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Report to Congress on the U.S. Department of Energy's Environmental Management Science Program

Research Funded and Its Linkages to Environmental Cleanup Problems

High Out-Year Cost Environmental Management Project Descriptions

Volume III of III
Appendix C

April 1998

U.S. Department of Energy
Office of Science and Technology
Office of Environmental Management

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MASTER

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U.S. Department of Energy
Office of Science and Technology
Office of Environmental Management
Washington, D.C. 20585

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Appendix C Table of Contents

Introduction

The Department of Energy's Environmental Management Science Program (EMSP) serves as a catalyst for the application of scientific discoveries to the development and deployment of technologies that will lead to reduction of the costs and risks associated with cleaning up the nation's nuclear complex. Appendix C provides details about each of the Department's 82 high cost projects and lists the EMSP research awards with potential to impact each of these projects. This information may prove useful to program managers who are planning, integrating, and prioritizing Environmental Management projects, researchers who are attempting to address the Department's environmental challenges in their work, and stakeholders and regulators who are interested in the Department's environmental challenges.

The high cost projects listed are those having costs greater than $50 million in constant 1998 dollars from the year 2007 and beyond, based on the March 1998 *Accelerating Cleanup: Paths to Closure Draft* data, and having costs or quantities of material associated with an environmental management problem area. The high cost project information is grouped by operations office and organized by site and project code. Each operations office section begins with a list of research needs associated with that operations office. Potentially related research awards are listed by problem area in the *Index of Research Awards by Environmental Management Problem Area*, which can be found at the end of appendices B and C. For projects that address high risks to the public, workers, or the environment, refer also the Health/Ecology/Risk problem area awards.

Research needs are programmatic or technical challenges that may benefit from knowledge gained through basic research. The research needs listed for each operations office may draw from any of the following sources:

- Research needs identified through a complex-wide need survey conducted in June of 1996 and assigned to projects at the operations office by the EMSP,
- Research needs identified at workshops on "Linking the DOE's Environmental Management Science Program with Site-Specific Science Research Needs," held at Hanford and Savannah River in June of 1996 and at Oak Ridge and Idaho in October of 1996,
- Science Needs as reported in the *Accelerating Cleanup: Paths to Closure, Draft* data, Table O.9.2, and
- Technology development and science needs from the decontamination and decommissioning, mixed waste, plutonium, radioactive waste tanks, sub-surface contaminant, and spent nuclear fuel technology development focus areas, and assigned to projects at the operations office by science program staff.

The need statements listed in this report, while extensive, may not be comprehensive. Not all sites have held site-specific research agenda workshops nor did all respond to the complex-wide research need survey. The listed needs are not a complete representation of the technology development focus areas and Departmental sites. In addition:

- Many need statements are the product of an individual who contributed to either the workshop or the survey,
- Some of the statements are brief and may not completely capture or clarify the nature of the need,
- The classification of complex-wide research needs to operations offices was performed by EMSP staff, and
- The classification of research awards to environmental management problems was done by EMSP staff.

The high cost project descriptions presented in Appendix C contain information taken from the project baseline summaries provided to support the March 1998 *Accelerating Cleanup: Paths to Closure, Draft.* In the table which follows, the field names and field contents are described.

The *Index of Research Awards by Environmental Management Problem Area* illustrate which research activities *may* be applied to high cost projects in each Environmental Management problem area. There is no guarantee that the research results will impact a given high cost project nor can the impact of research results on other Departmental activities be predicted. The information presented illustrates some ways in which the EMSP can add value the

Department's environmental management cleanup mission by providing the scientific knowledge that could lead to significantly lower cleanup costs and reduced risks to workers, the public, and the environment.

This document is intended to begin the process of creating links between the research communities and Department of Energy sites. The EMSP will evolve as new research needs and technical solutions are identified.

Guide to Fields on High Cost Project Summaries

Field Name	Description of Contents
Project Code (Precedes project title)	Project identification code used by the Operations/Field Office site
Problem Area:	Environmental Management problem area with which the project is associated
Life Cycle Cost in 2007+:	Projects estimated life-cycle costs for the years 2007 and beyond, in constant 1998 dollars
DOE Project Manager:	Department of Energy employee assigned as the project manager (name, phone number, E-mail)
Contractor Manager:	Contractor manager assigned to the project (name, phone number, E-mail)
For More Information:	World Wide Web address for the project baseline summary
Max Public Risk:	Relative level of public health risk (Urgent, High, Medium, Low) managed by the project in the year 2007 and beyond
Max Worker Risk:	Relative level of risk to workers (Urgent, High, Medium, Low) managed by the project in the year 2007 and beyond
Max Environmental Risk:	Relative level of risk to the environment (Urgent, High, Medium, Low) managed by the project in the year 2007 and beyond
Technical Approach Provided by Project Manager:	Description of the overall approach to the project.
Post 2006 Project Scope Provided by Project Manager:	Key work scope activities that are scheduled to occur after the year 2006
Project End State Provided by Project Manager:	Description of the status/accomplishments reached at the conclusion of the project

Albuquerque Operations Office

Research Identified Through the Complex-Wide Needs Survey, June 1996

CS-055 - Improved methods for removing surface (removable) Actinide contamination from non porous surfaces to <100 nCi/gm.
CS-061 - Simple and safe methods for digging and crushing concrete foundations is needed.
CS-073 - Best available technologies for demolition of concrete structures.
CS-077 - Methods for decontamination of concrete surfaces (walls, floors, ceilings) to <100 nCi/gm.
CS-108 - Chromium contamination in soils and groundwater.
CS-109 - Acid mine drainage (AMD).
CS-116 - Proper application of Electronic Soil remediation techniques to removal of metal ions and anions (including radionuclides) from contaminated soil.
CS-126 - Remove OU 5 landfill contents.
CS-128 - Environmental remediation of soils and other media adjacent to dismantled buildings.
CS-150 - Characterization of radionuclide constituents and concentrations deterring waste classification.

Technology Development and Science Needs related to the Decontamination and Decommissioning Technology Focus Area

D&D15 - Improved concrete decontamination technologies are needed that are faster, more cost effective, nondestructive (for a reusable concrete surface) and that reduce the amount of secondary waste.
Science Need: A basic understanding of the chemistry and surface science of porous surfaces is needed to develop improved decontamination methods for wood, concrete, and asbestos.

Technology Development and Science Needs related to the Sub-Surface Contaminants Technology Focus Area

SCFA01 - Cost effective monitoring strategy. Need cost effective monitoring strategy for containment of radionuclides, metals, and organic systems.
Science Need: Fundamental biological studies are needed for collection of data related to long term monitoring using natural systems to monitor for radionuclides, metals, and organic molecules. Fundamental studies to relate ecological change to contamination level.
SCFA03 - Active groundwater remediation. Need for cheaper, active groundwater remediation to replace expensive pump and treat methods for radionuclides and metals in groundwater; include bioremediation and permeable reactive barriers if feasible.
Science Need: Basic biological and geochemical studies are needed to understand methods, mechanisms, and routes to actively remediate ground water in place.
SCFA04 - Long term (200-500 years) performance monitoring. Also include modeling/prediction for landfill closure cover for both arid and humid climates.
Science Need: Fundamental engineering science studies are needed to understand aging effects and structural longevity using the aging phenomena associated with natural structures.

Albuquerque Operations Office

Grand Junction Office

AL024 - Grand Junction Office (GJO) All Other Projects

Problem Area:	Remedial Action
Life-Cycle Cost in 2007+:	$1,209,000,000
DOE Project Manager:	Jack Tillman, 970-248-2001, Jtillman@.doegjpo.com
Contractor Manager:	Various within two separate contractors
For More Information:	http://www.doe.gov/em52/pbs/al024.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Low **Worker:** Low **Environment:** Low

Technical Approach Provided by Project Manager:

Grand Junction Office Remedial Action Project (GJORAP)
The selected alternatives are to either 1) remove contaminated materials from the Grand Junction site and co-dispose of these with UMTRA Project tailings or 2) apply for DOE approval of Supplemental Limits on buildings with extremely low exposure risks. Complete removal of contaminated material or approval of Supplemental Limits will eliminate radiation contamination and will allow the natural dispersion and eventual elimination of contaminants from the alluvial aquifer beneath the site.

Facility Management
Not applicable.

Uranium Lease Management (ULM)
The reclamation effort will involve cleanup in and around the mine sites using conventional equipment.

Long-Term Surveillance and Maintenance (LTSM)
Activities include: (1) inspecting sites annually or more frequently, if required; (2) maintaining security systems and establishing liaisons with local authorities for notification of security breeches; (3) maintaining sites and restoring degraded as-built features as needed; (4) monitoring air, soil, and surface and ground water, as necessary; (5) responding to emergencies in the event of a site security breach or a natural disaster; (6) providing additional designs and performing construction, as needed, due to site failure or new regulatory requirements; (7) maintaining permanent site record files and providing reports annually within DOE and to outside agencies; and (8) responding to public requests for information. For the LTRM portion of the project, activities include: (1) receiving tailings and tailings-contaminated materials; (2) field testing of received materials; (3) decontaminating transportation and site equipment; (4) maintaining site engineered features; (5) providing site security; (6) performing environmental monitoring of soil, water, and air; (7) maintaining permanent site record files; (8) providing reports annually within DOE and to outside agencies and regulators; and (9) responding to public requests for information.

The technical approach for implementation of LTSM activities at the Monticello Sites will be established in the site-wide Monticello LTSM Plan. This Plan will compile the LTSM requirements for the repository, millsite, supplemental standards properties and wetlands surveys. The Plan will be reviewed prior to turnover of the LTSM activities to the LTSM Program for implementation on October 1, 2001.

Waste Management/Minimization
The objective of this project is to minimize the volume and toxicity of all types of waste and ensure that wastes are managed in compliance with DOE requirements and all applicable federal, state, and local environmental laws and regulations. Wastes that cannot be prevented will be recycled when practical. Wastes shall be stored and managed appropriately on-site, and treated, if possible. Wastes will be shipped for off-site treatment or disposal in full compliance with all applicable regulations, permits, and agreements.

Post 2006 Project Scope Provided by Project Manager:

Grand Junction Office Remedial Action Project (GJORAP)
Monitoring of natural flushing of ground water will continue under the LTSM Program. When contaminants in ground water fall below regulated concentrations, the ground water monitoring and institutional controls will be terminated.

Facility Management
Facility Management will provide the appropriate support, as previously defined, to the extent required to support the ongoing GJO mission.

Uranium Lease Management (ULM)
Reclamation of the active lease tracts by the current leaseholders will continue until the sites are acceptable to the BLM for public use. Project personnel will review and approve all reclamation plans, and will monitor all reclamation activities. It is currently estimated that all lands will be restored to the public domain under BLM's administrative control by the end of FY 2010.

Long-Term Surveillance and Maintenance (LTSM)
Activities beyond FY 2006 are the same as for FY 2006, except that additional sites are expected to be added.

Waste Management/Minimization
It is planned that clean-up of the GJO site will be completed. All waste currently stored at the site will have been disposed/treated by FY 2006. At FY 2006 and thereafter, the project will only treat/dispose wastes generated by projects assigned to the site.

Project End State Provided by Project Manager:

Grand Junction Office Remedial Action Project (GJORAP)
The entire site will have met remediation goals and will be available for reuse.

Facility Management
End state for Facility Management at the present site will be the total privatization through donation or sale or, transfer of ownership of the site from the DOE to another Federal agency. Facility Management support to GJO projects will end when the projects assigned to the GJO cease.

Uranium Lease Management (ULM)
If the active leases are not relinquished by their respective leaseholders prior to the end of the current ten-year term, and if DOE does not extend the leases beyond the current ten-year term, then the reclamation of these tracts will take approximately four years to complete; two and one-half years to perform the actual reclamation and reestablish adequate vegetation, and 18 months to restore the lands to the public domain under BLM's administrative control (approximately FY 2010). If DOE extends the current leases beyond the current ten-year term, the final end state will be adjusted outward accordingly.

Long-Term Surveillance and Maintenance (LTSM)
Activities will continue at the assigned sites, in accordance with approved LTSM plans. For the LTRM portion of the project, it is anticipated that by FY 2023, all tailings and tailings contaminated materials will have been placed in the Cheney Disposal Cell and the Cell closed and licensed by the NRC. Long-Term Surveillance and Maintenance of the cell will continue for up to 1,000 years as part of the LTSM Program.

The Project End State for the implementation of the Monticello LTSM Plan is in determinant. Long-term surveillance and maintenance activities will continue indefinitely to ensure that 1) the on-site repository continues to meet performance standards, 2) the land use restrictions associated with supplemental standards for OU III are enforced, and 3) commitments to the City of Monticello and Utah Department of Transportation for the application of supplemental standards are met. The LTSM Program will also be required to conduct the operation and maintenance of the ground water remediation effort until cleanup goals are reached.

Waste Management/Minimization

The desired end state at the present site will be the total privatization through donation or sale or, transfer of ownership of the site from the DOE to another Federal agency. Waste management/Minimization support to GJO projects will end when the projects assigned to the GJO cease.

The full list of science research awards that have the potential to address projects such as this one, which deals with Remedial Action problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "Remedial Action".

The following awards were identified through systems engineering to have the potential to address the specific needs of this Project. Those research awards that may have the strongest link to this project are designated by the symbol "§".

Award ID	Page #	Award Title
§ 55396-CA	B-33	Sorption of Colloids, Organics, and Metals onto Gas-Water Interfaces: Transport Mechanisms and Potential Remediation Technology
§ 54893-FL	B-99	Research Program to Determine Redox Properties and Their Effects on Speciation and Mobility of Pu in DOE Wastes
§ 54888-MA	B-175	Manipulating Subsurface Colloids to Enhance Cleanups of DOE Waste Sites
§ 55119-TN	B-315	Phase Equilibria Modification by Electric Fields
§ 60197-TN	B-329	Microsensors for In-situ Chemical, Physical, and Radiological Characterization of Mixed Waste
§ 55185-TX	B-349	New Strategies for Designing Inexpensive but Selective Bioadsorbants for Environmental Pollutants: Selection of Specific Ligands & Their Cell Surface Expression
60141-DC	B-95	Gamma Ray Imaging for Environmental Remediation
55247-IL	B-119	Sensors Using Molecular Recognition in Luminescent, Conductive Polymers
55294-IL	B-121	Superconducting Open-Gradient Magnetic Separation for the Pretreatment of Radioactive or Mixed Waste Vitrification Feeds
55211-IL	B-141	Cavitational Hydrothermal Oxidation: A New Remediation Process
54791-KS	B-153	Managing Tight-binding Receptors for New Separations Technologies
59977-MD	B-169	Synthesis and Characterization of Templated Ion Exchange Resins for the Selective Complexation of Actinide Ions
54724-NM	B-205	Synthesis of New Water-Soluble Metal-Binding Polymers: Combinatorial Chemistry Approach
54751-NM	B-209	High Fluence Neutron Source for Nondestructive Characterization of Nuclear Waste
55387-NM	B-237	Photooxidation of Organic Wastes Using Semiconductor Nanoclusters
60017-PA	B-285	Removal of Technetium, Carbon Tetrachloride, and Metals from DOE Properties
54856-PA	B-289	Structural Biology of the Sequestration & Transport of Heavy Metal Toxins: NMR Structure Determination of Proteins Containing the -Cys-X-Y-Cys-metal Binding Motifs
54973-TN	B-301	A Novel Energy-Efficient Plasma Chemical Process for the Destruction of Volatile Toxic Compounds
54735-TX	B-343	Development of Inorganic Ion Exchangers for Nuclear Waste Remediation
60050-WA	B-395	Chemical Speciation of Inorganic Compounds under Hydrothermal Conditions

Albuquerque Operations Office

Kansas City Plant

AL007 - Environmental Restoration

Problem Area: Remedial Action
Life-Cycle Cost in 2007+: $66,000,000
DOE Project Manager: G. P. Keary, 816-997-7288, pkeary@kcp.com
Contractor Manager: David E. Brown, 816-997-4034, debrown@kcp.com
For More Information: http://www.doe.gov/em52/pbs/al007.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Low **Worker:** Low **Environment:** Low

Technical Approach Provided by Project Manager:

Contaminated soil will be remedied based on risk. Where little risk to human health and the environment exists, exposure risks will be managed through institutional controls. Institutional controls include physical and procedural controls to protect workers from inadvertent exposure to contaminated soil or groundwater. Significant contamination in soil above the water table will be excavated and landfilled in certified off-site disposal facilities. Contaminated groundwater will be treated by an ultra-violet light, hydrogen peroxide treatment system prior to discharge into the sanitary sewer system. Alternative cleanup technologies such as deep-soil mixing, microwave enhanced subsurface contaminant removal, and zero-valent iron filings will be utilized where proven to cost-effectively reduce risk.

A passive, in-situ groundwater treatment system utilizing zero-valent iron filings has been selected a Technology Deployment Program project.

Post 2006 Project Scope Provided by Project Manager:

Groundwater treatment and monitoring will continue until three consecutive years of not exceeding Maximum Contamination Levels can be demonstrated or an alternative can be agreed to by the regulators. Innovative, in-situ groundwater /soil treatment methods are reviewed as they become available.

Based on Environmental Protection Agency guidance, it is estimated that tens to hundreds of pore volumes will need to be removed to achieve clean-up. Based on current interceptor systems plume pore volume removal rates, hundreds to thousands of years of groundwater pump and treat will be required for alluvial aquifer restoration.

Project End State Provided by Project Manager:

All projects necessary to meet the "complete" criteria are scheduled for completion by the end of FY 1999. "Complete" criteria applicable to the KCP includes "All releases to the environment have been cleanup up in accordance with agreed upon cleanup standards" and "groundwater contamination has been contained, and long term treatment or monitoring is in place."

Land: For the various projects at the KCP, contamination has been contained or removed, and cleanup levels are determined for each individual project based on the nature of the contaminant and proximity of the contamination to receptors.

Groundwater: Cleanup levels have not been agreed upon. DOE proposed risk based levels for industrial areas above Maximum Concentration Levels. EPA responded with risk based standards for residential areas which, in some cases, are below Maximum Concentration Limits. Negotiations are not completed on this issue. Long term monitoring, and possibly treatment, is expected for hundreds of years at the present remediation rate due to the presence of DNAPLs (Dense Non-Aqueous Phase Liquids).

