Westinghouse DDR Facility demonstrated the feasibility of the following two decontamination techniques: (1) dry abrasive cleaning, a proven technology used in other industries for years, recently applied in a unique and innovative approach to decontamination; and (2) freon cleaning, a proven, nondestructive decontamination method. These decontamination methods were used to release copper, aluminum, monel, carbon steel, and stainless steel items considered to be scrap. The report provides the specific decontamination methods used, the criteria for unrestricted release of the scrap, the radiation survey equipment used, a description of the individual items decontaminated, the results of each item's cleanup, and the waste generated by the project.

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Summary of the Environmental Restoration Program Retrieval Demonstration Project at the Idaho National Engineering Laboratory - Revision 1

EGG-WTD-9291 (Rev. 1); 65 pp. (February 1991)

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

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Methodology for Generating Waste Volume Estimates

ES/ER/TM-18; 49 pp. (September 1991)

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

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Model Based, Sensor Directed Remediation of Underground Storage Tanks

CONF-910451; Proceedings of the Fourth Annual Hazardous Materials Management Conference/Central and Institute of Electrical and Electronic Engineers Robotics and Automation Conference, Sacramento, CA, April 9-12, 1991. IEEE Service Center, Piscataway, NJ, 2847 pp.; (pp. 1377-1385) (1991)

Sensor-rich, intelligent robots that function with respect to models of their environment have significant potential to reduce the time and cost for the cleanup of hazardous waste while increasing operator safety. Sandia National Laboratories is performing experimental investigations into the application of intelligent-robot control technology to the problem of removing waste stored tanks. This paper describes the experimental environment employed at Sandia with particular attention to the

computing and software control environment. Intelligent system control is achieved though the integration of extensive geometric and kinematic world models with real-time sensor based control. All operator interactions with the system are validated before execution with all operator commands to provide safe operation. Sensing is used to add information to the robot system's world model and to allow sensor-based sensor control during selected operations. The results of a first Critical Feature Test are reported and the potential for applying advanced intelligent control concepts to the removal of waste in storage tanks is discussed.

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R&D Activities at DOE Applicable to Mixed Waste

ANL/CP-73026; CONF-9110207; HazMat '91 South, Proceedings of the Hazardous Materials Management Conference, Atlanta, GA, October 2-4, 1991; (7 pp.) (1991)

The Department of Energy (DOE) has established the Office of Environmental Restoration and Waste Management. Within the new organization, the Office of Technology Development (OTD) is responsible for research, development, demonstration, testing and evaluation activities aimed at meeting DOE cleanup goals, while minimizing cost and risk. Because of U.S. governmental activities dating back to the Manhattan Project, mixed radioactive and hazardous waste is an area of particular concern to DOE. The OTD is responsible for a number of research and development (RD) activities aimed at improving capabilities to characterize, control, and properly dispose of mixed waste. These activities and their progress to date will be reviewed. In addition, needs for additional RD on managing mixed waste will be presented.

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The Department of Energy's Robotics Technology Development Program for ER and WM

CONF-910274; Automation and Robotics, Proceedings of a Workshop, Livermore, CA, February 6, 1991, 243 pp. (February 1991)

This presentation describes Department of Energy efforts to combine waste management and robotics technology goals to allow removal of workers from hazards, increase speed and productivity compared to alternate methods and technologies, increase safety of operations, and reduce life-cycle costs compared to alternate methods and technologies. The publication of this presentation consists of overheads only.

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Guidance Manual for Conducting Technology Demonstration Activities

ORNL/TM-11848; 272 pp. (December 1991)

This demonstration guidance manual has been prepared to assist Martin Marietta Energy Systems, Inc. (Energy Systems) staff in conducting demonstrations. It is prepared in checklist style to facilitate its use and assumes that Energy Systems personnel have project management responsibility. In addition to a detailed step-by-step listing of procedural considerations, a general checklist, logic flow diagram, and several examples of necessary plans are included to assist the user in developing an understanding of the many complex activities required to manage technology demonstrations. Demonstrations are pilot-scale applications of often innovative technologies to determine the commercial viability of the technologies to perform their designed function. Demonstrations are generally conducted on well-defined problems for which existing technologies or processes are less than satisfactory in terms of effectiveness, cost, and/or regulatory compliance. Critically important issues in demonstration management include, but are not limited to, such factors as communications with line and matrix management and with the U.S. Department of Energy and Energy Systems

staff responsible for management oversight, budgetary and schedule requirements, regulatory compliance, and safety.

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Remediation Technology Needs and Applied R&D Initiatives

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 479-484) (September 1991)

The U.S. Department of Energy (DOE) recently consolidated its environmental restoration and waste management activities into the new Office of Environmental Restoration and Waste Management (EM). EM is divided into three major offices: (1) the Office of Waste Operations (WO), responsible for treatment and disposal of currently generated waste; (2) the Office of Environmental Restoration (ER), which handles remediation of sites no longer in use; and (3) the Office of Technology Development (OTD), which supports the other offices by developing needed technology. This paper describes the organization, program structure, and activities of the Office of Technology Development. Major problems at DOE facilities and the specific types of innovative technology needed to solve them are also discussed. OTD consists of two major divisions: the Research and Development Division (R&D) identifies innovative technologies and generates data to support engineering decisions to proceed with development; and the Demonstration, Testing, and Evaluation Division (DT&E) acts as a conduit to full-scale implementation through demonstration and testing. The objectives of RDDT&E activities are: (a) to rapidly advance beyond currently available restoration and waste management technologies; (b) to provide solutions to key technical issues that will improve effectiveness, efficiency, and safety; and (c) to enhance DOE's ability to meet its 30-year compliance and cleanup goals. Four general categories where R&D and DT&E activities need to focus are: (i) waste minimization technologies, (ii) site characterization and assessment methods, (iii) waste treatment technologies, and (iv) remediation technologies with emphasis on in situ methods. For technology development, DOE is committed to forming cooperative partnerships with qualified academic, commercial, governmental, and international organizations who can contribute to RDDT&E activities.

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U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, DC

Synopses of Federal Demonstrations of Innovative Site Remediation Technologies

EPA/540/8-91/009; OSWER Directive 9380.1-06; 133 pp. (May 1991)

This document is a compendium of abstracts documenting the results of demonstrations of hazardous treatment technologies conducted by federal agencies involved in Superfund remediation and Resource Conservation and Recovery Act and USTF corrective actions. The document contains abstracts from U.S. Environmental Protection Agency (primarily from the Superfund Innovative Technology Evaluation program), U.S. Department of Defense, and U.S. Department of Energy. It also includes an outline of data needs to guide project managers in submitting information on new projects for future editions of the document.