Facilities: There are no Environmental Restoration facilities at the KCP.

The full list of science research awards that have the potential to address projects such as this one, which deals with Remedial Action problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "Remedial Action".

The following awards were identified through systems engineering to have the potential to address the specific needs of this Project. Those research awards that may have the strongest link to this project are designated by the symbol "§".

Award ID	Page #	Award Title
§ 55014-AL	B-1	Kinetics and Mechanisms of Metal Retention/Release in Geochemical Processes in Soil
§ 55396-CA	B-33	Sorption of Colloids, Organics, and Metals onto Gas-Water Interfaces: Transport Mechanisms and Potential Remediation Technology
§ 55249-CA	B-47	Experimental Determination of Contaminant Metal Mobility as a Function of Temperature Time and Solution Chemistry
§ 55284-CA	B-55	Aquifer Transport of Th, U, Ra, and Rn in Solution and on Colloids
§ 54860-CA	B-59	Sorption of Heavy Metals and Radionuclides on Mineral Surfaces in the Presence of Organic Co-Contaminants
§ 54661-DE	B-91	Electrochemical Processes for In-Situ Treatment of Contaminated Soils
§ 54683-MA	B-173	Speciation and Structural Characterization of Plutonium and Actinide-organic Complexes in Surface and Groundwaters
§ 54741-NM	B-207	Characterization of Contaminant Transport Using Naturally-Occurring U-Series Disequilibria
§ 54857-NM	B-245	Surface Nuclear Magnetic Resonance Imaging of Water Content Distribution in the Subsurface
§ 54639-NM	B-251	Development of an In-Situ Microsensor for the Measurements of Chromium and Uranium in Groundwater at DOE Sites
§ 55036-TN	B-307	Colloid Transport and Retention in Fractured Deposits
§ 55267-TN	B-317	Containment of Toxic Metals and Radionuclides in Porous and Fractured Media: Optimizing Biogeochemical Reduction versus Geochemical Oxidation
§ 60197-TN	B-329	Microsensors for In-situ Chemical, Physical, and Radiological Characterization of Mixed Waste
§ 54635-WA	B-361	Molecular-Level Process Governing the Interaction of Contaminants with Iron and Manganese Oxides
§ 60355-WA	B-377	Mineral Surface Processes Responsible for the Decreased Retardation (or Enhanced Mobilization) of 137Cs from HLW Tank Discharges
54546-CA	B-61	Engineered Antibodies for Monitoring of Polynuclear Aromatic Hydrocarbons
60141-DC	B-95	Gamma Ray Imaging for Environmental Remediation
55042-GA	B-105	Quantifying Silica Reactivity in Subsurface Environments: Controls of Reaction Affinity and Solute Matrix on Quartz and SiO2 Glass Dissolution Kinetics
55247-IL	B-119	Sensors Using Molecular Recognition in Luminescent, Conductive Polymers
60247-IL	B-139	Miniature Nuclear Magnetic Resonance Spectrometer for In-Situ and In-Process Analysis and Monitoring
60231-MD	B-165	Novel Miniature Spectrometer for Remote Chemical Detection
54751-NM	B-209	High Fluence Neutron Source for Nondestructive Characterization of Nuclear Waste

Albuquerque Operations Office

Los Alamos National Laboratory

AL009 - LANL Environmental Restoration

Problem Area: Remedial Action
Life-Cycle Cost in 2007+: $193,000,000
DOE Project Manager: Theodore J. Taylor, 505-665-7203, ttaylor@doe.lanl.gov
Contractor Manager: Julie Ann Canepa, 505-667-0808, jcanepa@lanl.gov
For More Information: http://www.doe.gov/em52/pbs/al009.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Low **Worker:** Low **Environment:** Low

Technical Approach Provided by Project Manager:

The LANL Environmental Restoration Project's approach to implementing the corrective action process uses a modified version of the DOE's streamlined approach. This approach incorporates elements of data quality objectives, risk assessment, and Environmental Protection Agency's (EPA) Superfund Accelerated Cleanup Model (SACM) to facilitate the rapid cleanup of potential release sites (PRSs). Both the technical approach and decision logic are tied to the EPA's regulations and guidance. For any given site, the ultimate objective of the approach is to reach a point at which no further action (NFA) is necessary. The approach stresses
- use of conceptual models and early identification of potential response actions based on existing information to assess sites,
- phased site characterization to close sites as early as possible, and
- integration of the phases of the corrective action process Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI), corrective measures study (CMS), and corrective measures implementation (CMI)] to collect data applicable to all three phases and to apply engineering analysis as early as possible in the process
- real time consultations and other interactions with regulatory agencies.

Many corrective action decisions require collecting, assimilating, and evaluating environmental data. The LANL technical approach to environmental restoration begins with decision criteria that are sufficiently explicit to guide the design of field investigations and the evaluation of the resulting data. Decisions required during the RFI include
- determining whether contaminants have been released to the environment -- the site-screening decision,
- determining whether corrective action is required for the site -- a risk-based decision that may be made before or after a CMS has been initiated, and
- determining whether a formal CMS is required to select and design an appropriate corrective action.

Depending on the nature and complexity of the site and the quality of existing information, it may be possible to propose a site for no further action (NFA). The remaining sites fall into the following categories:
- sites where accelerated cleanup is possible,
- sites where CMS and CMI are expected, and
- sites for which existing information is not adequate to support a decision concerning potential outcomes that include NFA, accelerated cleanup, and further investigation.

Site-specific land use assumptions and exposure scenarios are considered in establishing preliminary remediation goals and media cleanup standards, as well as in risk assessments, to estimate the reduction of risk that could be realized by a potential corrective action. Target risk and dose levels are set following EPA and DOE guidance. Following EPA guidance, preliminary remediation goals and media cleanup standards for nonradioactive carcinogens are derived using EPA's target incremental risk range of 10-4 to 10-6. A target hazard index value of 1 is used for noncarcinogens. Hazardous constituents and radionuclide cleanup levels are evaluated based on total overall risk from a site. If radionuclides are the only contaminants of concern, the cleanup is conducted under the jurisdiction of DOE in accordance with DOE orders.

The project is working with other organizations to build into the process approaches for addressing National Resources Damage Assessment, watershed protection, ground water protection, and NEPA evaluations. This project also is developing material disposal area performance assessment of in-situ stabilization, and ecological risk assessment.

Post 2006 Project Scope Provided by Project Manager:

The LANL Environmental Restoration project will not be completed by 2006. Work at some complex sites will be completed in FY2008. A few smaller sites will also not be completed until FY2008 since this work is being deferred so that complex sites can be started earlier. Following this, it is anticipated that responsibility for long-term surveillance and maintenance will be turned over to other DOE & Laboratory organizations at that time. Surveillance and maintenance for hazardous waste sites may extend for only 30 years, but could extend indefinitely for most radiologically contaminated sites.

Project End State Provided by Project Manager:

The LANL Environmental Restoration (ER) project will be completed in 2008. The majority of lands and facilities addressed under the project will be used to achieve the future Laboratory mission. Therefore, the primary end point ER activities will achieve levels of remediation that generally allow industrial type activities to continue in a safe manner, with associated process development for NRDA, etc. described in A.2.3 and vulnerabilities stated in A.2.7.

Where lands have already been released or are scheduled to be released, the primary end point will achieve levels that allow unrestricted use of the property.

The 54 facilities (139 structures) which will be decommissioned will be done such that the associated property will be available for industrial use at completion. No additional Surveillance and Maintenance (S&M) is anticipated for these properties following decommissioning. Surplus facilities that are not on the list of 139 structures will remain following the completion of the ER project in 2008. It is anticipated that these and other facilities that become surplus in the future will be decommissioned by the landlord organizations. If the "V-site" structures at TA 16 structures are determined to be of enough historical significance to warrant continued deferral from decommissioning, there will be associated S&M.

Major material disposal areas will likely be maintained through institutional controls implemented by the landlord organizations after they have been remediated in accordance with regulatory requirements. Surveillance and monitoring of these sites will be in accordance with plans approved by the administrative authority and will continue after 2008.

It is not anticipated that ground water remediation will be necessary at LANL. However, should it be determined that such remediation is necessary, it will take place following plans approved by the administrative authority and will continue after 2008.

The full list of science research awards that have the potential to address projects such as this one, which deals with Remedial Action problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "Remedial Action".

Albuquerque Operations Office

Los Alamos National Laboratory

AL013 - LANL Waste Management - Legacy Waste

Problem Area:	Decontamination and Decommissioning
Life-Cycle Cost in 2007+:	$267,000,000
DOE Project Manager:	Jon Mack, 505-665-5026, jmack@doe.lanl.gov
Contractor Manager:	Micheline Devaurs, 505-667-1519, devaurs_micheline@lanl.gov
For More Information:	http://www.doe.gov/em52/pbs/al013.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Low **Worker:** High **Environment:** High

Technical Approach Provided by Project Manager:

TRANSURANIC WASTE:

All retrieval operations to remove TRU waste from earth-covered storage pads will comply with all LANL and DOE site-specific requirements of DOE Order 5480.31 and Operational Readiness Reviews, the Consent Agreement with the New Mexico Environment Department (NMED) of 1994, and the LANL RCRA permit.

A single integrated program, which minimizes individual characterization activities where possible, is used to satisfy various requirements (including compliance orders and agreements, federal and state regulations, WIPP WAC, DOE orders, and on-site safe storage requirements). TRU waste must be fully characterized to meet requirements and must be certified as meeting the WIPP WAC. The main elements of characterization are: nondestructive testing (radiography and radioassay), acceptable knowledge development, sampling and chemical analysis, headspace gas sampling, visual characterization, and associated QA documentation and recordkeeping. Characterization includes use of both fixed nuclear facilities and mobile systems; mobile systems are used to supplement facility capacity and to facilitate characterization where bringing the systems to the location of the TRU waste is the most practical.

Certification tasks include developing, implementing, and maintaining procedures and plans to verify that TRU waste meets the WIPP WAC. The tasks that make up this activity provide for fully implementing certification of TRU waste to WIPP WAC revision 5, and all required WIPP and site-specific documents, including the TRU Waste Characterization Quality Assurance Program Plan, the LANL Quality Assurance Project Plan, the LANL TRU Waste Certification Plan, and associated procedures. The TRU waste certification program also satisfies certification as described in the LANL RCRA storage Waste Analysis Plan (WAP) for TRU waste and certification of radioactive waste as required by DOE orders and LANL Laboratory Standards. Beginning in FY2001, characterization and certification activities will be increased to two shifts a day, which will allow the work to be completed in FY2015.

Temporary Storage Enclosures (or domes) are used for the storage of fiberglass-reinforced plastic-coated plywood (FRP) crates, standard waste boxes (SWBs), and drums of TRU waste. The domes used for TRU waste storage are equipped with a smoke detection system in accordance with DOE 5480.7A and lightening protection is provided. Local ventilation consisting of single-stage HEPA-filtered blowers mounted on dollies may be required to reduce the possibility of airborne emissions from repackaging and overpacking operations and to control internal contamination.

Implement two upstream treatment projects for legacy TRU waste. These projects are targeted at treating legacy TRU waste contained in non-certifiable packages. One project will sort, segregate, and size reduce TRU wastes contained in non-standard waste containers currently on-site. It is expected that this will reduce legacy TRU waste volumes by as much as 2,000 m3. The second project will decontaminate some of the legacy TRU metal wastes contained in non-standard containers, which will result in reclassification of approximately 300 m3 of legacy TRU waste to low-level radioactive waste which can be disposed on site.

MIXED LOW LEVEL WASTE:

The overall process for managing legacy MLLW is to continue to store the waste pending treatment in accordance with requirements, prepare the waste for treatment, and ship the waste for treatment and disposal. Storage of legacy MLLW involves inspection of the waste containers, repackaging and overpacking wastes as necessary, and radiological surveys of the containers and storage facilities. The MLLW storage operations include activities for auditing, inspection, waste characterization and verification, maintaining equipment and storage facilities, and maintaining the database and records that document the RCRA classification and radiological characteristics of the MLLW inventory in storage.

The FFCO/STP Annual Update Report will be prepared each year throughout the MLLW work-off process in accordance with FFCO/STP requirements. Compliance with the FFCO/STP will be monitored and enforced on an ongoing basis. Changes in regulatory requirements and both waste generator and DOE needs will be assessed on an annual basis.

Post 2006 Project Scope Provided by Project Manager:

Legacy TRU waste, including remote-handled TRU waste, work-off activities will continue and be completed in FY 2015. Upon completion of legacy TRU waste work-off, facilities used for legacy TRU waste storage, characterization and certification activities will be closed. Decommissioning and decontamination activities, including regulatory closures, for the WCRRF and RAMROD facilities will begin in FY2016 and be completed in FY2017.

Project End State Provided by Project Manager:

All legacy TRU waste, including remote-handled TRU waste, will be retrieved, characterized, treated, certified, placed in TRUPACTs and shipped directly to WIPP by the end of FY2015. Newly generated TRU waste will be certified and shipped to WIPP as it is generated starting in FY2002.

The upstream treatment projects for legacy TRU waste will be completed in FY2006.

All legacy MLLW will be appropriately disposed by the end of FY 2004, and newly-generated MLLW will be shipped for treatment and disposal within one year of generation after FY 1999.

The WCRRF and the RAMROD will be decommissioned and decontaminated by the end of FY2017.

The full list of science research awards that have the potential to address projects such as this one, which deals with Decontamination and Decommissioning problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "Decontamination and Decommissioning".

Idaho Operations Office

Research Identified Through the Complex-Wide Needs Survey, June 1996

CS-018 - Understand partitioning of Pu-238 in high temperature melters.
CS-019 - Waste forms having long-term durability.
CS-089 - Rapid (Field) non Invasive, real time *in-situ* measures to reduce cost of site characterization.
CS-091 - Location and characterization of high hazard waste and verification of remedial action.
CS-098 - Replace current batch sampling of surface water with a continuous monitoring systems maximizing information value of down-sized data collection.
CS-105 - Need inexpensive approach to characterizing burial grounds. Under current approaches it costs as much to characterize a burial ground as it would to retrieve all waste. No real-time analytical system. Analytical data are too costly to support real technical decisions.
CS-106 - Burial ground characterization.
CS-110 - Nitrate - contaminated groundwater.
CS-111 - Cyanide leach ponds leaking into groundwater.
CS-116 - Proper application of Electronic Soil remediation techniques to removal of metal ions and anions (including radionuclides) from contaminated soil.
CS-117 - Contaminated underground plumes.
CS-128 - Environmental remediation of soils and other media adjacent to dismantled buildings.
CS-133 - Removal of ^{3}H, ^{129}I, and CCl_4 from large volumes of groundwater plumes.
CS-134 - Restoration of an aquifer. Principal contaminant is ^{90}Sr.
CS-136 - Characterization of Waste; Chemical characteristics and remediation; degradation of chlorinated hydrocarbons TRU/TRM/LL/LLM waste to be retrievable. Appropriate technology required.
CS-140 - Many organic contaminated wastes can be treated by removal of the organic chemical species.
CS-142 - Technical justification to allow waste from different waste categories to be placed within the same TRUPACT-II container. Allows for more efficient use of available volume.
CS-144 - Technical justification to increase Pu gram limit above 325g/TRUPACT-II container.
CS-145 - Efficient method to eliminate hydrogen buildings in TRU containers being shipped to WIPP that contain organics.
CS-146 - Faster, better, cheaper methods are desirable for waste certification prior to shipment for disposal.
CS-149 - Detection and quantification of RCRA and CAA regulated organic chemicals in process off gases.
CS-150 - Characterization of radionuclide constituents and concentrations deterring waste classification.
CS-151 - Real time radiography is required for waste certification for shipment to WIPP. Improved techniques would speed this process.
CS-152 - Techniques for representative sampling of heterogeneous wastes.
CS-153 - Rapid, in-situ identification and quantification Rad contaminants in process equipment and tanks.
CS-155 - Because of the different treatment requirements for LL, LLM, TRU, TRM and residue wastes, there is a technical need for accurate, fast determination of drum contents via Non-Destructive Assay (NDA) and Non-Destructive Evaluation (NDE).
CS-157 - Technology needed for improved characterization of LLM waste and ER waste.
CS-159 - Conduct headspace gas sampling and gas generations studies on residue drums destined for WIPP.
CS-160 - Technical justification is necessary to establish appropriate Pu gram limits for various choices of waste storage buildings. Without this, the number of drum storage spaces and buildings required cannot be accurately estimated.
CS-161 - TRU, TRM, and Residue wastes will require critically safe treatment and interim storage systems to minimize/eliminate the possibility of a nuclear criticality. Commercial disposal facilities have an upper acceptance limit of 10 nCi/g. Existing in-drum counter instrumentation cannot detect levels this low.
CS-163 - Characterization of RCRA metals, volatile and semi-volatile in containers by non-intrusive measurement.
CS-165 - Waste assay is required for waste certification for shipment to WIPP. Improved techniques would speed this process.
CS-167 - Non-intrusive detection, quantification, and speciation of RCRA toxic metals in drums, boxes, and debris.
CS-172 - Bioremediation of Mixed Waste.
CS-173 - Safe, reliable, clean methods to detoxify toxic materials--for example using specific catalysts.
CS-178 - Liquid wastes will require immobilization prior to disposal. Use of appropriate absorbents is necessary for some liquids.

CS-179 - Offsite treatment of radioactive, hazardous, and mixed wastes is a consideration under ASAP II. Such facilities must be evaluated to ensure they provide adequate treatment, safety, and are licensable for these applications.

CS-182 - Some Hazardous wastes, particularly liquid wastes, will need to be immobilized prior to packaging. Also includes liquids entrained in solid waste matrices.

CS-183 - Some hazardous wastes will require oxidative treatment to minimize the hazardous component.

CS-189 - Liquid waste stabilization is required for all residue wastes to comply with the WIPP waste acceptance criteria.

CS-191 - Effective treatment of transuranic waste containing ^{238}Pu.