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U.S. Environmental Protection Agency, Washington, DC

Superfund Innovative Technology Evaluation (SITE) Program - Spring Update 1991

EPA/540/8-91/005; 19 pp. (1991)

The U.S. Environmental Protection Agency's (EPA's) Superfund Innovative Technology Evaluation (SITE) Program serves several purposes, including (1) the development and

implementation of innovative treatment technologies for hazardous waste remediation and (2) the development and implementation of monitoring and measurement technologies for evaluating the nature and extent of hazardous waste site contamination. The SITE Program is administered by EPA's Office of Research and Development and consists of four interrelated programs: (a) Demonstration Program, (b) Emerging Technologies Program, (c) Monitoring and Measurement Technologies Program, and (d) Technology Transfer Program. This update bulletin, developed as a part of the Technology Transfer Program, highlights progress over the past year under the Demonstration, Emerging Technologies, and Monitoring and Measurement Technologies Programs. It also focuses on new technologies and significant events since the November 1990 SITE Technology Profiles (EPA/540/5-90/006) document was published. Further opportunities for technology transfer are provided in this bulletin.

ENVIRONMENTAL AND WASTE MANAGEMENT ISSUES

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Natural Resources Damage Assessments at Department of Energy Facilities - Using the CERCLA Process to Minimize Natural Resources Injuries

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 447-454) (September 1991)

Fifty years of research, development, and production in support of national defense have left the U.S. Department of Energy (DOE) with numerous radioactive, hazardous, and mixed waste sites requiring remediation and environmental restoration. DOE's responsibility for possible releases of these wastes into the environment is driving major efforts to characterize the contamination and to identify and implement remedial alternatives. The subject of this paper is the recently issued DOE guidance for minimizing damage claims resulting from injuries to natural resources on, over and under lands owned or controlled by DOE that result from releases of hazardous substances from DOE facilities. Since it is both the natural resource trustee and the lead agency at facilities under its control, DOE has a dual responsibility. This dual responsibility requires site remediation if necessary, restoration of any injured natural resources, and compensation for any such injuries. Depending on the regulatory authority governing the facility, the preferred means of evaluating the possibility of natural resource injury is either an ecological risk assessment or an environmental evaluation. This paper details several executive and legislative sources of authority for DOE's dual role as lead agency and trustee of natural resources. It also describes, as an example of how the DOE guidance can be applied, ongoing remedial investigation/feasibility studies at the Fernald Environmental Management Project in Ohio.

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Accumulated Waste Characterization Work Plan

POEF-Z-4223; 128 pp. (January 1992)

The Portsmouth Gaseous Diffusion Plant (PORTS), as part of the nation's uranium enrichment complex, produces enriched uranium for power generation and defense purposes. Since the beginning of diffusion plant operations in 1953, a variety of waste materials and excess equipment has been generated through both normal operations and as part of major system upgrade programs. However, as a result of the closure of former on-site radioactive management facilities and limited on-site and off-site disposal facilities for mixed (hazardous and radioactive) wastes, PORTS has accumulated large quantities of waste awaiting final disposition. In the Accumulated Waste Plan (AWP), these accumulated wastes were estimated to consist of some 21,700 containers of the radioactive, RCRA-hazardous, PCB, mixed and asbestos wastes in various storage areas and process buildings within PORTS. To properly manage these wastes on-site and prepare them for ultimate treatment or disposal, a detailed understanding of the waste's contents and characteristics must be developed. The strategy for managing and disposing of these wastes was outlined in the AWP. The purpose of this Accumulated Waste Characterization Work Plan (AWCWP) is to provide a detailed plan for characterizing waste containers from the existing PORTS inventory. The AWCWP documents the process and analytical information currently available and describes the statistically-based sampling and analyses required to support proper regulatory classification.

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Recycling and Resource Recovery at Oak Ridge National Laboratory

CONF-9111105; Proceedings of the Caribbean Haztech Conference, San Juan, Puerto Rico, November 13-15, 1991; (10 pp.) (1991)

This paper discusses the recycling and resource recovery strategies being developed to maintain continued operations at the Oak Ridge National Laboratory (ORNL). Several industrial

decontamination techniques for the minimization, segregation, and recycling of wastes are presented. A wide variety of liquid wastewater streams are generated from operations at the ORNL research facilities. The major chemical constituents (bicarbonates of calcium, magnesium, and sodium) are introduced by local river water and shallow drainage wells. Liquid low-level waste (LLLW), generated in support of DOE's nuclear energy technology programs over the past 40 years, are highly contaminated with fission products and transuranic (TRU) elements. These wastes are routinely collected in centralized collection tanks, concentrated by evaporation, and stored for future processing and disposal. The Resource Conservation and Recovery Act (RCRA) of 1976 mandated a nationwide system for the safe management of wastes that have been determined to be hazardous, from their creation to their ultimate disposal ("cradle-to-grave" control). The Hazardous and Solid Waste Amendments of 1984 (HWSA) prohibited the continued placement of RCRA-regulated, hazardous wastes in or on the land without compliance to Environmental Protection Agency (EPA) treatment standards. The EPA promulgated RCRA/LDR (land-disposal restriction) regulations, minimizing the short- and long-term threats arising from land disposal, and will not allow facilities to store mixed LLLW after 1994 (56 FR 42730, August 29, 1991). ORNL waste tank storage-volume capacities are approaching maximum limits, while treatment facilities to process and dispose these type wastes have been delayed indefinitely. As a result, these regulations and additional challenges have caused an increase in the emphasis on recycling and resource recovery.

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Solid Waste Program Plan

WHC-EP-0363 (Rev. 1); 98 pp. (August 1991)

The objective of the Solid Waste Program Plan (SWPP) is to provide a summary level comprehensive approach for the storage, treatment, and disposal of current and future solid waste received at the Hanford Site (from on-site and off-site generators) in a manner compliant with applicable regulations and orders. A previous version of the SWPP (titled Solid Waste Management Program Plan) was drafted in 1990 and released as WHC-EP-0363. The SWPP also presents activities required for disposal of selected wastes currently in retrievable storage. The SWPP provides a central focus for the description and control of cost, scope, and schedule of Hanford Site solid waste activities and provides a vehicle for ready communication of the scope of those activities to on-site and off-site organizations. This SWPP represents the most complete description available of Hanford solid waste activities and the interfaces between those activities. It will be updated annually to reflect changes in plans due to evolving regulatory requirements and/or the solid waste mission.

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Application of Quality Assurance/Quality Control to Waste Management Processes at the Hanford Site

CONF-9005178 (Vol. 1); Quality Control of Radioactive Waste Packaged for Removal: Requirements for Waste Acceptance and Quality Control, Proceedings of the Second International Seminar, Juelich, Federal Republic of Germany, May 28-June 1, 1990, Vol. 1, 741 pp.; (pp. 93-107) (1990)

The Hanford Site contains hazardous, radioactive and mixed wastes. Both the State of Washington and the United States Environmental Protection Agency (EPA) have regulatory and oversight responsibility for the environmental restoration/remedial action (ERRA) program. A landmark agreement, the first of its kind in the United States, was signed in May 1989 between the United States Department of Energy (DOE), EPA, and the State of Washington Department of Ecology. The agreement binds DOE to specific actions and milestones over a 30-year period.

Public participation is provided throughout the process. This document is commonly known as the "Tri-Party Agreement". The paper discusses examples of unique waste management and ERRA activities subject to the quality assurance program and the considerations involved in designing an appropriate quality assurance program for Hanford's new mission.

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Surface Contamination Criteria for Free Release

EPA/520/1-90-013; CONF-8909236; Residual Radioactivity and Recycling Criteria, A.B. Wolbarst, H. Terada, and A.C.B. Richardson (eds.), Proceedings of a Workshop, St. Michaels, MD, September 27-28, 1989, 311 pp.; (pp. 220-236) (September 1989)

Recycling of materials, equipment, and facilities during decontamination, decommissioning, or remedial action projects requires criteria for surface radioactivity guides. A consensus standard developed by the Health Physics Society on permissible limits of residual surface radioactivity for unrestricted release has gone through an evolutionary process during the last 18 years. A brief history of the surface contamination limits (including draft ANSI standard N13.12 and NRC Regulatory Guide 1.86) from 1971 through 1989 is presented. The paper discusses the practical application of the standard, limits and objections to the standard, measurement methods, and hazards analysis relating to the limits. Four primary concerns of a working group reviewing the standard include (1) a study conducted to determine if the limit of 300 dpm/100 cu cm for total alpha surface activity was too low to measure found it to be detectable; (2) the airborne concentration limits and toxicity classification of natural uranium and thorium were found not stringent enough; (3) an analysis of the performance standard in terms of health hazards showed doses below regulatory limits; and (4) consideration of the distinction between fixed and loose radioactive contamination prompted the conclusion that both direct and indirect (e.g., wiping) measurement methods were necessary.

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Meeting Licensing Restrictions from a Regulator's Perspective

CONF-9008119; Proceedings of the Twelfth Annual U.S. Department of Energy Low-Level Waste Management Conference, Chicago, IL, August 28-29, 1990, 336 pp.; (pp. 150-160) (1990)

The State of South Carolina was delegated the authority by the U.S. Nuclear Regulatory Commission to regulate the receipt, possession, use, and disposal of radioactive material as an Agreement State. Since 1970, the state has been the principal regulatory authority for the Barnwell Low-Level Waste Disposal Facility operated by Chem-Nuclear Systems, Inc. The radioactive material license issued has experienced many changes necessitated by technical advancements, which led to stricter controls and restrictions for shallow land disposal. Low-level waste has evolved from simple contaminated items with minimal radioactivity, to complex waste streams requiring elaborate processing and containment of high quantities of radionuclides. Waste streams also require extensive analysis and qualification to meet many of the restrictions imposed at the burial facility, and to comply with national standards and regulations for classification. This paper presents a chronological history of many of these restrictions, the rationale for them, and the waste generators' abilities and inabilities to comply. Case histories of some examples are discussed.

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Status and Implementation of the NRC Policy on Exemptions from Regulatory Control

EPA/520/1-90-013; CONF-8909236; Residual Radioactivity and Recycling Criteria, A.B. Wolbarst, H. Terada, and A.C.B. Richardson

(eds.), Proceedings of a Workshop, St. Michaels, MD, September 27-28, 1989, 311 pp.; (pp. 216-219) (September 1989)

The U.S. Nuclear Regulatory Commission (NRC) is considering a broad policy on exemptions from regulatory control. An advance notice of policy development was published for public comment in December 1988, and an international workshop and public meeting were held in October 1988 and January 1989, respectively. The policy will establish the framework within which the NRC will consider specific regulations and licensing actions that exempt certain practices from all or part of the normal system of regulatory control. Included within the policy will be the specification of numerical individual-dose criteria that define levels below which the Commission believes that further compliance with the ALARA principle is unwarranted. The individual-dose criterion in the proposed policy statement is 10 mrem (0.1 mSv) and the collective-dose criterion is 500 person-rem (5 person-Sv). Additional information is needed to translate the proposed exemption policy into actual regulatory decisions in the area of residual-contamination criteria. Developing interim criteria requires examination of all exposure pathways and tabulation of dose-per-unit concentrations for a variety of radionuclides in soils or structures. Generic values for each radionuclide corresponding to the individual-dose criterion must also be established. The policy will have broad applicability in areas such as waste disposal, decommissioning, and consumer products.

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Resolution of Regulatory Issues Facing the DOE In Situ Vitrification Program

PNL-SA-20059; CONF-920307; Waste Management '92, R.G. Post (ed.), Proceedings of a Conference, Tucson, AZ, March 1-5, 1992; (9 pp.) (March 1992)

In situ vitrification (ISV) is being developed by researchers at the Pacific Northwest Laboratory (PNL), Idaho National Engineering Laboratory (INEL), and Oak Ridge National Laboratory (ORNL) as a technology for remediating soils, underground storage tank residuals, and buried materials that have been contaminated with hazardous, radioactive, and mixed wastes (i.e., wastes containing both radioactive and hazardous wastes) at U.S. Department of Energy (DOE) facilities. The goal of the DOE ISV technology development program (i.e., the ISV Integrated Program) is to ensure that ISV is a workable technology for environmental restoration applications for DOE and other agencies. A DOE complex-wide plan was prepared during Fiscal Year 1991 to coordinate all levels of activities associated with the deployment of ISV. As part of this plan, a programmatic regulatory strategy was developed which focused on the federal environmental, health, safety, and nuclear regulations, including the U.S. Environmental Protection Agency (EPA) and DOE regulations, believed to have the most significant near-term impact on the use of ISV as a remediation technology. The portion of the programmatic regulatory strategy addressing compliance with the Comprehensive Environmental Response, Compensation and Liability Act, as amended, and the Resource Conservation and Recovery Act, as amended, is presented in this paper.