CS-192 - Continuous real time, at temperature monitors for measurements of hazardous compound concentrations in stack gas-specific metals and chemicals.

CS-194 - Treatment of spent deionizers with long-lived radionuclides (carbon-14).

CS-195 - Excess water from liquid wastes requires evaporation for volume reduction. Improvements in this technology will make this operation more efficient.

Technology Development and Science Needs related to the MIxed Waste Technology Focus Area

MWFA3 - Removal of sodium nitrate from low level waste destined for landfill disposal is required to comply with regulations.

Science Need: Basic studies associated with methods, chemistry, and kinetics of reduction of sodium nitrate are needed to treat liquid low level waste prior to landfill disposal.

MWFA4 - Radio assay improvements in data collection and analysis time are needed to reduce assay throughput bottlenecks.

Science Need: Fundamental studies leading to development of improved (sensitivity) gamma or neutron detectors, refinement of analysis algorithms, and improved neutron sources are needed to reduce uncertainty and measurement times.

MWFA5 - Non-invasive RCRA analysis of combustible and sludge waste forms is needed to reduce stakeholder concerns related to thermal treatment of these wastes.

Science Need: Basic experiments interested in non-intrusive chemical species determinations in heterogeneous matrices are required to support development of RCRA analysis methods. Neutron induced prompt gamma methods are a fruitful area.

Technology Development and Science Needs related to the Radioactive Waste Tanks Technology Focus Area

TFA02 - In-Situ Testing of LLW Glass Release. Propose a full-instrumented, in-situ, field experiment to validate computational model to calculate fluid-flow, release of contaminants from glass, and solute transport through soils.

Science Need: Basic geochemical studies are needed to support model validation of radionuclide leaching rates from fracture borosilicate glasses in unsaturated environments.

TFA04 - Cold Cap/Off-gas Thermodynamics Model. Need an improved immobilization or treatment process for volatile metals to lower cost and improve safety and reliability in handling the off-gas products.

Science Need: Fundamental chemical studies are needed to determine species concentration above molten glass solutions containing heavy metals, cesium, strontium, lanthanides, and actinides with and without a cold cap composed of unmelted material.

TFA10 - Develop HLW Formulations for the High Activity Fraction of SBW and Calcine. Need technology to denitrate and solidify the high-activity fraction resulting from radionuclide separation process in a form capable of shipment in NRC-certified casks.

Science Need: Fundamental physical chemistry studies of sodium nitrate/nitrite mixtures are needed for HLW processing and stabilization.

TFA11 - Develop Grout Process for Sodium Bearing Waste. Need formulations and processes for immobilizing low activity waste resulting from radionuclide separation of SBW, dissolved calcine, and decontamination operations.

Science Need: Basic chemistry of sodium when mixed with rare earth oxides is desired for development of alternative high level waste forms.

TFA13 - Sludge Waste Form Study. Need lab-scale vitrification and grouting studies with surrogates and actual waste samples to define the operational envelopes for these waste forms.

Science Need: Materials science studies of molten materials that simulate conditions anticipated during vitrification of HLW are needed to develop improved processes and formulations.

TFA16 - Alternative Calcination Process Flowsheet. Develop an alternative process flow sheet using sugar and/or higher calcination temperatures for processing SBW, which is not compatible with fluidized bed calcination at 500 degrees C.

Science Need: Fundamental chemical studies associated with high temperature (500 degrees C) calcination of concentrated nitrate solutions using reducing agents other than sugar are needed for advanced HLW calcination processes.

TFA21 - Removal of Undissolved Solids from Tank Waste & Dissolved Calcine. Need a method to separate undissolved solids from sodium bearing waste or dissolved calcine for the solvent extraction and ion-exchange processes used for TRU, Cs, and Tc separation.

Science Need: Basic engineering and separations science studies are required to support pretreatment activities, development of solid/liquid separations, and tank remediation of high solids loaded liquids.

TFA24 - Develop In Situ Sensor to Identify Flammable Gas Species. Need species-specific detectors to monitor the tank environment during waste retrieval and characterization activities to ensure that unsafe conditions are not being generated.

Science Need: Basic measurement science and sensor development are required to remotely detect low concentrations of hydrogen inside tanks and containers.

TFA27 - Colloidal Transport. Need definitive data on the kinetics of agglomeration of tank solid waste to develop colloidal transport models.

Science Need: Basic engineering and separations science studies are required to support pretreatment activities, development of solid/liquid separations, and tank remediation of high solids loaded liquids.

TFA37 - Develop high-activity waste form equivalent to borosilicate glass that can be designated as an "equivalent specified technology" or can be granted treatment variance. Investigate direct immobilization of high-activity fraction of radionuclide separation.

Science Need: Materials science and heavy element chemistry of actinides in mixed oxide matrices are required to provide improved understanding of HLW vitrified materials and glasses.

TFA38 - Calcine dissolution studies including acid concentration, mixing intensity, temperature, kinetics, and vessel geometry parameters.

Science Need: Basic materials science studies concerned with dissolution of mixed oxide materials characteristic of calcined waste are needed to design improved pretreatment processes.

Idaho Operations Office

Idaho National Engineering and Environmental Laboratory

ID-ER-103 - Idaho Chemical Processing Plant Remediation

Problem Area:	Remedial Action
Life-Cycle Cost in 2007+:	$199,000,000
DOE Project Manager:	T. Jenkins, 208-526-4978, JENKINTW@INEL.gov
Contractor Manager:	D. Greenwell, 208-526-0858, FRG@INEL.gov
For More Information:	http://www.doe.gov/em52/pbs/id-er-103.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Medium **Worker:** High **Environment:** High

Technical Approach Provided by Project Manager:

Assessment of the 95 WAG 3 potential release sites has been conducted in accordance with the FFA/CO and CERCLA. The assessment has included characterization of the release sites through the determination of the nature and extent of the potential release and an evaluation of the impact of the release (if any) on human health and the environment. The characterization approach, as specified in the FFA/CO, required Track 1, Track 2, and a RI/FS. Track 1 investigations were performed at sites that did not require further characterization as a basis for a decision for No Further Action and where by definition envisioned to be evaluations of existing data. Track 2 investigations were performed at those sites that required field data collection before a decision could be made for No Further Action or Interim Action of the site. A RI/FS was performed at those sites at that sufficient data existed to demonstrate unacceptable risks to human health and the environment, but required more data before a remedial action could be selected. This process provided a bias for action for those sites which posed immediate threats to human health and the environment.

To date, 32 Track 1s and 7 Track 2s have been completed. These investigations are currently being evaluated in the WAG 3 Comprehensive RI/FS in respect to determining the final action for all of the potential release sites that have not been determined No Further Action sites. Upon completion of this investigation, a ROD will be prepared detailing remedial action that must be performed at those sites that posed unacceptable threats to human health and the environment. Accelerated site cleanup actions including CERCLA Non-Time Critical Removal Actions will be performed to the maximum extent practicable to expedite risk reduction and reduce project lifecycle costs.

Cleanup Process:

The cleanup process will include remediation of sites at WAG 3 with unacceptable risk by the year 2005, with the exception of cleanup of the tank farm and other inaccessible sites that will continue beyond the year 2006. Cleanup of contaminated soil around the tank farm under the CERCLA will be coordinated with the Resource Conservation and Recovery Act (RCRA) closure of the high-level waste tanks at the tank farm. Following RCRA closure, an engineered cap meeting both CERCLA and RCRA requirements will be installed to prevent water infiltration and surface exposure to contaminants. Other contaminated soil sites will be remediated using an appropriate combination of institutional controls, caps, treatment, and excavation for consolidation at an INEEL CERCLA soil/debris repository. Interim measures will be implemented between the years 1999 and 2001 to reduce contaminant migration below the tank farm. Cleanup of contaminated soil sites located under buildings will be coordinated with decontamination and dismantlement, with completion of cleanup anticipated beyond the year 2006. The INEEL CERCLA soil/debris repository will be an available disposal option for other INEEL CERCLA projects. There are no interdependencies of this scope of work with other National Programs. Long-term monitoring and maintenance activities will be required for sites with remedies that leave contamination in place such as on-site capping.

Specific clean up activities anticipated include: Group 1 (Tank Farm Soils) existing institutional controls and surface water control improvement Interim Action followed by final remedial action decisions under the OU 3-14 RI/FS ROD, Group 2 (Soils Under Buildings/Structures) existing and additional institutional controls and construction of containment barriers, Group 3 (Other Surface Soil Sites) excavation and disposal within an on-site soil/debris repository, Group 4 (Perched Water) existing and additional institutional controls and surface water infiltration controls, and Group 5 (Snake River Plain Aquifer) existing and additional institutional controls. In addition, development of an INEEL CERCLA soil/debris repository is proposed including two cells designed for radionuclide-contaminated soil and one cell designed for RCRA Subtitle D compliant soil/debris disposal. For the buried gas cylinder sites, removal of gas cylinders, treatment of the contents and recycle of the cylinders is proposed. For the SFE-20 Tank System, existing institutional controls, removal/treatment of liquid contents, and grouting of tank sludge, tank, and vault are proposed.

Technology Needs:

There are no known technology needs critical to performance of the current work scope assumptions. However, if excavation, treatment, and disposal is selected as the remedial alternative for tank farm soil contamination sites, significant additional technology development may be required to support characterization, remote excavation, treatment, and disposal in coordination with similar waste management operations of the tank wastes. In addition, significant cost savings may be realized through development of more efficient characterization, treatment, and removal of buried waste tanks and radionuclide-in-soil characterization and separation technologies.

See section A.2.7 for expanded Technical Approach narrative

Post 2006 Project Scope Provided by Project Manager:

RCRA closure of the tank farm, to be performed under a separate project, will begin in 2009 and will be completed before 2035. This is assumed to include stabilization of the tank heels, filling the voids inside all tanks, and vaults with grout, and removing all support buildings within the tank farm fence line. Remediation Program part is $18M in 2011--2015 for closing and capping soil repository, and $71M in 2046--2050 for tank farm remediation and capping and soil under buildings.

Facilities that are immediately adjacent to the tank farm are scheduled for decontamination and dismantlement completion by 2044.

This project includes construction of a cap over the tank farm at a point in time when the RCRA closure and D&D actions have sufficiently progressed. The cap will prevent water infiltration and exposure to contaminants at the surface. It will meet all requirements for CERCLA remediation and RCRA closure. Monitoring and maintenance of the tank farm cap will begin after completion of the cap construction. It is assumed that, if new tanks are needed for the high level waste program, they will not interfere with installation of the cap.

100 Years of post remediation long term monitoring and maintenance is assumed to maintain the CAP and verify remedial actions.

Project End State Provided by Project Manager:

The final end state does not differ from that described in A.2.4 and A.2.5. Completion of the activities contained in this PBS support the goal of deletion of the INEEL from the National Priorities List.

The cleanup process and end states described here are purely assumptions. No regulator or other stakeholder acceptance has been received.

A conceptual vision of the end state in the year 2094 for the INEEL and each of the major facility areas has been defined through a compliance reengineering effort. These end states have not been agreed upon by the regulators, stakeholders, or Tribal Nations. The compliance reengineering project will identify a pathway to achieve concurrence on each end state by the end of FY-98.

The full list of science research awards that have the potential to address projects such as this one, which deals with Remedial Action problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "Remedial Action".

The following awards were identified through systems engineering to have the potential to address the specific needs of this Project. Those research awards that may have the strongest link to this project are designated by the symbol "§".

Award ID	Page #	Award Title
§ 55014-AL	B-1	Kinetics and Mechanisms of Metal Retention/Release in Geochemical Processes in Soil
§ 55164-AL	B-3	Advanced Experimental Analysis of Controls on Microbial Fe(III) Oxide Reduction
§ 54898-AZ	B-5	Molecular Dissection of the Cellular Mechanisms Involved in Nickel Hyperaccumulation in Plants
§ 55097-CA	B-15	Heavy Metal Pumps in Plants
§ 55278-CA	B-17	Molecular Genetics of Metal Detoxification: Prospects for Phytoremediation
§ 54698-CA	B-19	Rapid Mass Spectrometric DNA Diagnostics for Assessing Microbial Community Activity During Bioremediation
§ 55264-CA	B-21	Subsurface High Resolution Definition of Subsurface Heterogeneity for Understanding the Biodynamics of Natural Field Systems: Advancing the Ability for Scaling to Field Conditions
§ 55343-CA	B-25	Enzyme Engineering for Biodegradation of Chlorinated Organic Pollutants
§ 55396-CA	B-33	Sorption of Colloids, Organics, and Metals onto Gas-Water Interfaces: Transport Mechanisms and Potential Remediation Technology
§ 60328-CA	B-37	High Frequency Electromagnetic Impedance Measurements for Characterization, Monitoring and Verification Efforts
§ 55011-CA	B-43	Surface and Borehole Electromagnetic Imaging of Conducting Contaminant Plumes
§ 55249-CA	B-47	Experimental Determination of Contaminant Metal Mobility as a Function of Temperature Time and Solution Chemistry
§ 55284-CA	B-55	Aquifer Transport of Th, U, Ra, and Rn in Solution and on Colloids
§ 54666-CA	B-57	Mechanisms, Chemistry, and Kinectics of Anaerobic Biodegradation of Cis-Dichloroethylene and Vinyl Chloride
§ 54860-CA	B-59	Sorption of Heavy Metals and Radionuclides on Mineral Surfaces in the Presence of Organic Co-Contaminants
§ 54681-CA	B-67	Dynamics of Coupled Contaminant and Microbial Transport in Heterogeneous Porous Media
§ 55118-CA	B-71	Plant Rhizosphere Effects on Metal Mobilization and Transport
§ 55061-CA	B-77	Fundamental Studies of the Removal of Contaminants from Ground and Waste Waters via Reduction by Zero-Valent Metals
§ 55041-CA	B-79	Molecular Characterization of a Novel Heavy Metal Uptake Transporter from Higher Plants & its Potential for Use in Phytoremediation
§ 54661-DE	B-91	Electrochemical Processes for In-Situ Treatment of Contaminated Soils
§ 55218-GA	B-107	Seismic Surface-Wave Tomography of Waste Sites
§ 55416-ID	B-111	Control of Biologically Active Degradation Zones by Vertical Heterogeneity: Applications in Fractured Media
§ 55374-IL	B-125	Use of Sonication for In-Well Softening of Semivolatile Organic Compounds
§ 55388-IL	B-131	Stable Isotopic Investigations of in situ Bioremediation of Chlorinated Organic Solvents
§ 60199-KS	B-159	Seismic-Reflection and Ground Penetrating Radar for Environmental Site Characterization
§ 59786-MD	B-167	Design and Construction of Deinococcus radiodurans for Biodegradation of Organic Toxins at Radioactive DOE Waste Sites
§ 55152-MD	B-171	Molecular Profiling of Microbial Communities from Contaminated Sources: Use of Subtractive Cloning Methods and rDNA Spacer Sequences
§ 54683-MA	B-173	Speciation and Structural Characterization of Plutonium and Actinide-organic Complexes in Surface and Groundwaters

Awards Related to ID-ER-103 Continued

Award ID	Page #	Award Title
§ 55300-MA	B-179	3-D Spectral IP Imaging: Non-Invasive Characterization of Contaminant Plumes
§ 55105-MI	B-183	Complete Detoxification of Short Chain Chlorinated Aliphatics: Isolation of Halorespiring Organisms and Biochemical Studies of the Dehalogenating Enzyme Systems
§ 60271-NH	B-199	Characterization of a New Family of Metal Transport Proteins
§ 54741-NM	B-207	Characterization of Contaminant Transport Using Naturally-Occurring U-Series Disequilibria
§ 54857-NM	B-245	Surface Nuclear Magnetic Resonance Imaging of Water Content Distribution in the Subsurface
§ 54639-NM	B-251	Development of an In-Situ Microsensor for the Measurements of Chromium and Uranium in Groundwater at DOE Sites
§ 54122-PA	B-281	A Broad Spectrum Catalytic System for Removal of Toxic Organics from Water By Deep Oxidation
§ 55205-SC	B-299	A Fundamental Study of Laser-Induced Breakdown Spectroscopy Using Fiber Optics for Remote Measurements of Trace Metals
§ 55013-TN	B-303	Biofiltration of Volatile Pollutants: Engineering Mechanisms for Improved Design, Long-term Operation, Prediction and Implementation
§ 55033-TN	B-305	Characterization of Chemically Modified Hyperthermophilic Enzymes for Chemical Syntheses and Bioremediation Reactions
§ 55036-TN	B-307	Colloid Transport and Retention in Fractured Deposits
§ 55108-TN	B-313	Monitoring Genetic & Metabolic Potential for In Situ Bioremediation: Mass Spectrometry
§ 55267-TN	B-317	Containment of Toxic Metals and Radionuclides in Porous and Fractured Media: Optimizing Biogeochemical Reduction versus Geochemical Oxidation
§ 60197-TN	B-329	Microsensors for In-situ Chemical, Physical, and Radiological Characterization of Mixed Waste
§ 55185-TX	B-349	New Strategies for Designing Inexpensive but Selective Bioadsorbants for Environmental Pollutants: Selection of Specific Ligands & Their Cell Surface Expression
§ 60069-VT	B-355	Least-Cost Groundwater Remediation Design Using Uncertain Hydrogeological Information
§ 54635-WA	B-361	Molecular-Level Process Governing the Interaction of Contaminants with Iron and Manganese Oxides
§ 55031-WA	B-373	Genetic Analysis of Stress Responses in Soil Bacteria for Enhanced Bioremediation of Mixed Contaminants
§ 60355-WA	B-377	Mineral Surface Processes Responsible for the Decreased Retardation (or Enhanced Mobilization) of 137Cs from HLW Tank Discharges
§ 54889-WA	B-389	Using Trees to Remediate Groundwaters Contaminated with Chlorinated Hydrocarbons
§ 54790-CAN-ON	B-407	Microbial Mineral Transformations at the Fe(II)/Fe(III) Redox Boundary for Solid Phase Capture of Strontium and Other Metal/Radionuclide Contaminants
54546-CA	B-61	Engineered Antibodies for Monitoring of Polynuclear Aromatic Hydrocarbons
54847-CO	B-87	Photocatalytic and Chemical Oxidation of Organic Compounds in Supercritical Carbon Dioxide
55012-CO	B-89	Extraction and Recovery of Mercury and Lead from Aqueous Waste Streams Using Redox-active Layered Metal Chalcogenides
60141-DC	B-95	Gamma Ray Imaging for Environmental Remediation
55042-GA	B-105	Quantifying Silica Reactivity in Subsurface Environments: Controls of Reaction Affinity and Solute Matrix on Quartz and SiO2 Glass Dissolution Kinetics
55247-IL	B-119	Sensors Using Molecular Recognition in Luminescent, Conductive Polymers
60247-IL	B-139	Miniature Nuclear Magnetic Resonance Spectrometer for In-Situ and In-Process Analysis and Monitoring