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Environmental and Waste Management Issues, Causes, Characteristics, and Cures

CONF-9008109; Environmental Issues and Waste Management in Energy and Minerals Production, T.M. Yegulalp and K. Kim (eds.), Proceedings of the First International Conference, Secaucus, NJ, August 27-29, 1990. Battelle Press, Columbus, OH, 602 pp.; (pp. 15-18) (1992)

The Department of Energy (DOE) views as one of its most challenging problems the minimization, management, and cleanup of waste materials generated from Departmental operations. The challenges for the DOE have striking similarities to the environmental restoration and waste management challenges associated with energy production and the mining and mineral processing

industries. Their challenges relate to uranium mining and the resulting mill tailings, decontamination and decommissioning of facilities, processing of nuclear materials, and production of weapons components. Add to this the challenge of environmental restoration solutions for waste disposal practices of the past. The fundamental goal of the DOE is to ensure that risks to human health and safety and to the environment posed by the Department's past, present, and future operations are either eliminated or reduced to prescribed levels by the year 2019. To achieve this goal DOE must be able to assess environmental and health impacts resulting from the low concentrations of contaminants. This paper presents an overview of the causes, characteristics, and cures for these environmental restoration and waste management issues.

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EPA's Proposed Environmental Standards for Low-Level Radioactive Waste Disposal and Criteria for Below Regulatory Concern

EPA/520/1-90-013; CONF-8909236; Residual Radioactivity and Recycling Criteria, A.B. Wolbarst, H. Terada, and A.C.B. Richardson (eds.), Proceedings of a Workshop, St. Michaels, MD, September 27-28, 1989, 311 pp.; (pp. 237-245) (September 1989)

The Environmental Protection Agency has developed generally applicable environmental standards for land disposal of low-level radioactive waste. The elements the proposed standard will include are: (1) exposure limits for pre-disposal management and storage operations, (2) criteria for other agencies to follow in specifying wastes that are below regulatory concern (BRC), (3) post-disposal exposure limits, (4) groundwater protection requirements, and (5) qualitative implementation requirements. To support the concept of BRC, the Agency has developed technical information, cost data, and a risk-assessment methodology for analyzing promising candidate waste streams. The BRC criteria are based on general population health risks, maximum annual exposures to critical population groups, and the costs now associated with regulation of these wastes. The regulatory package for these standards is presently under interagency review. Promulgation of the proposed standards is expected in 1990.

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W.H. Holcomb, J.M. Gruhike, and F.L. Galpin, U.S. Environmental Protection Agency, Office of Radiation Programs, Washington, DC

US EPA's Proposed Standard for BRC Criteria

Report; 4 pp. (1986)

The United States Environmental Protection Agency (EPA) has developed technical information, cost data, a methodology for analyzing promising candidate wastes streams, and a rationale for proposing Below Regulatory Concern (BRC) criteria. Risk assessments to support the BRC criteria include an analysis of surrogate radioactive waste streams, disposal alternatives, and diverse demographic settings. In considering the development of a proposed BRC level, EPA carefully weighed many factors. Foremost was protection of the public and the development of an exposure level with assurance of no undue risk. Also considered were other daily risks encountered, ability to demonstrate compliance, guidance for similar exemptions by other groups, consistency with other regulated risk levels, general population health risks, maximal annual exposures to critical population groups, and the costs presently associated with the regulation of these wastes.

1011

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Case Studies on Designing Meetings for Effective Institutional Interactions

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the

21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 27-30) (September 1991)

The U.S. Department of Energy (DOE) has been actively pursuing opportunities for external input into its programs and plans. This pursuit of external input is a result of DOE's commitment to a culture of openness and public involvement in decision making and policy decisions. This input has included interactions between DOE and other institutions, such as state and local governments and American Indian nations. One way these interactions occur is in the form of meetings to discuss issues or concerns the various participants have regarding DOE policies. The Management Systems Laboratories (MSL) involvement with this type of interaction has been as the meeting designer, coordinator, and facilitator for two external review groups: (1) the State and Tribal Government Working Group, and (2) a group composed of DOE transportation officials and local government officials from cities and counties around the country, the Local Government Network. MSL coordinates the design and facilitation of the Local Government Network with the Urban Energy and Transportation Corporation. In order to design an effective meeting, it is important to identify the audience and the meeting objectives. This paper discusses what MSL has learned about effective meeting design from their involvement with the two external review groups mentioned above. It also discusses the results of meeting evaluations that participants filled out following a meeting to help MSL determine if their meeting designs met the participants' purposes.

1012

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Development of a National Consensus Standard for Quality Assurance for Environmental Programs

EPA/600/A-92/011; 12 pp. (1991)

Decisions on where and how to cleanup federally owned facilities contaminated by mixtures of hazardous chemical and radioactive wastes requires that quality environmental data be obtained. The Federal Government is currently using several different standards or sets of requirements for establishing the quality assurance and quality control (QA/QC) procedures associated with environmental data operations for these sites. These standards define the criteria for the QA activities and documentation required, the content and format of the documentation, and who is responsible for implementation. Shortcomings in these standards or requirements led, in 1989, to efforts by several public and private sector groups to "harmonize" the multiple sets of standards and requirements into a single set. These efforts are being conducted under the auspices of the American Society for Quality Control (ASQC) and involve participation by the Environmental Protection Agency, Department of Energy, Department of Defense, Nuclear Regulatory Commission, and others in the contractor and regulated communities. The paper describes the progress toward establishing a national consensus standard for QA for environmental programs through the ASQC standard-setting process.

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NRC Residual Contamination Criteria

EPA/520/1-90-013; CONF-8909236; Residual Radioactivity and Recycling Criteria, A.B. Wolbarst, H. Terada, and A.C.B. Richardson (eds.), Proceedings of a Workshop, St. Michaels, MD, September 27-28, 1989, 311 pp.; (pp. 212-215) (September 1989)

The Nuclear Regulatory Commission (NRC) is addressing the issue of residual-contamination criteria. A Commission Policy Statement on exemptions from regulatory control is expected in the very near future. Based on this policy, NRC staff will develop interim guidance on acceptable levels of residual contamination early in 1990. This paper summarizes the current guidelines (found in Regulatory Guide 1.86) for terminating nuclear reactor licenses and releasing sites for unrestricted use, including the current acceptable

surface-contamination limits. Development of revised guidelines is discussed.

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Application of Exemption Principles to Low-Level Waste Disposal and Recycle of Wastes from Nuclear Facilities

PNL-SA-14711; CONF-880404; Proceedings of the Seventh International Radiation Protection Association Conference, Sydney, Australia, April 10-17, 1988; (5 pp.) (April 1988)

The International Atomic Energy Association (IAEA) and other international groups have been investigating the possibility of exempting from regulation certain radiation sources and practices, initially under the heading of "de minimis". Interest in this topic arises from the recognition that a significant fraction of nuclear wastes are contaminated to such low levels that the associated health risks are trivial. Therefore, regulatory control of these wastes seems unwarranted. Recently the IAEA work has been conducted on two interrelated levels: to establish principles for exemption, and to apply the principles to various areas of waste management. In the second area, the main objectives have been: (1) to illustrate a methodology for developing practical radiological criteria through the application of the IAEA preliminary exemption principles, (2) to establish generic criteria, and (3) to determine the practicability of the preliminary exemption principles. The method used by the IAEA to develop the criteria relies on a modeling assessment of the potential radiation exposure pathways and scenarios for individuals and population groups following the unrestricted release of materials. The scenarios and models used are necessarily generic; however, an attempt was made by IAEA to identify the most important pathways based on available literature. The generic scenarios and methods are intended to provide the basic framework for the numerical derivation of generic exempt quantities that would be adequately conservative in most situations. This paper describes the IAEA's assessment methodology and presents the generic results expressed in terms of the limiting activity concentrations in municipal waste and in low-activity materials for recycle and reuse.