Awards Related to ID-ER-103 Continued

Award ID	Page #	Award Title
60231-MD	B-165	Novel Miniature Spectrometer for Remote Chemical Detection
54571-MA	B-181	Removal of Heavy Metals and Organic Contaminants from Aqueous Streams by Novel Filtration Methods
54584-NJ	B-201	Comparison of the Bioavailability of Elemental Waste Laden Soils Using in vivo and in vitro Analytical Methodology, and Refinement of Exposure/Dose Models
54751-NM	B-209	High Fluence Neutron Source for Nondestructive Characterization of Nuclear Waste
60474-OH	B-273	Develop and Demonstrate Novel Ultrahigh Sensitivity Heavy Noble Gas Detectors for Long-Term Monitoring of Spent Fuel and TRU Waste
60041-OK	B-275	Removal of Radioactive Cations and Anions from Polluted Water Using Ligand-Modified Colloid-Enhanced Ultrafiltration
55103-TN	B-311	Utilization of Kinetic Isotope Effects for the Concentration of Tritium
55115-TX	B-345	The Adsorption and Reaction of Halogenated Volatile Organic Compounds (VOC's) on Metal Oxides
54897-WA	B-391	The Sonophysics and Sonochemistry of Liquid Waste Quantification and Remediation

Idaho Operations Office

Idaho National Engineering and Environmental Laboratory

ID-ER-106 - Radioactive Waste Management Complex Remediation

Problem Area: Remedial Action
Life-Cycle Cost in 2007+: $906,000,000
DOE Project Manager: Alan T. Jines, 208-526-7524, jinesa@inel.gov
Contractor Manager: Douglas K. Jorgensen, 208-526-7022, dkj@inel.gov
For More Information: http://www.doe.gov/em52/pbs/id-er-106.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Medium **Worker:** Medium **Environment:** Medium

Technical Approach Provided by Project Manager:

The cleanup technologies for Operable Units; Transuranic Pits and Trenches, Non-transuranic Pits and Trenches, Vadose Zone Rad Metals, Soil Vaults, Air Pathway, Surface Water Pathway, Ground Water Pathway, Transuranic Storage Area Releases, Septic Tanks and the Acid Pit will be considered under the Waste Area Group 7 Comprehensive Record of Decision. It is anticipated that these areas will be stabilized and capped, after limited retrieval of waste from the transuranic and non-transuranic pits and trenches are completed. The Comprehensive Record of Decision is the final Waste Area Group 7 Record of Decision that will be used to closeout the Comprehensive Environmental Response, Compensation, and Liability Act activities at the Radioactive Waste Management Complex and will include information about all the previous Waste Area Group 7 Records of Decision. The technology that is being used on the organic contamination in the Vadose Zone, Operable Unit 7-08, is vapor vacuum extraction with flameless thermal oxidation.

The following Idaho National Engineering and Environmental Laboratory Technology Development needs are associated with this site:

- ID-6.1.01 - Characterization for partial retrieval - development of technology to better characterize buried waste through location of specific contaminants of concern in the waste

- ID-6.1.02 - Real-time characterization field instrumentation - development of technology for instrumentation to characterize waste @ dig face, excavation control, and cleanup verification

- ID-6.1.05 - Separation to reduce the volume of waste requiring treatment at the Subsurface Disposal Area - development of technology to aid in physical separation processes at dig face to aid in reduction of waste volume going to treatment

- ID-6.1.23 - Insitu stabilization of contaminated soils and waste - demonstrate effectiveness of grouting technologies, grouting types, migration of contaminants from grouted form, and longevity of grout on actual waste forms

- Understanding migration of VOCs around an ISV melt is required for data request.

Post 2006 Project Scope Provided by Project Manager:

By 2018, retrieval and treatment of waste for Operable Unit 7-13/14 will be completed and treated waste will have been shipped to the Waste Isolation Pilot Plant for disposal.
By 2024, a cap over the Subsurface Disposal Area will have been installed and all Decontamination & Dismantlement completed.
By 2054, the 30-year maintenance and monitoring requirement of the site will be completed.
All remediation activities for Waste Area Group 7 will be conducted under Operable Unit 7-13/14.

Project End State Provided by Project Manager:

The final end state does not differ from that described in A.2.4 and A.2.5. However, the cleanup process and end states described for Operable Unit 7-13/14 are assumptions to date and will not be finalized until the Record of Decision is signed (the end state for Operable Unit 7-08 has been decided due to Record of Decision completion). No regulatory or stakeholder acceptance has been received for Operable Unit 7-13/14 end state assumptions. Completion of the activities contained in this Project Baseline Summary support the goal of delisting the INEEL from the National Priorities List.

A conceptual vision of the end state in 2094 for the INEEL, and each of the major facility areas, has been defined through a compliance reengineering effort. These end states have not been agreed upon by the regulators, stakeholders, or Tribal Nations. The compliance reengineering project will identify a pathway to achieve concurrence on each end state by the end of FY-98.

The full list of science research awards that have the potential to address projects such as this one, which deals with Remedial Action problems, are listed in the <u>Index of Research Awards by Environmental Management Problem Area</u>, in the back of this appendix, under the heading "Remedial Action".

Idaho Operations Office

Idaho National Engineering and Environmental Laboratory

ID-ER-109 - Remediation Operations

Problem Area: Remedial Action
Life-Cycle Cost in 2007+: $226,000,000
DOE Project Manager: A. Zadah, 208-526-4049, ZADAHAS@SSW.gov
Contractor Manager: R. G. Barnette, 208-526-6509, RGE@INEL.gov
For More Information: http://www.doe.gov/em52/pbs/id-er-109.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: N/A **Worker:** Low **Environment:** Low

Technical Approach Provided by Project Manager:

Activities within this PBS support technical and administrative functions within the remaining ER PBSs. Consequently, technical approaches for establishing systems and processes for the support are consistent with the requirements of the FFA/CO. Additionally, in order to minimize cost and schedule impacts, electronic media have been used to expedite information retrieval and accuracy. Systems and processes are routinely reviewed and updated to provide the most cost effective technical support possible. Examples of technology support are: (a) Geographic Information System data that provides plume migration and contaminant location data for each site,; (b) electronic monthly report generation capability; © electronic development of baseline change controls; (d) electronic access to the Administrative Record from Internet and an optical imaging system; and (e) on-line access to waste streams and projections data.

Post 2006 Project Scope Provided by Project Manager:

Beyond FY 2006, Program Management Support costs will be adjusted commensurate with the completion of remediation activities, ultimately resulting in the provision of project management only for remaining surveillance and maintenance and operations work scope.

Project End State Provided by Project Manager:

The Final End State ensures that the INEEL can be administratively delisted from the National Priorities List and that configuration/records management ensures long term availability of information associated with the decisionmaking process. Additionally, all support for D&D and RD/RA activities will be completed. Long-term surveillance and maintenance activities will remain.

The full list of science research awards that have the potential to address projects such as this one, which deals with Remedial Action problems, are listed in the <u>Index of Research Awards by Environmental Management Problem Area</u>, in the back of this appendix, under the heading "Remedial Action".

Idaho Operations Office

Idaho National Engineering and Environmental Laboratory

ID-ER-110 - Decontamination and Decommissioning

Problem Area:	Decontamination and Decommissioning
Life-Cycle Cost in 2007+:	$339,000,000
DOE Project Manager:	A. MIKKOLA, 208-526-0725, mikkolaw@inel.gov
Contractor Manager:	Brad J. Frazee, 208-526-3775, bjf@inel.gov
For More Information:	http://www.doe.gov/em52/pbs/id-er-110.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Low **Worker:** Medium **Environment:** Medium

Technical Approach Provided by Project Manager:

Accomplish total decontamination, dismantlement, and removal of facilities, with specific entombment applications to specified surplus contaminated facilities. The contaminated surplus facilities and structures will be transferred into the EM40 D&D Program after they have been Deactivated by EM60 and transferred by a Memorandum of Agreement (MOA) at DOE-HQ [EM72 to EM44].

Deactivation and D&D programs work closely to integrate their work efforts to minimize overall life cycle costs. The contaminated surplus facilities and structures transfer process is an ongoing operation that will continue throughout the life of the INEEL D&D Program; therefore, the number of active facilities will vary. There are a total of 215 contaminated surplus facilities and structures at the INEEL (known existing and/or planned future facilities/structures).

INEEL active D&D projects are: ARA-I, -II,-III, LOFT-MTA, CPP-631/709/734, TRA-660, TRA-655/704/705/706/755, CFA-691/657/716, and TAN-620/656.

INEEL planned D&D projects are: TAN-616, TAN-609, TRA-641, TRA-643, TRA-644, and CPP-608.

1997 transfers to EM40 are: TRA-751, CFA-691, CFA-716, CFA-657, TRA-641, TRA-645, TAN-609, TAN-620/656, and CPP-608.

Technical approach: Specific technical approaches for each D&D project will be outlined in specific D&D plans as the project completes the detailed planning and engineering phase of the work.

Technical Application: To include the latest proven technology in the accomplishment of decontamination and dismantlement work tasks . . . mechanical assistance and/or remote applications are preferred to reduce exposure and risk to the worker. The technologies identified are: Concrete Decontamination (7.2.03), Metal Decontamination (7.2.04), Waste Recycle (7.2.05), Remote Characterization (7.2.06), Remote Demolition (7.2.07), and Robotic Technology to use Multiple End Effectors (7.2.08)

Technical Integration: To include an interfacing and systems engineering approach with the "Co-Located" facilities/structures that are within Waste Area Group (WAG) Operational Unit (OU) . . . assures overall WAG OU criteria are met and that RCRA/TSCA/CERCLA have all been considered and integrated. This would include the close coordination between INEEL EM40, Remediation Program, and EM30, Waste Management . . . specifically coordination of future INEEL Waste Management needs related to Industrial Waste, Low Level Waste (LLW), Hazardous Waste (RCRA), Mixed Low Level Waste (MLLW), and High Level Waste (HLW) and required Treatment Storage and Disposal Facilities (TSDF) development on-Site or off-Site. The Site Treatment Plan currently addresses these "known" waste streams and will be updated as "new" waste streams are identified by future facility characterization efforts as part of the INEEL D&D Program.

Post 2006 Project Scope Provided by Project Manager:

All facilities awaiting D&D require surveillance and maintenance funding to maintain containment and alleviate the industrial hazards associated with degrading facilities/structures.

Characterization/Assessment includes:
•Pre-Characterization -- historical research, sampling & analysis plan, building survey plan, sampling and surveys (radiological and hazardous materials), characterization and decision analysis report
•Waste Characterization -- sampling & analysis plan, sampling and surveys (radiological and hazardous materials), and preparation of waste transportation/disposal forms
•Post-Characterization -- sampling & analysis plan, sampling and surveys (radiological and hazardous materials), and preparation of a post characterization report

D&D/Cleanup includes:
•Documentation--environmental permitting - National Environmental Policy Act (NEPA) - [EC, CX, EA, EIS], State Historic Preservation Office (SHPO), hazard classification, safety analysis report, health & safety plan, D&D plan, generator treatment plan, transportation plan, waste documentation, work permits (safe work permits, integrated planning sheets, radiological work permits, burn permits, confined space permits, excavation permits)
•Physical Work Tasks--removal of clean equipment, removal of loose contamination, removal of contaminated equipment, asbestos abatement, removal of fixed contamination, removal of hazardous waste and/or mixed waste, facility/structure dismantlement, site cleanup & restoration

Of the 215 contaminated surplus INEEL facilities/structures identified for decontamination and dismantlement, 32 projects have been completed. The decontamination and dismantlement of an additional 66 facilities/structures is planned for completion through 2006.

Project End State Provided by Project Manager:

Facilities decontaminated and dismantled, areas ready for release for reuse by other programs at the INEEL, and meeting specific release requirements of DOE Order 5400.5 and those agreed to in the INEEL Final Land Use Plan.

Utilizing RESRAD ==> 100 mR effective dose equivalent in a year

•Complete decontamination and dismantlement operations of PBF 2018.
•Complete decontamination and dismantlement operations of TAN 2014.
•Complete decontamination and dismantlement operations of the CPP Tank Farm 2023, and all other CPP facilities/structures 2044.
•Complete decontamination and dismantlement operations of TRA 2044.

The full list of science research awards that have the potential to address projects such as this one, which deals with Decontamination and Decommissioning problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "Decontamination and Decommissioning".

Idaho Operations Office

Idaho National Engineering and Environmental Laboratory

ID-HLW-101 - High-Level Waste Pretreatment

Problem Area: High Level Waste
Life-Cycle Cost in 2007+: $377,000,000
DOE Project Manager: T.L. Wichmann, 208-526-0535, wichmatl@inel.gov
Contractor Manager: John C. Sinclair III, 208-526-6881, Sinclajc@inel.gov
For More Information: http://www.doe.gov/em52/pbs/id-hlw-101.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
- **Public:** Low **Worker:** Medium **Environment:** Medium

Technical Approach Provided by Project Manager:

Four major types of material are stored, treated, and disposed: liquid, calcine solids, debris, and used HEPA filters. The liquid is stored in 300,000-gallon tanks which are contained in underground concrete vaults in the Tank Farm. Existing and newly generated liquid wastes are concentrated by the HLLW Evaporator, to minimize stored volume, and collected in the Tank Farm. These wastes are then solidified (calcined) at the New Waste Calcining Facility (NWCF). The resulting calcine is stored in stainless steel bins which are contained in concrete vaults. Used filters are treated by the Filter Leach Facility and mixed debris will be treated by the Debris Treatment Facility. The products from each of these operations is a solid LLW which is disposed to the RWMC and a liquid mixed waste which is sent to the Tank Farm and treated along with the other Tank Farm wastes. This process currently results in the mixed waste being treated as high level waste because it is blended with high level waste either in the tank farm or in the bin sets. The HEPA filters are also technically categorized as mixed waste, but are shown in the metrics section (A.4.a) as high level waste since they are funded and treated within the high level waste program using high level waste equipment. An aggressive program of liquid waste minimization, based on the use of new technology or improved operating methods, is being implemented to reduce the volume of liquid waste generated.

Post 2006 Project Scope Provided by Project Manager:

The NWCF will continue to operate until 2012 to empty the Tank Farm to comply with the Settlement Agreement with the State of Idaho. The existing Tank Farm will not be utilized after 2012. Newly generated waste will be concentrated by the HLLW Evaporator, to minimize stored volume, and collected in new RCRA compliant tanks after 2012. Calcine storage will continue to be monitored until the bin sets are emptied by HLW Project ID-HLW-103. Project ID-HLW-101 is terminated at the end of 2014, and Project ID-HLW-103 carries the HLW treatment activity forward.

Project End State Provided by Project Manager:

When this project is complete, the calcining facility will be permanently shut down and flushed. The eleven existing, 300,000-gallon Tank Farm tanks will have been emptied to heel level (the lowest liquid level which can be attained with existing equipment) to comply with the Settlement Agreement with the State of Idaho. The bin sets, containing approximately 6000 cubic meters of calcine, will be isolated from the calcination process and properly prepared to store the calcine until calcine treatment is initiated. Projects ID-HLW-102, -103, -104, and -105 will treat all HLW-related materials to final, disposable forms and then properly dispose of the waste.

The full list of science research awards that have the potential to address projects such as this one, which deals with High Level Waste problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "High Level Waste".

The following awards were identified through systems engineering to have the potential to address the specific needs of this Project. Those research awards that may have the strongest link to this project are designated by the symbol "§".

Award ID	Page #	Award Title
§ 59827-AZ	B-9	The Influence of Radiation and Multivalent Cation Additions on Phase Separation and Crystallization of Glass
§ 55318-CA	B-23	Improved Analytical Characterization of Solid Waste-Forms by Fundamental Development of Laser Ablation Technology
§ 55137-CA	B-53	Investigation of Novel Electrode Materials for Electrochemically-Based Remediation of High- and Low-Level Mixed Wastes in the DOE Complex
§ 54890-CA	B-69	On-Line Slurry Viscosity and Concentration Measurement as a Real-Time Waste Stream Characterization Tool
§ 55188-DC	B-93	Chemical Decomposition of High-Level Nuclear Waste Storage/Disposal Glasses Under Irradiation
§ 54982-FL	B-101	Analysis of Surface Leaching Processes in Vitrified High-Level Nuclear Wastes Using In-Situ Raman Imaging and Atomistic Modeling
§ 54807-GA	B-103	Studies Related to Chemical Mechanisms of Gas Formation in Hanford High-Level Nuclear Wastes
§ 55042-GA	B-105	Quantifying Silica Reactivity in Subsurface Environments: Controls of Reaction Affinity and Solute Matrix on Quartz and SiO2 Glass Dissolution Kinetics
§ 60424-ID	B-113	High Temperature Condensed Phase Mass Spectrometric Analysis
§ 55229-IL	B-117	The NOx System in Nuclear Waste
§ 55294-IL	B-121	Superconducting Open-Gradient Magnetic Separation for the Pretreatment of Radioactive or Mixed Waste Vitrification Feeds
§ 55367-IL	B-123	Investigation of Microscopic Radiation Damage in Waste Forms Using ODNMR and AEM Techniques
§ 60313-IL	B-135	Radiation Effects on Transport and Bubble Formation in Silicate Glasses
§ 59977-MD	B-169	Synthesis and Characterization of Templated Ion Exchange Resins for the Selective Complexation of Actinide Ions
§ 55141-MA	B-177	Imaging and Characterizing the Waste Materials Inside an Underground Storage Tank Using Seismic Normal Modes
§ 54691-MI	B-189	Radiation Effects on Materials in the Near-Field of Nuclear Waste Repository
§ 54765-NM	B-211	Enhanced Sludge Processing of HLW: Hydrothermal Oxidation of Chromium, Technetium, and Complexants by Nitrate
§ 59990-NM	B-221	Fundamental Chemistry, Characterization, and Separation of Technetium Complexes in Hanford Waste
§ 59993-NM	B-223	Dynamic Effects of Tank Waste Aging on Radionuclide-Complexant Interactions
§ 60403-NM	B-243	Phase Chemistry of Tank Sludge Residual Components
§ 54595-NM	B-255	f-Element Ion Chelation in Highly Basic Media
§ 59982-NY	B-259	Reactivity of Peroxynitrite: Implications for Hanford Waste Management and Remediation
§ 55179-NY	B-267	Acoustic Probe for Solid-Gas-Liquid Suspensions
§ 54674-OH	B-271	Design and Development of a New Hybrid Spectroelectrochemical Sensor
§ 60219-PA	B-287	Development of Advanced Electrochemical Emission Spectroscopy for Monitoring Corrosion in Simulated DOE Liquid Waste
§ 55087-TN	B-309	Design and Synthesis of the Next Generation of Crown Ethers for Waste Separations: An Inter-Laboratory Comprehensive Proposal
§ 59978-TN	B-321	Thermospray Mass Spectrometry Ionization Processes Fundamental Mechanisms for Speciation, Separation and Characterization of Organic Complexants in DOE Wastes
§ 60020-TN	B-323	Stability of High-Level Waste Forms

Awards Related to ID-HLW-101 Continued

Award ID	Page #	Award Title
§ 60217-TN	B-331	Optically-Based Array Sensors for Selective In Situ Analysis of Tank Waste
§ 54735-TX	B-343	Development of Inorganic Ion Exchangers for Nuclear Waste Remediation
§ 54621-WA	B-357	Chemical Speciation of Strontium, Americium, and Curium in High Level Waste: Predictive Modeling of Phase Partitioning During Tank Processing
§ 54628-WA	B-359	Colloidal Agglomerates in Tank Sludge: Impact on Waste Processing
§ 54672-WA	B-365	Radiation Effects in Nuclear Waste Materials
§ 60345-WA	B-375	New Silicotitanate Waste Forms: Development and Characterization
§ 60362-WA	B-379	Ion-Exchange Processes and Mechanisms in Glasses
§ 60451-WA	B-385	Mechanics of Bubbles in Sludges and Slurries
§ 60050-WA	B-395	Chemical Speciation of Inorganic Compounds under Hydrothermal Conditions
§ 60075-WA	B-401	Particle Generation by Laser Ablation in Support of Chemical Analysis of High Level Mixed Waste from Plutonium Production Operations
55094-CA	B-13	Chemical and Ceramic Methods Toward Safe Storage of Actinides Using Monazite
60328-CA	B-37	High Frequency Electromagnetic Impedance Measurements for Characterization, Monitoring and Verification Efforts
60370-CA	B-39	Rational Design of Metal Ion Sequestering Agents
54926-CA	B-75	Novel Ceramic-Polymer Composite Membranes for the Separation of Hazardous Liquid Waste
54893-FL	B-99	Research Program to Determine Redox Properties and Their Effects on Speciation and Mobility of Pu in DOE Wastes
55382-IL	B-129	Determination of Transmutation Effects in Crystalline Waste Forms
60247-IL	B-139	Miniature Nuclear Magnetic Resonance Spectrometer for In-Situ and In-Process Analysis and Monitoring
54791-KS	B-153	Managing Tight-binding Receptors for New Separations Technologies
60231-MD	B-165	Novel Miniature Spectrometer for Remote Chemical Detection
54571-MA	B-181	Removal of Heavy Metals and Organic Contaminants from Aqueous Streams by Novel Filtration Methods
60070-MS	B-193	The Development of Cavity Ringdown Spectroscopy as a Sensitive Continuous Emission Monitor for Metals
55110-MO	B-195	An Alternative Host Matrix Based on Iron Phosphate Glasses for the Vitrification of Specialized Nuclear Waste Forms
55223-MO	B-197	De Novo Design of Ligands for Metal Separation
54724-NM	B-205	Synthesis of New Water-Soluble Metal-Binding Polymers: Combinatorial Chemistry Approach
54751-NM	B-209	High Fluence Neutron Source for Nondestructive Characterization of Nuclear Waste
54770-NM	B-213	New Anion-Exchange Resins for Improved Separations of Nuclear Materials
59981-NM	B-219	Real-Time Broad Spectrum Characterization of Hazardous Waste by Membrane Introduction Mass Spectrometry
60015-NM	B-227	Long-term Risk from Actinides in the Environment: Modes of Mobility
60118-NM	B-229	Fundamental Thermodynamics of Actinide-Bearing Mineral Waste Forms
54122-PA	B-281	A Broad Spectrum Catalytic System for Removal of Toxic Organics from Water By Deep Oxidation
55205-SC	B-299	A Fundamental Study of Laser-Induced Breakdown Spectroscopy Using Fiber Optics for Remote Measurements of Trace Metals
55036-TN	B-307	Colloid Transport and Retention in Fractured Deposits
55119-TN	B-315	Phase Equilibria Modification by Electric Fields
60096-TN	B-339	Rational Synthesis of Imprinted Organofunctional Sol-Gel Materials for Toxic Metal Separation
54679-WA	B-367	Architectural Design Criteria for F-Block Metal Ion Sequestering Agents
55146-WA	B-393	Adsorption/Membrane Filtration as a Contaminant Concentration and Separation Process for Mixed Wastes and Tank Wastes

Idaho Operations Office

Idaho National Engineering and Environmental Laboratory

ID-HLW-102 - High-Level Waste Immobilization Facility (Privatized)

Problem Area: High Level Waste
Life-Cycle Cost in 2007+: $1,533,000,000
DOE Project Manager: T L Wichmann, 208-526-0535, wichmatl@inel.gov
Contractor Manager: K. D. Quigley, 208-526-3779, Kquigle@inel.gov
For More Information: http://www.doe.gov/em52/pbs/id-hlw-102.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Low **Worker:** Medium **Environment:** Low

Technical Approach Provided by Project Manager:

A new remote handled immobilization facility (RHIF) will begin operation in FY-2020. It will convert both liquid and calcine to final, disposable forms. This process may consist of calcine retrieval, calcine dissolution, radionuclide separations, and high activity waste vitrification, and low activity waste immobilization. All of these processes are highly technical, one-of-kind systems. The private contractor may choose the approach given above or choose a different approach.

Post 2006 Project Scope Provided by Project Manager:

The immobilization facility will be designed and constructed. Immobilized waste interim storage modules will be provided as needed beyond 2020 .

Project End State Provided by Project Manager:

When this project is complete, the immobilization facility will be available to treat liquid and calcine wastes to final, disposable forms. Facilities will also be available for interim storage of these immobilized wastes until a final repository is available.

The full list of science research awards that have the potential to address projects such as this one, which deals with High Level Waste problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "High Level Waste".

The following awards were identified through systems engineering to have the potential to address the specific needs of this Project. Those research awards that may have the strongest link to this project are designated by the symbol "§".

Award ID	Page #	Award Title
§ 59827-AZ	B-9	The Influence of Radiation and Multivalent Cation Additions on Phase Separation and Crystallization of Glass
§ 55188-DC	B-93	Chemical Decomposition of High-Level Nuclear Waste Storage/Disposal Glasses Under Irradiation
§ 54982-FL	B-101	Analysis of Surface Leaching Processes in Vitrified High-Level Nuclear Wastes Using In-Situ Raman Imaging and Atomistic Modeling
§ 54807-GA	B-103	Studies Related to Chemical Mechanisms of Gas Formation in Hanford High-Level Nuclear Wastes
§ 55042-GA	B-105	Quantifying Silica Reactivity in Subsurface Environments: Controls of Reaction Affinity and Solute Matrix on Quartz and SiO2 Glass Dissolution Kinetics
§ 60424-ID	B-113	High Temperature Condensed Phase Mass Spectrometric Analysis
§ 55294-IL	B-121	Superconducting Open-Gradient Magnetic Separation for the Pretreatment of Radioactive or Mixed Waste Vitrification Feeds
§ 55367-IL	B-123	Investigation of Microscopic Radiation Damage in Waste Forms Using ODNMR and AEM Techniques
§ 60313-IL	B-135	Radiation Effects on Transport and Bubble Formation in Silicate Glasses
§ 54691-MI	B-189	Radiation Effects on Materials in the Near-Field of Nuclear Waste Repository
§ 54765-NM	B-211	Enhanced Sludge Processing of HLW: Hydrothermal Oxidation of Chromium, Technetium, and Complexants by Nitrate
§ 60403-NM	B-243	Phase Chemistry of Tank Sludge Residual Components
§ 60020-TN	B-323	Stability of High-Level Waste Forms
§ 54672-WA	B-365	Radiation Effects in Nuclear Waste Materials
§ 60345-WA	B-375	New Silicotitanate Waste Forms: Development and Characterization
§ 60362-WA	B-379	Ion-Exchange Processes and Mechanisms in Glasses
§ 60075-WA	B-401	Particle Generation by Laser Ablation in Support of Chemical Analysis of High Level Mixed Waste from Plutonium Production Operations
55094-CA	B-13	Chemical and Ceramic Methods Toward Safe Storage of Actinides Using Monazite
60319-CA	B-51	Thermodynamics of the Volatilization of Actinide Metals in the High-Temperature Treatment of Radioactive Wastes
54893-FL	B-99	Research Program to Determine Redox Properties and Their Effects on Speciation and Mobility of Pu in DOE Wastes
55382-IL	B-129	Determination of Transmutation Effects in Crystalline Waste Forms
55110-MO	B-195	An Alternative Host Matrix Based on Iron Phosphate Glasses for the Vitrification of Specialized Nuclear Waste Forms
54751-NM	B-209	High Fluence Neutron Source for Nondestructive Characterization of Nuclear Waste
60015-NM	B-227	Long-term Risk from Actinides in the Environment: Modes of Mobility
60118-NM	B-229	Fundamental Thermodynamics of Actinide-Bearing Mineral Waste Forms
55205-SC	B-299	A Fundamental Study of Laser-Induced Breakdown Spectroscopy Using Fiber Optics for Remote Measurements of Trace Metals
55119-TN	B-315	Phase Equilibria Modification by Electric Fields

Idaho Operations Office

Idaho National Engineering and Environmental Laboratory

ID-HLW-103 - High-Level Waste Treatment and Storage

Problem Area: High Level Waste
Life-Cycle Cost in 2007+: $2,191,000,000
DOE Project Manager: T.L.Wichmann, 208-526-0535, WICHMATL@inel.gov
Contractor Manager: J. H. Valentine, 208-526-3267, JHV@inel.gov
For More Information: http://www.doe.gov/em52/pbs/id-hlw-103.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Low **Worker:** Medium **Environment:** High

Technical Approach Provided by Project Manager:

Four major types of material are stored, treated and disposed: liquid, calcine solids, debris, and used HEPA filters. The newly generated liquid will be stored in new RCRA compliant tankage. An aggressive program of waste minimization continues under this scope and is employed to eliminate or reduce the volume of liquid waste generated. Existing and newly generated wastes are concentrated by evaporation to minimize stored volume, and the waste is calcined to a granular solid for safer storage. The calcine remains stored in stainless steel bins which are contained in concrete vaults until 2020. A new HLW Immobilization Facility begins operation in FY 2020. It separates both liquid (accumulated from 2012 to 2020) and calcine into LAW and HAW fractions by dissolution, ion exchange, and solvent extraction. These waste fractions are both immobilized for final disposal: the HAW to a glass and the LAW to a grout. The glass is stored on an interim basis on site until an offsite repository is available. The LAW grout is disposed on site. Used filters are treated in the Filter Leach Facility, and mixed debris is treated in the Debris Treatment Facility, with the use of decontamination solutions. The products from each of these operations is a solid LLW which is disposed to the Radioactive Waste Management Complex (RWMC) and a mixed liquid waste which is sent to new tankage to await treatment.

Post 2006 Project Scope Provided by Project Manager:

Newly generated waste will be concentrated by the HLLW Evaporator to minimize stored volume after 2014 under this scope and collected in new RCRA compliant tanks designed and constructed under this scope. Stored calcine will be monitored. Process development and support for the Immobilization Facility design will be completed. The Immobilization Facility will begin operation in 2020 and will complete calcine treatment in FY 2035 to comply with the Settlement Agreement. After 2014 used filters and debris will continue to be treated until their inventories are reduced to zero. After 2035, the waste treatment facilities will be flushed and readied for closure activities to begin.

Project End State Provided by Project Manager:

When this project is complete, all HLW related materials will be converted to LLW, grout, and glass forms. The LLW and grout will be disposed to their respective long term storage locations. The glass will be in interim storage on site. Most of the ICPP will be closed and the remaining waste treatment facilities will be ready for closure activities to begin.

The full list of science research awards that have the potential to address projects such as this one, which deals with High Level Waste problems, are listed in the <u>Index of Research Awards by Environmental Management Problem Area</u>, in the back of this appendix, under the heading "High Level Waste".

Idaho Operations Office

Idaho National Engineering and Environmental Laboratory

ID-OIM-113 - Post-2006 Surveillance, Maintenance, and Monitoring

Problem Area:	Decontamination and Decommissioning
Life-Cycle Cost in 2007+:	$52,000,000
DOE Project Manager:	D.J.Sanow, 208-526-1049, sanowdj@inel.gov
Contractor Manager:	D. Preussner, 208-526-3814, dpres@inel.gov
For More Information:	http://www.doe.gov/em52/pbs/id-oim-113.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Low **Worker:** Medium **Environment:** Low

Technical Approach Provided by Project Manager:

Perform surveillance and maintenance of the surplus facilities at the INEEL to maintain these facilities in a safe condition. Surveillance and maintenance activities include the following: maintaining these facilities in a condition that meets requirements for reduced risk to the public, site personnel, and the environment from release of radiological and hazardous materials is accomplished by maintaining facility and site HEPA filtered off-gas systems, cleaning up and containing contamination `creep', preventing and cleaning up inflow of environmental liquids, and maintenance of the equipment necessary to accomplish this task.

Post 2006 Project Scope Provided by Project Manager:

There are forty-four facilities identified for Post-Deactivation Surveillance and Maintenance covering a time period of FY07 thru FY50. At that time the assumption is that the facilities in EM that support the cleanup of the INEEL will have been surplused and deactivated. As programs are phased out in the Reactor, High Level Waste, and the Nuclear Fuels Handling areas facilities will be added to the surplus facilities list, these facilities will be placed in the INEEL Deactivation Program, deactivated, and will require some level of post-closure monitoring.

Project End State Provided by Project Manager:

Project ID-OIM-113, surveillance and maintenance scope covers several sub-projects. The surveillance and maintenance project ends when each sub-project in deactivation, located in ID-OIM-111, is completed, final closure reached, and the monitoring requirements turned over to a landlord group which has yet to be identified.

The full list of science research awards that have the potential to address projects such as this one, which deals with Decontamination and Decommissioning problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "Decontamination and Decommissioning".

Idaho Operations Office

Idaho National Engineering and Environmental Laboratory

ID-SNF-102 - Integrated Spent Nuclear Fuel Program

Problem Area:	Spent Nuclear Fuel
Life-Cycle Cost in 2007+:	$179,000,000
DOE Project Manager:	Robert C. Stump, 208-526-1448, stumprc@inel.gov
Contractor Manager:	Alan P. Hoskins, 208-526-4620, axh@inel.gov
For More Information:	http://www.doe.gov/em52/pbs/id-snf-102.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Medium **Worker:** N/A **Environment:** Low

Technical Approach Provided by Project Manager:

The technical approach for dealing with SNF is:
1. SNF will be moved from existing aging dry storage facilities into a privatized dry storage facility (construction of this facility is covered by ID-SNF-05).
2. SNF will be received from domestic and foreign research reactors to address safety and proliferation concerns.
3. SNF will be moved from wet storage to new dry storage.
4. SNF will be prepared for final disposition by:
   - Developing a single integrated disposal plan addressing over 90 specific spent nuclear fuel types in order to reduce redundancies and increase cost effectiveness.
   - Working with the Office of Civilian Radioactive Waste Management (OCRWM) in identifying repository acceptance criteria for INEEL SNF to ensure the SNF is prepared/packaged in a manner acceptable to the repository. (Immediate identification of acceptance criteria is needed to support constructing facilities for packaging or storage of SNF to meet Settlement Agreement milestones.)
   - Developing technology needs to support interim repackaging activities, to adequately characterize SNF to meet NRC licensing criteria for interim storage, transportation, and acceptance at the repository. The technology development needs and INEEL priority are: 1) INEEL Site Technology Coordination Group Tracking Number 1.1.18 Preparation for canned sodium & reactive metal SNF electrometalurgical processing, treatment of fuels currently not acceptable to the repository (Priority #1); 2) 1.1.02 Microbiologically induced corrosion in dry storage containers (Priority #8); 3) 1.1.05 Interactions between SNF materials & modular storage containers (Priority #9); 4) 1.1.07 Drying out the moisture remaining within a complex geometry fuel element (Priority #10); 5) 1.1.08 Small standardized primary container for corroded, disrupted and rubblized SNF (Priority #11); 6) 1.1.11 Dry physically entrained water in SNF (Priority #12); 7) 1.1.13 Stabilize U-Moly fuel meat matrix (Priority #13); 8) 1.1.15 Dry physically entrained water in crushed or rubblized SNF (Priority #14); 9) 1.1.16 Mechanically dry carbon/graphite SNF (Priority #15); 10) 1.1.10 Non-destructively determine fissile material content of SNF, fission assay (Priority #38); 11) 1.1.09 Non-destructive assay methods for SNF using gamma neutron (Priority #39); 12) 1.1.12 SNF end-of-life values and burn-up from non-destructive assay methods (Priority #40); and 13) 1.1.14 Computer codes for criticality and heat transfer calculations for mixed fuel types in modular storage containers (Priority #41). Technology opportunities are 1) 1.2.03 Non-destructive examination of fuel; 2) 1.2.04 Technology to deploy non-destructive examination techniques; and 3) 1.2.06 Examine dry storage canisters to assure safe conditions.