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G.S. Linsley, International Atomic Energy Agency, Division of Nuclear Fuel Cycle and Waste Management, Vienna, Austria

International Principles for Exemption from Regulatory Control and Their Application to Waste Management

Report; 5 pp. (1986)

This paper describes the main features of the international consensus on principles for exempting radiation sources and practices from regulatory control reached at a meeting sponsored by the International Atomic Energy Agency and the Nuclear Energy Agency in Vienna in March 1988. Some remaining problems, both of a philosophical and technical nature, especially those related to the application of the principles to radioactive waste disposal, are discussed.

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Characteristics of Low-Level Radioactive Waste - Volume 1: Decontamination Waste Program - Annual Report for Fiscal Year 1990

NUREG/CR-5672 (Vol. 1); EGG-2635 (Vol. 1); 35 pp. (February 1991)

The objective of the project described here (FIN A6359), "Characteristics of Low-Level Radioactive Waste: Decontamination Waste Forms," which was funded by the U.S. Nuclear Regulatory Commission (NRC), is to provide baseline data on the stability and leachability of solidified decontamination wastes that are generated at

operating commercial nuclear power stations through the process of chemical decontamination of their primary coolant systems. This work is being performed to assess the adequacy of tests identified in "Technical Position on Waste Forms," a report prepared by the NRC Low-Level Waste Management Branch, to meet the requirements of 10 CFR 61. As part of this project, samples of decontamination waste-stream resins and cement waste forms were obtained from various commercial nuclear power stations. During Fiscal Year 1990, samples from the FitzPatrick and Brunswick nuclear stations were examined. To assess the effects of the decontamination wastes on the stability and leachability of the waste forms, samples were subjected to the leach tests described in "Technical Position on Waste Forms." Demineralized water and four different synthetic leachates with pH ranging from 4.2 to 10.4 were used for the tests. The results of these tests are tabulated and the preliminary analyses from these results are presented in this report. In addition, samples from the Peach Bottom nuclear station were acquired for examination during Fiscal Year 1991.

1017

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Advisory Committee on Nuclear Waste Comments on Proposed Nuclear Regulatory Commission Position on Regulatory Control Exemptions for Practices Whose Public Health and Safety Impacts Are Below Regulatory Concern (BRC)

NUREG-1423 (Vol. 1); (pp. 7-8, 11-13, 41-42, 73-74) (August 1990)

These selections from NUREG-1423 Volume 1 consist of letters from the Advisory Committee on Nuclear Waste (ACNW) to the chairman of the Nuclear Regulatory Commission (NRC) conveying the committee's comments on the Proposed Policy Statement on Below Regulatory Concern (BRC). The main comments of the ACNW were that: (1) The policy statement should state unequivocally that practices that are candidates for exemption should not, taking into consideration all such practices, result in an annual dose rate greater than a small fraction (about 10%) of the long-term annual dose limit for individual members of the public; (2) The NRC staff recognize that other agencies within the U.S. government (such as the Departments of Transportation and Health and Human Services) have already exempted certain practices, and that the NRC, in considering the granting of additional exemptions, must take into account the total impact upon the public; (3) The ACNW also believes that the collective dose limit should be variable. Following this approach, higher annual collective dose limits would be permitted for exempted practices that contribute smaller dose rates to individuals.

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Characteristics of Low-Level Radioactive Waste - Volume 2: Decontamination Waste Program - Annual Report for Fiscal Year 1991

NUREG/CR-5672 (Vol. 2); EGG-2635 (Vol. 2); 60 pp. (June 1992)

The objective of the project described here (FIN A6359), "Characteristics of Low-Level Radioactive Waste: Decontamination Waste Forms," which was funded by the U.S. Nuclear Regulatory Commission (NRC), is to provide baseline data on the stability and leachability of solidified decontamination wastes that are generated at operating commercial nuclear power stations through the process of chemical decontamination of their primary coolant systems. This work is being performed to assess the adequacy of tests identified in "Technical Position on Waste Forms," a report prepared by the NRC Low-Level Waste Management Branch, to meet the requirements of 10 CFR 61. During Fiscal Year 1991, samples of decontamination waste stream resins solidified in Portland cement and unsolidified waste stream resins were obtained from the Peach Bottom commercial nuclear power station. The radioisotopic composition of the waste stream was determined, and the solidified samples were leached in demineralized water and in simulated sea water. The compressive strength of the

samples immersed for 90 days in these two leachants was determined. In addition to the samples obtained from Peach Bottom, filter-sludge waste stream and solidified waste forms were obtained from Nine Mile Point nuclear power station. The radioisotopic composition of the Nine Mile Point waste stream was determined.

1019
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In-Drum Solidification of Low-Level Mixed Waste

CONF-9010166; Waste Management and Environmental Restoration, Proceedings of the 1990 DOE Model Conference, Oak Ridge, TN, October 29-November 2, 1990, 343 pp.; (5 pp.) (1990)

Because of the limited treatment capacity available for low-level mixed waste, many generators are forced to develop their own treatments, or store their mixed waste on site indefinitely. While the U.S. Environmental Protection Agency (EPA) estimates that it takes as much as two years and $200,000 to obtain a Resource Conservation and Recovery Act (RCRA) permit, in-container treatment is allowed in many cases without a RCRA permit. Although treating mixed waste in drums or other storage containers poses technical problems, mixed waste can be solidified in storage containers with little difficulty. Solidifying the mixed waste serves two functions: (1) it treats the hazardous portion of the waste by making the hazardous constituents less leachable; and (2) it removes any free-standing liquids, allowing the waste to eventually be disposed of at a low-level radioactive waste burial ground. Once solidified, the waste must then be delisted (if it is a listed hazardous waste), or the generator must show that it no longer exhibits a characteristic (if it is a characteristic waste). In-container solidification can be a simple and inexpensive waste-management alternative for generators of low-level mixed waste, and it may be their only feasible alternative.