Post 2006 Project Scope Provided by Project Manager:

SNF receipt from foreign research reactors and domestic reactors, shipment of SNF to SRS, and essential support activities will continue until removal of the SNF to a long term storage repository. Technology Development and Program Planning to support required activities will also continue.

Project End State Provided by Project Manager:

- By 2035, all SNF under the direction of this project will have been packaged, treated as necessary, removed from the INEEL, and sent to a DOE long term storage repository. Facilities will be turned over to other projects for decontamination and decommissioning.

The full list of science research awards that have the potential to address projects such as this one, which deals with Spent Nuclear Fuel problems, are listed in the <u>Index of Research Awards by Environmental Management Problem Area</u>, in the back of this appendix, under the heading "Spent Nuclear Fuel".

Idaho Operations Office

Idaho National Engineering and Environmental Laboratory

ID-WM-105 - Advanced Mixed Waste Treatment Project (AMWTP) Production Operations

Problem Area: Mixed Waste
Life-Cycle Cost in 2007+: $209,000,000
DOE Project Manager: Mike J. Bonkoski, 208-526-1412, BONKOSKIMJ@INEL.GOV
Contractor Manager: N/A
For More Information: http://www.doe.gov/em52/pbs/id-wm-105.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Low **Worker:** Medium **Environment:** Medium

Technical Approach Provided by Project Manager:

Due to the early stages of design, only a brief discussion of the technical approach that will be used in the project is provided here. All of the technologies being utilized in the AMWTP have been demonstrated on similar waste-type problems and are not expected to require significant development efforts beyond those necessary for application specific to this project.

- Retrieval of the waste will employ earth-moving equipment, a high-capacity vacuum, and hands-on activities for dirt removal, and forklifts and trucks for transporting the waste to the treatment facility.
- Retrieved waste will be sorted and segregated; the facility will have one sort/segregate line for boxes and one line for drums.
- Characterization (i.e., for storage, treatment and disposal) will utilize a combination of real-time radiography, non-destructive assay methods, and direct analysis of contents.
- Treatment will include incineration and/or vitrification; macroencapsulation; and supercompaction. The type of treatment employed will depend on the physical/chemical characteristics of the retrieved waste.

Post 2006 Project Scope Provided by Project Manager:

Per the Settlement Agreement between the DOE and the state of Idaho, the AMWTP will retrieve, characterize, and treat sufficient quantities of waste necessary to maintain a running average of 2000 m3 of waste per year shipped out of Idaho, until the total 65,000 m3 of waste is out of the state (by December 31, 2015, but no later than December 31, 2018). The contract with BNFL includes provisions for treating additional wastes from throughout the DOE Complex, and it is anticipated that other DOE sites will send mixed wastes to the facility for treatment. Following completion of all treatment, the facility will be closed in accordance with RCRA and decontaminated and decommissioned within approximately 3 years of completing facility operations.

Project End State Provided by Project Manager:

Completion of AMWTP Asset Acquisition project will support the EM end-state by providing a facility for the retrieval, treatment and preparation for disposal (transportation of waste to WIPP and subsequent disposal will be funded by CAO) at WIPP of 65,000 m3 of mixed transuranic and alpha low-level radioactive wastes, as well as the subsequent RCRA closure and decontamination and decommissioning (D&D) of the facility. The AMWTF operations associated with the second project are scheduled to begin in 2003 and complete in 2015, followed by completion of the D&D of the facility by 2018. There is a provision in the contract to extend the contract life as necessary and at the discretion of DOE, to treat non-INEEL DOE mixed waste at the AMWTP.

Additional projects that are required to support this end-state include ID-WM-104, which provides for the actual construction of the Advanced Mixed Waste Treatment Facility; and, ID-WM-107, which provides for facility and infrastructure support to BNFL from the INEEL M&O Contractor during operation of the treatment facility.

The full list of science research awards that have the potential to address projects such as this one, which deals with Mixed Waste problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "Mixed Waste".

The following awards were identified through systems engineering to have the potential to address the specific needs of this Project. Those research awards that may have the strongest link to this project are designated by the symbol "§".

Award ID	Page #	Award Title
§ 60370-CA	B-39	Rational Design of Metal Ion Sequestering Agents
§ 60155-CO	B-83	Measurements and Models for Hazardous Chemical and Mixed Wastes
§ 54847-CO	B-87	Photocatalytic and Chemical Oxidation of Organic Compounds in Supercritical Carbon Dioxide
§ 55012-CO	B-89	Extraction and Recovery of Mercury and Lead from Aqueous Waste Streams Using Redox-active Layered Metal Chalcogenides
§ 55247-IL	B-119	Sensors Using Molecular Recognition in Luminescent, Conductive Polymers
§ 55211-IL	B-141	Cavitational Hydrothermal Oxidation: A New Remediation Process
§ 54942-IN	B-147	Spectroscopy, Modeling and Computation of Metal Chelate Solubility in Supercritical CO_2
§ 54791-KS	B-153	Managing Tight-binding Receptors for New Separations Technologies
§ 54864-KS	B-157	Supramolecular Chemistry of Selective Anion Recognition for Anions of Environmental Relevance
§ 60231-MD	B-165	Novel Miniature Spectrometer for Remote Chemical Detection
§ 54571-MA	B-181	Removal of Heavy Metals and Organic Contaminants from Aqueous Streams by Novel Filtration Methods
§ 60070-MS	B-193	The Development of Cavity Ringdown Spectroscopy as a Sensitive Continuous Emission Monitor for Metals
§ 55110-MO	B-195	An Alternative Host Matrix Based on Iron Phosphate Glasses for the Vitrification of Specialized Nuclear Waste Forms
§ 55223-MO	B-197	De Novo Design of Ligands for Metal Separation
§ 54751-NM	B-209	High Fluence Neutron Source for Nondestructive Characterization of Nuclear Waste
§ 54770-NM	B-213	New Anion-Exchange Resins for Improved Separations of Nuclear Materials
§ 55387-NM	B-237	Photooxidation of Organic Wastes Using Semiconductor Nanoclusters
§ 55171-PA	B-283	Development of Advanced In-Situ Techniques for Chemistry Monitoring and Corrosion Mitigation in SCWO Environments
§ 54973-TN	B-301	A Novel Energy-Efficient Plasma Chemical Process for the Destruction of Volatile Toxic Compounds
§ 55103-TN	B-311	Utilization of Kinetic Isotope Effects for the Concentration of Tritium
§ 55276-TN	B-319	Fundamental Chemistry and Thermodynamics of Hydrothermal Oxidation Processes
§ 60096-TN	B-339	Rational Synthesis of Imprinted Organofunctional Sol-Gel Materials for Toxic Metal Separation
§ 54679-WA	B-367	Architectural Design Criteria for F-Block Metal Ion Sequestering Agents
§ 54897-WA	B-391	The Sonophysics and Sonochemistry of Liquid Waste Quantification and Remediation
§ 55146-WA	B-393	Adsorption/Membrane Filtration as a Contaminant Concentration and Separation Process for Mixed Wastes and Tank Wastes
§ 60150-WA	B-399	Genetic Engineering of a Radiation-Resistant Bacterium for Biodegradation of Mixed Wastes
59827-AZ	B-9	The Influence of Radiation and Multivalent Cation Additions on Phase Separation and Crystallization of Glass
60319-CA	B-51	Thermodynamics of the Volatilization of Actinide Metals in the High-Temperature Treatment of Radioactive Wastes
55137-CA	B-53	Investigation of Novel Electrode Materials for Electrochemically-Based Remediation of High- and Low-Level Mixed Wastes in the DOE Complex
54890-CA	B-69	On-Line Slurry Viscosity and Concentration Measurement as a Real-Time Waste Stream Characterization Tool

Awards Related to ID-WM-105 Continued

Award ID	Page #	Award Title
54926-CA	B-75	Novel Ceramic-Polymer Composite Membranes for the Separation of Hazardous Liquid Waste
54893-FL	B-99	Research Program to Determine Redox Properties and Their Effects on Speciation and Mobility of Pu in DOE Wastes
54807-GA	B-103	Studies Related to Chemical Mechanisms of Gas Formation in Hanford High-Level Nuclear Wastes
60424-ID	B-113	High Temperature Condensed Phase Mass Spectrometric Analysis
55294-IL	B-121	Superconducting Open-Gradient Magnetic Separation for the Pretreatment of Radioactive or Mixed Waste Vitrification Feeds
60143-IL	B-137	Foaming in Radioactive Waste Treatment and Immobilization Processes
60247-IL	B-139	Miniature Nuclear Magnetic Resonance Spectrometer for In-Situ and In-Process Analysis and Monitoring
54834-IN	B-143	An Investigation of Homogeneous and Heterogeneous Sonochemistry for Destruction of Hazardous Waste
54724-NM	B-205	Synthesis of New Water-Soluble Metal-Binding Polymers: Combinatorial Chemistry Approach
54639-NM	B-251	Development of an In-Situ Microsensor for the Measurements of Chromium and Uranium in Groundwater at DOE Sites
55179-NY	B-267	Acoustic Probe for Solid-Gas-Liquid Suspensions
54674-OH	B-271	Design and Development of a New Hybrid Spectroelectrochemical Sensor
54122-PA	B-281	A Broad Spectrum Catalytic System for Removal of Toxic Organics from Water By Deep Oxidation
60017-PA	B-285	Removal of Technetium, Carbon Tetrachloride, and Metals from DOE Properties
55205-SC	B-299	A Fundamental Study of Laser-Induced Breakdown Spectroscopy Using Fiber Optics for Remote Measurements of Trace Metals
55087-TN	B-309	Design and Synthesis of the Next Generation of Crown Ethers for Waste Separations: An Inter-Laboratory Comprehensive Proposal
55119-TN	B-315	Phase Equilibria Modification by Electric Fields
60197-TN	B-329	Microsensors for In-situ Chemical, Physical, and Radiological Characterization of Mixed Waste
54735-TX	B-343	Development of Inorganic Ion Exchangers for Nuclear Waste Remediation
54672-WA	B-365	Radiation Effects in Nuclear Waste Materials
54996-WA	B-371	Ionizing Radiation Induced Catalysis on Metal Oxide Particles
60362-WA	B-379	Ion-Exchange Processes and Mechanisms in Glasses
60050-WA	B-395	Chemical Speciation of Inorganic Compounds under Hydrothermal Conditions

Idaho Operations Office

Idaho National Engineering and Environmental Laboratory

ID-WM-107 - Long Term Treatment/Storage/Disposal Operations

Problem Area:	Mixed Waste
Life-Cycle Cost in 2007+:	$938,000,000
DOE Project Manager:	Joel T. Case, 208-526-6795, casejt@inel.gov
Contractor Manager:	Mary Magleby, 208-526-5051, mym@inel.gov
For More Information:	http://www.doe.gov/em52/pbs/id-wm-107.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Low **Worker:** Medium **Environment:** Medium

Technical Approach Provided by Project Manager:

This PBS continues the technical aspects from each of the predecessor Projects out through closure of the INEEL.

The overall approach for MLLW is to utilize AMWTP after 2003. Once this facility has demonstrated that it can effectively treat MLLW, the treatment facilities at the Waste Reduction Operations Complex (WROC) will be shutdown and closed under RCRA. This occurs prior to the start of the Long-Term (LT) Treatment/Storage/Disposal (TSD) Project in 2006. MLLW storage will be consolidated, and the Waste Experimental Reduction Facility (WERF) Waste Storage Building (WWSB) and Idaho Chemical Processing Plant (ICPP) 1617 will be transferred to the Decontamination and Decommissioning Project (ID-ER-110) in 2011. SCW is divided into six subcategories. Three of these subcategories (noncertifiable defense TRU, nondefense TRU, and fuel/fuel debris) are managed under separate projects and mentioned here for completeness only. A separate technical approach is required for each of these subcategories. These technical approaches are described in detail in the SCW portion of the LLW/MLLW/Other Waste Project (ID-WM-101).

Prior to 2006, the INEEL CH LLW disposal facility will be closed and all CH-LLW will be disposed of at an off-site facility. An appropriate contract will be maintained with the off-site facility, covering disposal and treatment as required to meet the waste acceptance criteria and for cost effectiveness. Waste Operations, under this LT TSD Project, will provide interface and brokering services for offsite disposal of CH-LLW from FY 2007 through the end of INEEL operations. RH LLW generated at the INEEL will continue to be direct disposed through FY 2008 or until an acceptable off-site disposal location is operational that meets regulatory requirements and any associated transportation issues are resolved. RH LLW disposal operations at the INEEL are performed by unloading the containers from the shielding cask directly into a vault. When an acceptable off-site disposal location is available for RH LLW, this LT TSD Project will provide interface and brokering services for offsite disposal of RH LLW from FY 2009 through the end of INEEL operations.

TRU waste that is not acceptable to the AMWTP will be identified by the AMWTP contractor. This will include, but will not be limited to, RH TRU waste. The TRU waste that is not accepted by the AMWTP will be characterized, certified, repackaged, and transported off-site for final disposal. The RH TRU waste drums may, depending on container integrity inspections, be overpacked into shielded containers and stored above ground at a RCRA Type II storage module pending disposal. Disposal will be accomplished via direct certification and transportation to WIPP, or by transporting the RH TRU waste to an offsite location for treatment and WIPP disposal. Compliant storage and monitoring of RH TRU waste at the RWMC will be provided; certification and transport plans will be prepared; needed facility upgrades to support certification and transportation will be completed. Facility support services will be performed. Finally, the RH TRU waste will be prepared for transportation and loaded into transport casks.

Commercial TSD facility contracts will be maintained for disposal of hazardous waste and broker services will be provided. Hazardous waste will be stored as necessary in permitted facilities. Industrial waste will be transferred to the Cold Waste Handling Facility, segregated for energy recovery, and cubed for fuel substitution in the Coal Fired Steam Generating Facility. Cross-cutting technical and business management, functional support and services will be provided for those products and services where it is more cost-effective to perform the activity in a consolidated manner. This includes items managing the INEEL STP, executing the WO public participation process, ensuring transportation compliance, and providing for independent oversight, among others.

Post 2006 Project Scope Provided by Project Manager:

Because this project begins after 2006, all of the work scope listed in A.2.2 is Post-2006 Project Scope.

Project End State Provided by Project Manager:

This LT TSD Project covers all INEEL Waste Management functions necessary through closure of the INEEL, assumed to be 2050. Disposition maps have been completed through 2035. At the end of the LT TSD Project, all MLLW, LLW, TRU waste, and SCW will be treated and disposed. WROC MLLW treatment facilities and hazardous and MLLW storage facilities will be closed under RCRA. Buildings will be turned over for demolition or reuse. Because SPAR SCW is generally not acceptable for shallow land disposal, this SCW will have been disposed offsite. Effective dispositioning of this waste is required to allow the Environmental Management (EM) site to reach its end state. However, once the SCW is transferred offsite, this waste will have no impact of potential INEEL land use. Once all INEEL operational facilities have been shut down and decontaminated, the capability to manage low-level radioactive waste will no longer be needed and will terminate.

The full list of science research awards that have the potential to address projects such as this one, which deals with Mixed Waste problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "Mixed Waste".

The following awards were identified through systems engineering to have the potential to address the specific needs of this Project. Those research awards that may have the strongest link to this project are designated by the symbol "§".

Award ID	Page #	Award Title
§ 60326-AZ	B-11	Isolation of Metals from Liquid Wastes: Reactive Scavenging in Turbulent Thermal Reactors
§ 55247-IL	B-119	Sensors Using Molecular Recognition in Luminescent, Conductive Polymers
§ 59934-IN	B-149	Hazardous Gas Production by Alpha Particles in Solid Organic Transuranic Waste Matrices
§ 60231-MD	B-165	Novel Miniature Spectrometer for Remote Chemical Detection
§ 60070-MS	B-193	The Development of Cavity Ringdown Spectroscopy as a Sensitive Continuous Emission Monitor for Metals
§ 54751-NM	B-209	High Fluence Neutron Source for Nondestructive Characterization of Nuclear Waste
§ 59981-NM	B-219	Real-Time Broad Spectrum Characterization of Hazardous Waste by Membrane Introduction Mass Spectrometry
55318-CA	B-23	Improved Analytical Characterization of Solid Waste-Forms by Fundamental Development of Laser Ablation Technology
60247-IL	B-139	Miniature Nuclear Magnetic Resonance Spectrometer for In-Situ and In-Process Analysis and Monitoring
59978-TN	B-321	Thermospray Mass Spectrometry Ionization Processes Fundamental Mechanisms for Speciation, Separation and Characterization of Organic Complexants in DOE Wastes
60197-TN	B-329	Microsensors for In-situ Chemical, Physical, and Radiological Characterization of Mixed Waste

Nevada Operations Office

Research Identified Through the Complex-Wide Needs Survey, June 1996

CS-055 - Improved methods for removing surface (removable) Actinide contamination from non porous surfaces to <100 nCi/gm.
CS-056 - Environmental remediation of tanks and piping adjacent to dismantled buildings.
CS-057 - Characterize site UBCs and PACs to determine type and extent of contamination.
CS-058 - In-situ method for surface decontamination for uranium process equipment.
CS-060 - Systems/procedures for assuring that all radioactive material has been removed from tanks and pipes prior to dismantlement is necessary to avoid budget/schedule impact.
CS-061 - Simple and safe methods for digging and crushing concrete foundations is needed.
CS-062 - Cleanup, decommissioning, dismantling, and construction activities will require containment technologies to prevent the spread of contamination offsite or to uncontaminated areas on-site.
CS-063 - Cost effective and safe systems and procedures are required to size reduce and remove excess equipment.
CS-070 - Improve techniques for volume reduction of decommissioning waste such as sheet metal, piping, conduit and furniture.
CS-071 - In-situ capping of dismantled buildings to prevent contaminant migration into groundwater or release to air or surface water.
CS-073 - Best available technologies for demolition of concrete structures.
CS-075 - Best available technologies for safe removal of friable asbestos.
CS-077 - Methods for decontamination of concrete surfaces (walls, floors, ceilings) to <100 nCi/gm.
CS-078 - Contain airborne contamination during disassembly and demolition activities.
CS-087 - Understanding of the natural physical, chemical, and biological processes that control the fate and transport of contaminants in the subsurface.
CS-089 - Rapid (Field) non Invasive, real time *in-situ* measures to reduce cost of site characterization.
CS-091 - Location and characterization of high hazard waste and verification of remedial action.
CS-097 - Accurate determination of hydrologic parameters of the subsurface (permeability, porosity and fluid saturation at and between boreholes.
CS-098 - Replace current batch sampling of surface water with a continuous monitoring systems maximizing information value of down-sized data collection.
CS-105 - Need inexpensive approach to characterizing burial grounds. Under current approaches it costs as much to characterize a burial ground as it would to retrieve all waste. No real-time analytical system. Analytical data are too costly to support real technical decisions.
CS-106 - Burial ground characterization.
CS-108 - Chromium contamination in soils and groundwater.
CS-109 - Acid mine drainage (AMD).
CS-116 - Proper application of Electronic Soil remediation techniques to removal of metal ions and anions (including radionuclides) from contaminated soil.
CS-126 - Remove OU 5 landfill contents.
CS-128 - Environmental remediation of soils and other media adjacent to dismantled buildings.
CS-150 - Characterization of radionuclide constituents and concentrations deterring waste classification.

Technology Development and Science Needs related to the Decontamination and Decommissioning Technology Focus Area

D&D03 - Current methods for locating buried objects (process equipment and piping) are inaccurate or ineffective in clay/silt environments and are often intrusive in nature.
Science Need: Basic studies leading to development of improved (object resolution and size recognition) methods for detection and location of buried metal and non-metal objects are required to develop improved technology for locating buried objects.
D&D05 - Real-time, field deployable characterization tools with sensitivities that will measure to free-release standards. Low-cost technologies which can differentiate between contaminated and non-contaminated equipment and materials are needed to aid in material segregation.

Science Need: Basic studies associated with non-intrusive, real time determination of chemical species in or on high density materials are needed to develop technology for sensing extremely low concentrations (PPM to PPB) concentrations of hazardous chemicals.

D&D06 - More durable, economical, and comfortable worker protection equipment, clothing, and breathing apparatus for both radioactive and non-radioactive environments are required to reduce the risk of exposure.

Science Need: Fundamental chemical and materials studies concerned with understanding the mechanism of penetration and diffusion of liquid materials through polymeric materials are needed to develop new personnel protection equipment.

D&D08 - Methods are needed to discern the type and depth of radioactive contamination in concrete. Current methods typically volatilize contaminants or create problems of cross contamination.

Science Need: Fundamental instrumentation studies concerned with development of non-intrusive, spatially resolved measurement of radioactive species inside structure bodies are needed to develop more sensitive characterization methods and technology.

D&D10 - Current processes are not effective in cleaning non-metal complex configurations to free-release conditions and in reducing secondary waste associated with cleaning porous materials.

Science Need: A basic understanding of the chemistry and surface science of porous surfaces is needed to develop improved decontamination methods for wood, concrete, and asbestos.

D&D11 - Cost effective concrete decontamination technologies are needed to reduce the amount of secondary wastes.

Science Need: Basic understanding of chemistry and surface science of concrete are needed to develop decontamination processes that reduce the amount of secondary process waste.

D&D13 - Improved metal decontamination technologies are needed that are faster, more cost effective, and that reduce the amount of secondary waste.

Science Need: Basic engineering and materials science studies associated with metal surface cleaning are needed to develop advanced surface ablation methods or other techniques for rapid decontamination of metal objects.

D&D14 - Non-intrusive, remote characterization technology is needed to verify the existence or absence of contamination in drains, pipes, and associated equipment.

Science Need: Fundamental sensor and instrumentation development studies are needed to support development of technology for remote inspection of inaccessible areas.

D&D15 - Improved concrete decontamination technologies are needed that are faster, more cost effective, nondestructive (for a reusable concrete surface) and that reduce the amount of secondary waste.

Science Need: A basic understanding of the chemistry and surface science of porous surfaces is needed to develop improved decontamination methods for wood, concrete, and asbestos.

Technology Development and Science Needs related to the Sub-Surface Contaminants Technology Focus Area

SCFA01 - Cost effective monitoring strategy. Need cost effective monitoring strategy for containment of radionuclides, metals, and organic systems.

Science Need: Fundamental biological studies are needed for collection of data related to long term monitoring using natural systems to monitor for radionuclides, metals, and organic molecules. Fundamental studies to relate ecological change to contamination level.

SCFA04 - Long term (200-500 years) performance monitoring. Also include modeling/prediction for landfill closure cover for both arid and humid climates.

Science Need: Fundamental engineering science studies are needed to understand aging effects and structural longevity using the aging phenomena associated with natural structures.

SCFA05 - Low maintenance vegetative covers. Covers needed for landfills containing organics, low level wastes, and/or uranium mill tailings.

Science Need: Plant molecular biology, tissue culture, and genetic strain improvement of grasses and herbaceous plants are needed to develop low-maintenance vegetative covers. Ecological studies of natural environments having similar characteristics may yield data.

Nevada Operations Office

Nevada Test Site

NV212 - Underground Test Area (UGTA)

Problem Area: Remedial Action
Life-Cycle Cost in 2007+: $248,000,000
DOE Project Manager: Robert M. Bangerter, Jr., 702-295-7340, rbangerter@nv.doe.gov
Contractor Manager: Not Identified
For More Information: http://www.doe.gov/em52/pbs/nv212.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Low **Worker:** Low **Environment:** N/A

Technical Approach Provided by Project Manager:

Anticipated environmental restoration activities associated with the Underground Test Area (UGTA) Project will include characterization of the subsurface hydrological regime and Long-Term Surveillance and Monitoring (LTS&M) of the test areas.

UGTA activities combine well monitoring and computer modeling to estimate the extent and nature of groundwater contamination and potential for risk to public health and the environment. These techniques facilitate the assessment for the possibilities for contaminant migration on the NTS and consequently beyond NTS boundaries. Individual Corrective Action Sites (CASs) have been grouped into six Corrective Action Units (CAUs). At each of the CAUs, groundwater flow rates, flow directions, and potential for contaminant transport will be modeled. A groundwater flow and transport model will be developed for each of the specific UGTA CAUs. The proposed remedial alternative for impacted groundwater will be well monitoring because the technologies available can not adequately address remediation at this time. The project provides for the design, implementation, and maintenance of a groundwater monitoring program at the NTS.

Preliminary modeling indicates that radionuclide contaminant migration beyond the NTS boundary is most likely to occur from the Western and Central Pahute Mesa areas, and early data indicates contaminants from Yucca Flat pose less of a possibility for breaching the NTS boundary. Issues regarding whether modeling and monitoring data are sufficient for predicting groundwater flow will continue to be the subject of stakeholder and regulator dialogue as results of the ongoing modeling effort and well monitoring and analysis become available. Improved equipment and techniques will be identified and utilized in order to maintain an effective and economically feasible monitoring program.

The remedial strategy will be to determine groundwater flow direction and velocity, model the potential for subsurface contaminant migration from the source cavities, and conduct long-term hydrological monitoring. This information will be used to assess potential risks to human health and the environment, and where necessary, restrict access to radiologically contaminated groundwater. Tritium is considered to be the primary contaminant of concern over the next 100 years, in that tritium is one of the most mobile radiologic contaminants and is found in abundance. Other radionuclides will be evaluated. Improved technologies are being sought in three areas of technology need: downhole, real-time monitoring of radiation (mainly tritium); deep-well sampling; and improved groundwater modeling. Although no technologies are presently available to be deployed for downhole, real-time tritium monitoring, significant performance enhancement could be gained in the long-term hydrologic monitoring program through the timely deployment of such technologies as they become available. In the area of groundwater modeling, a number of models are being investigated and evaluated which could enhance performance in the modeling area.

Understanding the current and future extent of such contamination is crucial to be able to responsibly plan future NTS groundwater management actions. Five of the CAU's will be characterized in accordance with the time frame in the 2006 Plan, and the final CAU will be characterized in FY 2007. Verification of the models (proof of concept) is currently planned to occur after FY 2006. Following design and implementation of a monitoring network for each CAU, LTS&M will be conducted for at least 100 years.

Closure in place is considered to be the only feasible corrective action because cost-effective groundwater technologies have not been developed to effectively remove or stabilize subsurface contaminants. In the future, applicable technologies may be developed, and the corrective action choice may be modified at that time.

Post 2006 Project Scope Provided by Project Manager:

Post FY 2006 activities have not yet been fully defined since the scope of the long-term surveillance and monitoring program must correspond proportionately with the assessed need for monitoring. In order to continuously implement an adequate and cost-effective surveillance and monitoring program, break-through technologies will be identified and utilized to adapt and modify work scope as the various CAUs are characterized. Identified as-needed activities related to long-term surveillance and monitoring currently include sampling, reporting, and well refurbishment/maintenance throughout the duration of post-closure activities. The Rainier Mesa/Shoshone Mountain CADD will be reviewed by NDEP in FY 2007. The 5-year proof-of-concept monitoring will have been completed in all CAUs by FY 2014, and then long term monitoring will continue for 100 years.

Project End State Provided by Project Manager:

The end state for the UGTA Project is 1) shot cavities closed in place; 2) completed contaminant fate and transport modeling and proof-of-concept validation of model results; and 3) established long-term environmental monitoring program including any appropriate monitoring technology enhancements. In that no proven, cost effective technologies presently exist for remediation of extensive, deep, groundwater plumes, subsurface contaminant sources in the shot cavities will not be remediated. Modeling groundwater flow and contaminant transport as validated with proof-of-concept techniques will provide a basis for monitoring system design to monitor groundwater and risk to off-site populations. Tritium, considered to be the primary and most abundant contaminant of concern over the next 100 years, is expected to be the most mobile radiological contaminant in the groundwater. Environmental monitoring for tritium will be continued for at least 100 years.

Institutional controls including restricted access and use of groundwater will be established and maintained in the UGTA Project region for the foreseeable future. For those UGTA Projects areas located off of the NTS, transfer of responsibilities to future landlord agencies (e.g., Air Force) will include institutional controls and underground resource access limitations, where appropriate. Groundwater resources access and use restrictions as well as appropriate institutional controls would also be maintained for the UGTA Project area within the NTS boundary with responsibility transferred to future landlord agencies (e.g., Environmental Protection Division or Defense Programs).

The full list of science research awards that have the potential to address projects such as this one, which deals with Remedial Action problems, are listed in the <u>Index of Research Awards by Environmental Management Problem Area</u>, in the back of this appendix, under the heading "Remedial Action".

The following awards were identified through systems engineering to have the potential to address the specific needs of this Project. Those research awards that may have the strongest link to this project are designated by the symbol "§".

Award ID	Page #	Award Title
§ 55014-AL	B-1	Kinetics and Mechanisms of Metal Retention/Release in Geochemical Processes in Soil
§ 55359-CA	B-31	Chaotic-Dynamical Conceptual Model to Describe Fluid Flow and Contaminant Transport in a Fractured Vadose Zone
§ 60328-CA	B-37	High Frequency Electromagnetic Impedance Measurements for Characterization, Monitoring and Verification Efforts
§ 54950-CA	B-41	Characterization of Contaminant Transport by Gravity, Capillarity and Barometric Pumping in Heterogeneous Vadose Regimes
§ 55011-CA	B-43	Surface and Borehole Electromagnetic Imaging of Conducting Contaminant Plumes
§ 55148-CA	B-45	Hydrologic and Geochemical Controls on the Transport of Radionuclides in Natural Undisturbed Arid Environments as Determined by Accelerator Mass Spectrometry Measurements

Awards Related to NV212 Continued

Award ID	Page #	Award Title
§ 55249-CA	B-47	Experimental Determination of Contaminant Metal Mobility as a Function of Temperature Time and Solution Chemistry
§ 55284-CA	B-55	Aquifer Transport of Th, U, Ra, and Rn in Solution and on Colloids
§ 54860-CA	B-59	Sorption of Heavy Metals and Radionuclides on Mineral Surfaces in the Presence of Organic Co-Contaminants
§ 54661-DE	B-91	Electrochemical Processes for In-Situ Treatment of Contaminated Soils
§ 55218-GA	B-107	Seismic Surface-Wave Tomography of Waste Sites
§ 54837-GA	B-109	Phytoremediation of Ionic and Methyl Mercury Pollution
§ 54576-IN	B-145	On the Inclusion of the Interfacial Area Between Phases in the Physical and Mathematical Description of Subsurface Multiphase Flow
§ 60199-KS	B-159	Seismic-Reflection and Ground Penetrating Radar for Environmental Site Characterization
§ 54683-MA	B-173	Speciation and Structural Characterization of Plutonium and Actinide-organic Complexes in Surface and Groundwaters
§ 55300-MA	B-179	3-D Spectral IP Imaging: Non-Invasive Characterization of Contaminant Plumes
§ 60271-NH	B-199	Characterization of a New Family of Metal Transport Proteins
§ 54741-NM	B-207	Characterization of Contaminant Transport Using Naturally-Occurring U-Series Disequilibria
§ 54857-NM	B-245	Surface Nuclear Magnetic Resonance Imaging of Water Content Distribution in the Subsurface
§ 55109-NM	B-247	New Permeameters for in situ Characterization of Unsaturated Heterogeneous Permeability
§ 54639-NM	B-251	Development of an In-Situ Microsensor for the Measurements of Chromium and Uranium in Groundwater at DOE Sites
§ 54793-NY	B-263	Establishing a Quantitative Functional Relationship Between Capillary Pressure Saturation and Interfacial Area
§ 55205-SC	B-299	A Fundamental Study of Laser-Induced Breakdown Spectroscopy Using Fiber Optics for Remote Measurements of Trace Metals
§ 55036-TN	B-307	Colloid Transport and Retention in Fractured Deposits
§ 60197-TN	B-329	Microsensors for In-situ Chemical, Physical, and Radiological Characterization of Mixed Waste
§ 55083-TN	B-335	Behavior of Dense, Immiscible Solvents in Fractured Clay-Rich Soils
§ 54635-WA	B-361	Molecular-Level Process Governing the Interaction of Contaminants with Iron and Manganese Oxides
§ 60355-WA	B-377	Mineral Surface Processes Responsible for the Decreased Retardation (or Enhanced Mobilization) of 137Cs from HLW Tank Discharges
54546-CA	B-61	Engineered Antibodies for Monitoring of Polynuclear Aromatic Hydrocarbons
60141-DC	B-95	Gamma Ray Imaging for Environmental Remediation
55042-GA	B-105	Quantifying Silica Reactivity in Subsurface Environments: Controls of Reaction Affinity and Solute Matrix on Quartz and SiO2 Glass Dissolution Kinetics
55247-IL	B-119	Sensors Using Molecular Recognition in Luminescent, Conductive Polymers
60231-MD	B-165	Novel Miniature Spectrometer for Remote Chemical Detection
54751-NM	B-209	High Fluence Neutron Source for Nondestructive Characterization of Nuclear Waste
60474-OH	B-273	Develop and Demonstrate Novel Ultrahigh Sensitivity Heavy Noble Gas Detectors for Long-Term Monitoring of Spent Fuel and TRU Waste

Nevada Operations Office

Nevada Test Site

NV214 - Industrial Sites

Problem Area:	Remedial Action
Life-Cycle Cost in 2007+:	$133,000,000
DOE Project Manager:	Janet Apenzeller-Wing, 702-295-0461, jwing@nv.doe.gov
Contractor Manager:	Not Identified
For More Information:	http://www.doe.gov/em52/pbs/nv214.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Low **Worker:** Medium **Environment:** Medium

Technical Approach Provided by Project Manager:

For all sites, characterization activities will focus on developing possible contaminant exposure profiles of various CAUs. Detailed characterization activities will be performed at sites that are exceptions to the profiles. The Streamlined Approach for Environmental Restoration (SAFER) and Expedited Site Characterization (ESC) methodologies will be utilized to reduce program costs and to accelerate program schedules. Remediation will be performed for applicable areas once future land-use decisions are made.

After contaminated sites and facilities have been characterized, closure plans will be developed. Closure may be in the form of "clean closure" (i.e., excavation or removal of all contamination and/or remediation of the media to achieve predetermined clean-up levels) or "closure in place" (leaving the waste in place and stabilized, solidified, or covered with an engineered cap). Some closures may be achieved through a combination of removal/remediation and closure in place. In some cases, no action may be appropriate. Decontamination and Decommissioning activities will include one or more of the following options: dismantlement, demolition, encapsulation, or entombment.

New technologies having the potential to enhance Decontamination and Decommissioning work will be investigated. DOE/NV has identified the following three technology needs for D&D:
In situ surveys in pipes and vessels
Improved detection and characterization of large concrete and metal surfaces
Improved decontamination of large concrete and metal surfaces

Post 2006 Project Scope Provided by Project Manager:

The remaining CASs will be characterized and remediated as applicable with completion schedule for FY 2009. Post-closure monitoring and maintenance activities are known to include: 1) collecting periodic measurements and/or samples from monitoring wells, effluent streams, etc., as stipulated in Post Closure Care Permits; 2) condition inspection and maintenance of any passive or active remedial systems; and 3) sample analysis and report preparation for each monitoring period.

The DOE/NV EM Program will supervise monitoring for a negotiated site-specific length of time after completion of remedial activities at each site. The EM Program has initial responsibility for monitoring then that responsibility is transitioned to the landlord (Defense Programs) for long-term monitoring. Upon completion of the DOE/NV Environmental Restoration Program, funding responsibility for long-term surveillance and monitoring will transition to the landlord.

Project End State Provided by Project Manager:

The end state for the Industrial Sites is completion of all applicable remedial actions with long-term surveillance and monitoring in place.

The full list of science research awards that have the potential to address projects such as this one, which deals with Remedial Action problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "Remedial Action".

The following awards were identified through systems engineering to have the potential to address the specific needs of this Project. Those research awards that may have the strongest link to this project are designated by the symbol "§".