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Nuclear Regulatory Commission, Office of the General Counsel, Washington, DC

Nuclear Regulatory Legislation, 101st Congress

NUREG-0980 (Vol. 2, No. 1); 426 pp. (June 1991)

This document is a compilation of nuclear regulatory legislation and other relevant material through the 101st Congress, 2nd Session. This compilation has been prepared for use as a resource document, which the Nuclear Regulatory Commission (NRC) intends to update at the end of every Congress. The contents of NUREG-0980 include (1) the Atomic Energy Act of 1954, as amended; (2) Energy Reorganization Act of 1974, as amended; (3) Uranium Mill Tailings Radiation Control Act of 1978; (4) Low-Level Radioactive Waste Policy Act; Nuclear Waste Policy Act of 1982; and (5) NRC Authorization and Appropriations Acts. Other materials included are statutes and treaties on export licensing, nuclear non-proliferation, and environmental protection.

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Wet Oxidation by Hydrogen Peroxide for the Treatment of Mixed Radioactive and Toxic Organic Wastes and Waste Waters

Waste Management 11(3):125-133 (1991)

Experiments carried out on a complex organic mixture, simulating the radioactive organic wastes produced in an Italian nuclear fuel reprocessing plant, have demonstrated the effectiveness of wet oxidation (WOX) in the reduction of the organic matter (up to 95%), and a maximum consumption of 15 l of H_2O_2 to entirely oxidize 1 l of organic waste. Preliminary tests on simulated waste water containing toxic organic compounds have produced good results: polychlorinated biphenyls are destroyed up to 95% when using the WOX in homogeneous media, and atrazine degradation is complete. The chemical oxidation demand (COD) values of olive vegetation water, a waste water with a high non-biodegradable phenolic content, are drastically decreased by WOX.

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Summary of EPRI BRC Research Program

Report; 4 pp. (1986)

In January, 1987, the Electric Power Research Institute (EPRI) embarked on a research program to provide the technical basis to support a rulemaking petition on Below Regulatory Concern (BRC) waste disposal. The petition would request the Nuclear Regulatory Commission (NRC) to authorize the disposal of very-low-activity power plant wastes other than in NRC-licensed low-level waste disposal facilities. The petition and supporting technical documents (approximately 1000 pages) have been completed and are currently under review by the utility industry. This paper summarizes some of the highlights and findings from the BRC research program.

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Development of Guidance for Variances from the RCRA Land Disposal Restrictions for US DOE Mixed-Waste Streams

PNL-SA-17828; CONF-900225; WATTec '90: Global Competitiveness - Managing Technology, Proceedings of the 17th Annual Technical Conference and Exhibition, Knoxville, TN, February 20-23, 1990, 78 pp.; (8 pp.) (February 1990)

In response to the U.S. Department of Energy's (DOE's) anticipated need for variances from the Resource Conservation and Recovery Act (RCRA) Land Disposal Restrictions (LDRs), a guidance manual was prepared. The guidance manual is for use by DOE facilities and operations offices in obtaining variances from the RCRA LDR treatment standards. The manual was prepared as a part of an ongoing effort by DOE-EH to provide guidance for the operations offices and facilities to comply with the RCRA LDRs. The manual addresses treatability variances and equivalent treatment variances. A treatability variance is an alternative treatment standard granted by EPA for a restricted waste. Such a variance is not an exemption from the requirements of the LDRs, but rather is an alternative treatment standard that must be met before land disposal. An equivalent treatment variance is granted by EPA that allows treatment of a restricted waste by a process that differs from that specified in the standards, but achieves a level of performance equivalent to the technology specified in the standard.

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Progress in the Development of Below Regulatory Concern Standards: An Industry Perspective

Report; 5 pp. (1986)

This paper discusses recent progress in the development of standards for the disposal of low-level radioactive waste as "below regulatory concern" (BRC). Topics discussed include the Nuclear Regulatory Commission's (NRC's) December 1988 advance notice of a policy statement on "generic" BRC, the industry's upcoming BRC rulemaking petition, the NRC's proposed "waste oil" rule, and the NRC's proposed reassertion of exclusive authority over on-site disposal. The paper focuses on those issues that are likely to determine whether or not the proposed BRC standards ultimately will provide meaningful benefits to industry, including the developing BRC dose criteria and the role of Agreement States in the implementation of BRC standards.

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U.S. Department of Energy, Assistant Secretary for Environment, Safety, and Health, Washington, DC

Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance

DOE/EH-0173T; 122 pp. (January 1991)

Effluent monitoring and environmental surveillance of radioactive materials are a continuing major part of the radiological protection programs at U.S. Department of Energy (DOE) sites. The purpose of this regulatory guide is to establish elements of a radiological effluent monitoring and environmental surveillance program considered acceptable to DOE, in support of DOE 5400.5 (Radiation Protection of the Public and the Environment) and DOE 5400.1 (General Environmental Protection Program). This guide identifies those monitoring and surveillance elements that are considered high priorities for a radiological effluent monitoring and environmental surveillance program. The guide both incorporates and expands on requirements embodied in DOE 5400.5 and DOE 5400.1.

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U.S. Department of Energy, Office of Environment, Safety, and Health, Washington, DC

Environmental Audit Manual

DOE/EH-0125; 1052 pp. (January 1990)

The U.S. Department of Energy (DOE) Environmental Audit Manual is a three-volume guide to the environmental regulatory compliance audit, assessment, or appraisal of a DOE facility. Use of the manual ensures that all aspects of a particular regulatory area are adequately and consistently covered. The audit manual also provides lines of inquiry to be used to assess a facility's adherence to environmental best management practices. The protocols in the audit manual are in a format of checklists so that the results and observations of an environmental audit can be documented and recorded directly in the manual. The manual's ultimate objectives are to (1) document a facility's compliance with environmental laws and regulations, (2) identify areas of potential noncompliance, and (3) plan for corrective action. The manual is designed for use at all levels within DOE. Because of the wide variety of DOE activities that can affect the environment and/or are regulated, this manual addresses the full range of environmental regulations and those technical disciplines and media that are not regulated by one specific statute, i.e., radiation, groundwater, and environmental monitoring quality assurance/quality control; there is a checklist for each of these areas. The checklists are based on federal regulations and relevant DOE orders. The manual does not address state or local regulations, nor does it cover compliance with the National Environmental Policy Act (NEPA), since a separate DOE checklist is available for that regulation. The regulatory-based checklists are organized on a section-by-section basis, following the specific requirements of the statutes or regulations. In general, individual sections or subparts of regulations are contained with separate sub-checklists. All of the checklists have been modified to a certain extent to apply to DOE facilities. Volume 1 of the audit manual contains Section 1, the manual's introduction, instructions for use, and list of the checklists, plus Sections 2-5: Clean Air Act, Clean Water Act, Comprehensive Environmental Response Compensation and Liability Act of 1980, and Federal Insecticide, Fungicide, and Rodenticide Act. Volume 2 contains Sections 6-8: Hazardous Materials Transportation Act, Natural and Cultural Resources Protection Acts and Executive Orders, and Resource Conservation and Recovery Act. Volume 3 contains Sections 9-16: Safe Drinking Water Act, Toxic Substances Control Act, Groundwater, Hazardous Materials Storage, Management Controls, Quality Assurance, Radiation, and Soil/Sediment/Biota.

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U.S. Department of Energy, Office of Environmental Guidance and Compliance, Washington, DC

DOE LDR Strategy Report for RMW

DOE/EH-91009496; 159 pp. (September 1989)

This report concerns the development of a U.S. Department of Energy (DOE) strategy for achieving radioactive mixed waste (RMW) compliance with the Resource Conservation and Recovery Act Land Disposal Restrictions (LDR). Quantities of DOE RMW subject to LDR are estimated at approximately 710,785 cubic meters. LDR regulations apply to RMW that contain spent solvents, dioxins, and California List wastes. These

categories represent 67 percent by volume of DOE RMW. The remaining 23 percent of DOE hazardous wastes are separated into three groups known as the First Third, Second Third, and Third Third wastes. The U.S. Environmental Protection Agency (EPA) has indicated that separate treatment standards for these remaining 23 percent of RMW are not being considered; instead, such RMW will be subject to the treatment standards that apply to nonradioactive hazardous wastes. However, development of these standards can be affected through submission of DOE data to EPA; four such data packages are identified in this report. Also identified are data on RMW accumulation and existing treatment capacity that were compiled to assist in an EPA review of the nationwide capacity to treat RMW. After reviewing the LDR compliance status of DOE's mixed waste operations, this report makes the following findings and observations: (1) LDR impacts are DOE-wide and of potentially great consequence to DOE operations; (2) LDR storage prohibition is the most immediate and common compliance issue at DOE facilities; (3) high-level RMW compliance relies on treatment and disposal technologies still under construction or in development; (4) transuranic RWM compliance requires that the Waste Isolation Pilot Plant no-migration petition be approved; (5) low-level RMW compliance issues vary due to the wide variety of wastes in this category; (6) 178 waste stream groupings were identified as subject to LDR; (7) DOE RMW was not fully considered by Congress or EPA when LDR were developed; (8) there are constraints on the optimal use of existing and planned treatment capacity within the DOE complex; (9) some RMW have not been adequately characterized relative to LDR; (10) LDR regulations are complex, misunderstood, and inconsistently applied to RMW by DOE personnel; and (11) soil and debris from DOE cleanups, representing a large category of future RMW, have undetermined treatment technologies. The report includes seven recommendations to DOE to (a) conduct comprehensive, near-term reevaluation of schedules to build site-specific RWM treatment facilities; (b) seek a solution to the LDR storage prohibition compliance issue; (c) develop new treatment standards or technologies for certain RMW; (d) pursue submission of a National Capacity Variance for First, Second and Third Third RWM; (e) continue to pursue compliance actions specific to DOE Operations Office facilities and RMW streams; (f) better coordinate the development and use of RMW treatments that meet compliance standards and disposal capacity within the DOE complex; and (g) continue to influence EPA's proposed rulemakings on LDR.

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U.S. Department of Energy, Washington, DC

Radioactive Waste Management

DOE Order 5820.2A (August 26, 1988)

The purpose of this order is to establish policies, guidelines, and minimum requirements for the Department of Energy (DOE) management of radioactive and mixed waste and contaminated facilities. It supersedes DOE Order 5820.2 of February 6, 1984. In general, DOE radioactive and mixed wastes shall be managed in a manner that assures protection of the health and safety of the public, DOE and contractor employees, and the environment. The generation, treatment, storage, transportation, and/or disposal of radioactive wastes, and the other pollutants and hazardous substances they contain, shall be accomplished in such a manner that minimizes the generation of such wastes and complies with all applicable federal, state, and local environmental, safety, and health laws and regulations.

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EPRI Discussion Paper on BRC and De Minimis Concepts

EPA/520/1-90-013; CONF-8909236; Residual Radioactivity and Recycling Criteria, A.B. Wolbarst, H. Terada, and A.C.B. Richardson (eds.), Proceedings of a Workshop, St. Michaels, MD, September 27-28, 1989, 311 pp.; (pp. 246-250) (September 1989)

The purpose of this discussion paper is to examine the definitions, relationships, and characteristics of the terms: (1) de minimis, (2) below regulatory concern (BRC), and (3) generic BRC. In the past

few years, these terms have been used in various contexts such as the disposal of very low-level wastes, dose levels to members of the public, and the unrestricted release or use of slightly radioactive materials. While all the terms have been taken to imply radiation risk levels of little significance, the use of these terms has not been wholly consistent. There appear to be multiple and sometimes conflicting interpretations of the terms. The use of these terms is explored herein. The results of the Electric Power Research Institute (EPRI) two-million-dollar research program to establish the technical basis for petitioning the Nuclear Regulatory Commission (NRC) to exempt very low-level nuclear reactor wastes from low-level waste-disposal facilities are also summarized.

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Environmental Monitoring Data for Evaluating Atmospheric Modeling Results

PNL-SA-18876;CONF-891053;Environmental Monitoring, Restoration and Assessment: What Have We Learned?, R.H. Gray (ed.), Proceedings of the 28th Hanford Life Sciences Symposium, Richland, WA, October 16-19, 1989, 340 pp.; (pp. 219-224) (1990)

Modeling results are often used to assess radionuclide exposures from atmospheric releases. Routine air monitoring has been conducted at many U.S. Department of Energy (DOE) facilities. In applying the Multimedia Environmental Pollutant Assessment System as part of DOE's Environmental Survey, these monitoring data were useful in evaluating modeling results. An example illustrates the comparison of monitoring and modeled atmospheric data at DOE sites.

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Status of Existing Federal Environmental Risk-Based Standards Applicable to Department of Energy Operations

CONF-910981; Environmental Remediation '91: Cleaning Up the Environment for the 21st Century, D.E. Wood (ed.), Proceedings of a Conference, Pasco, WA, September 8-11, 1991, 970 pp.; (pp. 847-851) (September 1991)

When conducting its environmental restoration, waste management, and decontamination and decommissioning activities, the U.S. Department of Energy (DOE) must comply with a myriad of regulatory procedures and standards. An assessment of the status of existing federal standards that may be applied to chemical and radioactive substances on DOE sites found substantial gaps and inconsistencies among the existing standards and technical issues associated with the application of those standards. Of 271 chemical and radioactive substances found to be important across environmental media at the Hanford, Savannah River, and Oak Ridge Sites, 96 (35%) are unregulated by federal regulations and are not covered by DOE guidelines, 48 (18%) are covered by single federal regulations or DOE guidelines, and 127 (47%) are covered by multiple regulations or DOE guidelines. Inconsistencies and technical issues among standards include the promulgation of different standards under different regulations for a given substance in an environmental medium, the application of standards for purposes other than originally intended, and the inability to meet standards because of technical limitations. Given the lack of a complete, consistent set of standards or generic procedures for determining applicable standards, and given the existence of inconsistencies and technical issues among the existing set of standards, DOE may be faced with lengthy negotiations of standards on a case-by-case basis. Such negotiations could result in inconsistent cleanup levels, high costs, potential delays, and missed regulatory milestones. Actions that DOE could take to resolve these issues include working with regulatory agencies to develop: (1) specific risk-based standards and generic procedures for determining risk-based standards for individual contaminants and contaminant mixtures; (2) consistent, accepted methods for assessing cumulative risk to humans for contaminant mixtures; (3) consistent, accepted methods for assessing ecological risk; and (4) methods for assessing and comparing risk to the public from contamination left in place, risk to the public from

transportation of contaminated materials, and risks to environmental restoration workers. DOE could also develop or adopt innovative approaches to working with regulators in determining standards, including: (1) negotiated rulemaking among all stakeholder groups; (2) negotiated time-phasing of activities based on relative risks and performances of existing and future technologies; and (3) reopener conditions where interim solutions are needed but cannot achieve desired levels of protection or standards.

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Dose Assessment and Environmental Monitoring to Demonstrate Compliance with the U.S. Environmental Protection Agency's Environmental Radiation Standards for Nuclear Fuel Cycle Facilities

PNL-SA-18876;CONF-891053;Environmental Monitoring, Restoration and Assessment: What Have We Learned?, R.H. Gray (ed.), Proceedings of the 28th Hanford Life Sciences Symposium, Richland, WA, October 16-19, 1989, 340 pp.; (pp. 331-333) (1989)

The U.S. Environmental Protection Agency issued regulations in 1977 setting forth environmental radiation protection standards for uranium fuel cycle facilities. The regulations require that radioactivity in planned effluent releases, except for radon and its daughter products, from uranium fuel cycle facilities be limited so that no member of the public receives an annual dose equivalent of more than 25 mrem to the whole body, 75 mrem to the thyroid, or 25 mrem to any other organ. The Nuclear Regulatory Commission (NRC) is responsible for assuring that licensees' uranium fuel cycle facilities meet these requirements. Since issuing environmental radiation protection standards, NRC developed a method for radiological assessment to demonstrate compliance with standards covering uranium mills, UF6 conversion plants, and fuel fabrication facilities. Generally, this method includes models for atmospheric transport, pathway analysis, and dose assessment. For certain unique facilities, the models may not be adequate to demonstrate compliance without using a supplemental environmental monitoring program, i.e., the actual measurement of radionuclide concentration, particle size distribution, and solubility of particles in air. This paper discusses the dose assessment models; their inadequacy to demonstrate compliance with certain unique facilities; and the ways environmental monitoring can be used to provide reasonable assurance that standards are met. Design criteria for a cost-effective monitoring program is discussed.

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U.S. Department of Energy, Assistant Secretary for Environment, Safety, and Health, Washington, DC

U.S. Department of Energy Radiological Control Manual

DOE/EH-0256T; DOE Order 5480.6; 202 pp. (June 1992)

The U.S. Department of Energy (DOE) has issued this manual to establish practices for the conduct of radiological control activities. The manual states DOE's positions and views on the best courses of action currently available in radiological control. The fundamental principle underlying the manual is: "There should not be any occupational exposure of workers to ionizing radiation without the expectation of an overall benefit from the activity causing the exposure." The provisions in the manual should be viewed by contractors as an acceptable technique, method, or solution for fulfilling their duties and responsibilities; it will be used by DOE in evaluating the performance of its contractors. If a user fully implements a provision of the manual, the user will have complied with, and most likely exceeded, any related statutory, regulatory, or contractual requirement. When incorporated into contracts, the provisions of the manual are binding requirements. The manual is not a substitute for regulations; it is intended to be consistent with all relevant statutory and regulatory requirements and shall be revised whenever necessary. The manual is a comprehensive guide, including chapters on: (1) excellence in radiological control, (2) radiological standards, (3)

conduct of radiological work, (4) radioactive materials, (5) radiological health support operations, (6) training and qualification, and (7) radiological records. In addition, it contains tables listing (a) suggested radiological performance indicators, (b) summary of dose limits, (c) summary of contamination values, (d) criteria for posting radiation areas, (e) criteria for posting contamination, high contamination, and airborne radioactivity areas, (f) guidelines for selecting protective clothing, (g) labeling requirements for radioactive materials, and (h) radiological worker entry training requirements.

1034

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Comprehensive Implementation Plan for the DOE Defense Buried TRU-Contaminated Waste Program

DOE/JIO-025; 454 pp. (February 1988)

In 1970, the U.S. Atomic Energy Commission established a "transuranic" (TRU) waste classification. Waste disposed of prior to the decision to retrievably store the waste, and which may contain TRU contamination, is referred to as "buried transuranic-contaminated waste" (BTW). The Department of Energy (DOE) reference plan for BTW, stated in the Defense Waste Management Plan, is to monitor it, to take such remedial actions as may be necessary, and to re-evaluate its safety as necessary, or in about 10-year periods. Responsibility for management of radioactive waste and byproducts generated by DOE belongs to the Secretary of Energy. Regulatory control for these sites containing mixed waste is exercised by both DOE (for radionuclides) and EPA (for hazardous constituents). Each DOE Operations Office is responsible for developing and implementing plans for long-term management of its radioactive and hazardous waste sites. This comprehensive plan includes site-by-site long-range plans, site characteristics, site costs, and schedules at each site.

1035

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BRC Disposal Alternatives for NORM Wastes in Texas

Report; 4 pp. (1986)

The Texas Low-Level Radioactive Waste Disposal Authority has investigated low-cost, alternative waste disposal methods for certain wastes containing small quantities of naturally-occurring radioactive materials (NORM). This paper presents a multipathway safety analysis of various scenarios for disposing of wastes containing limited quantities of NORM in Texas. The wastes include pipe scales and sludges from oil and gas production, residues from rare-earth mineral processing, and water treatment resins, but exclude large-volume, diffuse wastes (i.e., coal flyash, phosphogypsum). The purpose of the safety analysis is to define concentration and quantity limits for the key nuclides of NORM that will avoid dangerous radiation exposures under different waste disposal scenarios.

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