Award ID	Page #	Award Title
§ 55014-AL	B-1	Kinetics and Mechanisms of Metal Retention/Release in Geochemical Processes in Soil
§ 55396-CA	B-33	Sorption of Colloids, Organics, and Metals onto Gas-Water Interfaces: Transport Mechanisms and Potential Remediation Technology
§ 60328-CA	B-37	High Frequency Electromagnetic Impedance Measurements for Characterization, Monitoring and Verification Efforts
§ 55011-CA	B-43	Surface and Borehole Electromagnetic Imaging of Conducting Contaminant Plumes
§ 55249-CA	B-47	Experimental Determination of Contaminant Metal Mobility as a Function of Temperature Time and Solution Chemistry
§ 55284-CA	B-55	Aquifer Transport of Th, U, Ra, and Rn in Solution and on Colloids
§ 54860-CA	B-59	Sorption of Heavy Metals and Radionuclides on Mineral Surfaces in the Presence of Organic Co-Contaminants
§ 54926-CA	B-75	Novel Ceramic-Polymer Composite Membranes for the Separation of Hazardous Liquid Waste
§ 60162-CO	B-85	Enhancements to and Characterization of the Very Early Time Electromagnetic (VETEM) Prototype Instrument and Applications to Shallow Subsurface Imaging at Sites in the DOE Complex
§ 54661-DE	B-91	Electrochemical Processes for In-Situ Treatment of Contaminated Soils
§ 54893-FL	B-99	Research Program to Determine Redox Properties and Their Effects on Speciation and Mobility of Pu in DOE Wastes
§ 55218-GA	B-107	Seismic Surface-Wave Tomography of Waste Sites
§ 54834-IN	B-143	An Investigation of Homogeneous and Heterogeneous Sonochemistry for Destruction of Hazardous Waste
§ 60199-KS	B-159	Seismic-Reflection and Ground Penetrating Radar for Environmental Site Characterization
§ 54683-MA	B-173	Speciation and Structural Characterization of Plutonium and Actinide-organic Complexes in Surface and Groundwaters
§ 54888-MA	B-175	Manipulating Subsurface Colloids to Enhance Cleanups of DOE Waste Sites
§ 55300-MA	B-179	3-D Spectral IP Imaging: Non-Invasive Characterization of Contaminant Plumes
§ 60271-NH	B-199	Characterization of a New Family of Metal Transport Proteins
§ 54741-NM	B-207	Characterization of Contaminant Transport Using Naturally-Occurring U-Series Disequilibria
§ 54857-NM	B-245	Surface Nuclear Magnetic Resonance Imaging of Water Content Distribution in the Subsurface
§ 54639-NM	B-251	Development of an In-Situ Microsensor for the Measurements of Chromium and Uranium in Groundwater at DOE Sites
§ 60158-OR	B-279	Development of Radon-222 as a Natural Tracer for Monitoring the Remediation of NAPL Contamination in the Subsurface
§ 54122-PA	B-281	A Broad Spectrum Catalytic System for Removal of Toxic Organics from Water By Deep Oxidation
§ 55205-SC	B-299	A Fundamental Study of Laser-Induced Breakdown Spectroscopy Using Fiber Optics for Remote Measurements of Trace Metals
§ 55033-TN	B-305	Characterization of Chemically Modified Hyperthermophilic Enzymes for Chemical Syntheses and Bioremediation Reactions
§ 55036-TN	B-307	Colloid Transport and Retention in Fractured Deposits
§ 55119-TN	B-315	Phase Equilibria Modification by Electric Fields

Awards Related to NV214 Continued

Award ID	Page #	Award Title
§ 55267-TN	B-317	Containment of Toxic Metals and Radionuclides in Porous and Fractured Media: Optimizing Biogeochemical Reduction versus Geochemical Oxidation
§ 60197-TN	B-329	Microsensors for In-situ Chemical, Physical, and Radiological Characterization of Mixed Waste
§ 55185-TX	B-349	New Strategies for Designing Inexpensive but Selective Bioadsorbants for Environmental Pollutants: Selection of Specific Ligands & Their Cell Surface Expression
§ 54635-WA	B-361	Molecular-Level Process Governing the Interaction of Contaminants with Iron and Manganese Oxides
§ 60355-WA	B-377	Mineral Surface Processes Responsible for the Decreased Retardation (or Enhanced Mobilization) of 137Cs from HLW Tank Discharges
60370-CA	B-39	Rational Design of Metal Ion Sequestering Agents
54546-CA	B-61	Engineered Antibodies for Monitoring of Polynuclear Aromatic Hydrocarbons
54847-CO	B-87	Photocatalytic and Chemical Oxidation of Organic Compounds in Supercritical Carbon Dioxide
55012-CO	B-89	Extraction and Recovery of Mercury and Lead from Aqueous Waste Streams Using Redox-active Layered Metal Chalcogenides
60141-DC	B-95	Gamma Ray Imaging for Environmental Remediation
55042-GA	B-105	Quantifying Silica Reactivity in Subsurface Environments: Controls of Reaction Affinity and Solute Matrix on Quartz and SiO2 Glass Dissolution Kinetics
60424-ID	B-113	High Temperature Condensed Phase Mass Spectrometric Analysis
55247-IL	B-119	Sensors Using Molecular Recognition in Luminescent, Conductive Polymers
55294-IL	B-121	Superconducting Open-Gradient Magnetic Separation for the Pretreatment of Radioactive or Mixed Waste Vitrification Feeds
60247-IL	B-139	Miniature Nuclear Magnetic Resonance Spectrometer for In-Situ and In-Process Analysis and Monitoring
55211-IL	B-141	Cavitational Hydrothermal Oxidation: A New Remediation Process
54942-IN	B-147	Spectroscopy, Modeling and Computation of Metal Chelate Solubility in Supercritical CO_2
54791-KS	B-153	Managing Tight-binding Receptors for New Separations Technologies
54864-KS	B-157	Supramolecular Chemistry of Selective Anion Recognition for Anions of Environmental Relevance
60231-MD	B-165	Novel Miniature Spectrometer for Remote Chemical Detection
59977-MD	B-169	Synthesis and Characterization of Templated Ion Exchange Resins for the Selective Complexation of Actinide Ions
54571-MA	B-181	Removal of Heavy Metals and Organic Contaminants from Aqueous Streams by Novel Filtration Methods
55223-MO	B-197	De Novo Design of Ligands for Metal Separation
54724-NM	B-205	Synthesis of New Water-Soluble Metal-Binding Polymers: Combinatorial Chemistry Approach
54751-NM	B-209	High Fluence Neutron Source for Nondestructive Characterization of Nuclear Waste
54770-NM	B-213	New Anion-Exchange Resins for Improved Separations of Nuclear Materials
59967-NM	B-217	Aqueous Electrochemical Mechanisms in Actinide Residue Processing
59981-NM	B-219	Real-Time Broad Spectrum Characterization of Hazardous Waste by Membrane Introduction Mass Spectrometry
55387-NM	B-237	Photooxidation of Organic Wastes Using Semiconductor Nanoclusters
60403-NM	B-243	Phase Chemistry of Tank Sludge Residual Components
54674-OH	B-271	Design and Development of a New Hybrid Spectroelectrochemical Sensor
60474-OH	B-273	Develop and Demonstrate Novel Ultrahigh Sensitivity Heavy Noble Gas Detectors for Long-Term Monitoring of Spent Fuel and TRU Waste
60041-OK	B-275	Removal of Radioactive Cations and Anions from Polluted Water Using Ligand-Modified Colloid-Enhanced Ultrafiltration

Awards Related to NV214 Continued

Award ID	Page #	Award Title
60017-PA	B-285	Removal of Technetium, Carbon Tetrachloride, and Metals from DOE Properties
54856-PA	B-289	Structural Biology of the Sequestration & Transport of Heavy Metal Toxins: NMR Structure Determination of Proteins Containing the -Cys-X-Y-Cys-metal Binding Motifs
54973-TN	B-301	A Novel Energy-Efficient Plasma Chemical Process for the Destruction of Volatile Toxic Compounds
55103-TN	B-311	Utilization of Kinetic Isotope Effects for the Concentration of Tritium
55276-TN	B-319	Fundamental Chemistry and Thermodynamics of Hydrothermal Oxidation Processes
60218-TN	B-333	Novel Mass Spectrometry Mutation Screening for Contaminant Impact Analysis
54735-TX	B-343	Development of Inorganic Ion Exchangers for Nuclear Waste Remediation
54679-WA	B-367	Architectural Design Criteria for F-Block Metal Ion Sequestering Agents
54996-WA	B-371	Ionizing Radiation Induced Catalysis on Metal Oxide Particles
54897-WA	B-391	The Sonophysics and Sonochemistry of Liquid Waste Quantification and Remediation
60050-WA	B-395	Chemical Speciation of Inorganic Compounds under Hydrothermal Conditions

Oak Ridge Operations Office

Science Needs as Reported in the March 1998 *Accelerating Cleanup: Focus on 2006*, Table O.9.2

BS-01 - Non -intrusive location and characterization of high hazard buried wastes
BS-02 - Reliability/failure (predictive) analysis of containment barriers and in situ waste forms
BS-03 - Innovative and/or non-intrusive verification of in situ stabilization and/or containment systems
BS-04 - Treatment of varying concentrations of Tc-99 in surface and groundwater
BS-05 - Definition of buried waste geometry and trench boundaries
BS-07 - Passive barrier treatment media and configurations
BS-08 - In situ treatment of primary and secondary sources in fractured geology/karst
BS-09 - Remote and in situ methods for detection and characterization of karst geology
BS-10 - Cost-effective, long-term confinement of DNAPL sources
BS-11 - Destruction or removal of DNAPL sources from fractured geological formations and soils
BS-12 - Stabilization and abandonment techniques for very deep, highly contaminated wells and boreholes
BS-13 - Advanced in situ stabilization, treatment, and containment technologies
BS-14 - Real-time field detection and treatment of total mercury in water to 12 ppt.
BS-15 - Geostatistical methods for designing watershed monitoring networks and interpreting limited data
BS-16 - Improved radiological characterization and certification of contaminated equipment and facilities
BS-17 - Improved decontamination techniques for process equipment and facilities
BS-18 - Dev. tech. capable of performing charact. of waste, waste tanks/containers/piping sys, & sur. soil
BS-19 - Develop cost-effective process for removing chelated nickel from biodenitrification effluent
BS-20 - Processes for selective removal of Cs, Sr, Co, Pu, U, alpha, Cr, Cd, Hg, and TRU from tank waste
BS-21 - Develop more efficient solid/liquid separation processes for tank wastes
BS-22 - Differentiation of TRU and non-TRU alpha-emitting radionuclides
BS-23 - Develop waste forms having long-term durability
BS-24 - Systems capable of continuous measurement of total, elemental, and speciated mercury effluent
BS-25 - Tech. for real-time field measurement of VOCs, PCBs, mercury, metals, & semi-volatiles
BS-26 - Tech. to detect the amount of low-level radioactivity in chemicals being discarded from laboratories
BS-27 - Charact. & treatment of heter. debris, sludges, & soils cont. w/both hazardous & radioactive species

Research Identified Through the Complex-Wide Needs Survey, June 1996

CS-055 - Improved methods for removing surface (removable) Actinide contamination from non porous surfaces to <100 nCi/gm.
CS-056 - Environmental remediation of tanks and piping adjacent to dismantled buildings.
CS-057 - Characterize site UBCs and PACs to determine type and extent of contamination.
CS-058 - In-situ method for surface decontamination for uranium process equipment.
CS-060 - Systems/procedures for assuring that all radioactive material has been removed from tanks and pipes prior to dismantlement is necessary to avoid budget/schedule impact.
CS-061 - Simple and safe methods for digging and crushing concrete foundations is needed.
CS-062 - Cleanup, decommissioning, dismantling, and construction activities will require containment technologies to prevent the spread of contamination offsite or to uncontaminated areas on-site.
CS-063 - Cost effective and safe systems and procedures are required to size reduce and remove excess equipment.
CS-070 - Improve techniques for volume reduction of decommissioning waste such as sheet metal, piping, conduit and furniture.
CS-071 - In-situ capping of dismantled buildings to prevent contaminant migration into groundwater or release to air or surface water.
CS-073 - Best available technologies for demolition of concrete structures.
CS-075 - Best available technologies for safe removal of friable asbestos.
CS-076 - Best available technologies for safe removal of lead.
CS-077 - Methods for decontamination of concrete surfaces (walls, floors, ceilings) to <100 nCi/gm.
CS-078 - Contain airborne contamination during disassembly and demolition activities.
CS-089 - Rapid (Field) non Invasive, real time *in-situ* measures to reduce cost of site characterization.
CS-091 - Location and characterization of high hazard waste and verification of remedial action.

CS-098 - Replace current batch sampling of surface water with a continuous monitoring systems maximizing information value of down-sized data collection.

CS-105 - Need inexpensive approach to characterizing burial grounds. Under current approaches it costs as much to characterize a burial ground as it would to retrieve all waste. No real-time analytical system. Analytical data are too costly to support real technical decisions.

CS-106 - Burial ground characterization.

CS-108 - Chromium contamination in soils and groundwater.

CS-109 - Acid mine drainage (AMD).

CS-110 - Nitrate - contaminated groundwater.

CS-111 - Cyanide leach ponds leaking into groundwater.

CS-112 - Cost effective remediation methods for DNAPLS found in unconsolidated, deep, subsurface sediments; i.e. sandy/clayey soils.

CS-113 - Cost effective, in-situ, and ex-situ, groundwater treatment methods for radioactive, voc's, and hazardous waste constituents in unconsolidated sandy/clayey soils.

CS-116 - Proper application of Electronic Soil remediation techniques to removal of metal ions and anions (including radionuclides) from contaminated soil.

CS-117 - Contaminated underground plumes.

CS-122 - Remove VOCs from groundwater using an in situ treatment method.

CS-126 - Remove OU 5 landfill contents.

CS-128 - Environmental remediation of soils and other media adjacent to dismantled buildings.

CS-133 - Removal of ^{3}H, ^{129}I, and CCl_4 from large volumes of groundwater plumes.

CS-134 - Restoration of an aquifer. Principal contaminant is ^{90}Sr.

CS-150 - Characterization of radionuclide constituents and concentrations deterring waste classification.

CS-176 - LL and LLM liquid wastes containing higher levels of radioactivity require precipitation. Improvements in this technology will make this operation more efficient.

CS-177 - Many solid wastes will require volume reduction to minimize the volume of waste shipped for disposal - also to preserve storage capacity.

CS-193 - Selective removal and recovery of toxic metal ions and radionuclides from DOE aqueous waste solutions is an urgent problem that needs a basic science approach to be able to eventually remediate the extensive metal ion/radionuclide contamination.

Technology Development and Science Needs related to the Decontamination and Decommissioning Technology Focus Area

D&D02 - Techniques are needed which allow/permit recycle and free-release of materials (metals) and which reduce secondary waste.

Science Need: Fundamental surface science studies are needed to improve removal of organic, inorganic, and radioactive species from materials requiring cleaning.

D&D03 - Current methods for locating buried objects (process equipment and piping) are inaccurate or ineffective in clay/silt environments and are often intrusive in nature.

Science Need: Basic studies leading to development of improved (object resolution and size recognition) methods for detection and location of buried metal and non-metal objects are required to develop improved technology for locating buried objects.

D&D04 - Study radioactive decay of materials in their disposed or recycled states to better understand the impact of residual radioactivity to the long-term integrity of the disposed or recycled materials. The impact of other factors such as temperature and material stress could be included in study.

Science Need: Fundamental material science studies related to mechanical property characterization are needed to determine the long-term integrity of disposed or recycled materials.

D&D05 - Real-time, field deployable characterization tools with sensitivities that will measure to free-release standards. Low-cost technologies which can differentiate between contaminated and non-contaminated equipment and materials are needed to aid in material segregation.

Science Need: Basic studies associated with non-intrusive, real time determination of chemical species in or on high density materials are needed to develop technology for sensing extremely low concentrations (PPM to PPB) concentrations of hazardous chemicals.

D&D06 - More durable, economical, and comfortable worker protection equipment, clothing, and breathing apparatus for both radioactive and non-radioactive environments are required to reduce the risk of exposure.

Science Need: Fundamental chemical and materials studies concerned with understanding the mechanism of penetration and diffusion of liquid materials through polymeric materials are needed to develop new personnel protection equipment.

D&D07 - Methods are needed to decontaminate mercury-contaminated process equipment, piping, and concrete resulting in the free release or restricted reuse of these materials.

Science Need: A basic understanding of chemistry and surface science associated with mercury contamination on bare and coated material surfaces is needed to develop more efficient and low cost cleaning and decontamination methods.

D&D08 - Methods are needed to discern the type and depth of radioactive contamination in concrete. Current methods typically volatilize contaminants or create problems of cross contamination.

Science Need: Fundamental instrumentation studies concerned with development of non-intrusive, spatially resolved measurement of radioactive species inside structure bodies are needed to develop more sensitive characterization methods and technology.

D&D09 - A methodology to estimate the human health risk of exposures to radiation from recycled metal including stainless steel. Determine the underlying basis for public fear of free release of decontaminated materials.

Science Need: Basic human health risk studies are needed to understand the implications of reuse of volumetrically contaminated structural materials.

D&D10 - Current processes are not effective in cleaning non-metal complex configurations to free-release conditions and in reducing secondary waste associated with cleaning porous materials.

Science Need: A basic understanding of the chemistry and surface science of porous surfaces is needed to develop improved decontamination methods for wood, concrete, and asbestos.

D&D11 - Cost effective concrete decontamination technologies are needed to reduce the amount of secondary wastes.

Science Need: Basic understanding of chemistry and surface science of concrete are needed to develop decontamination processes that reduce the amount of secondary process waste.

D&D12 - Modifications of thermal treatment methods to prevent unacceptable releases of contaminants.

Science Need: Basic understanding of chemistry of species in high temperature environments is needed to formulate improved waste forms produced by thermal treatment processes and to design higher efficiency off-gas treatment systems.

D&D13 - Improved metal decontamination technologies are needed that are faster, more cost effective, and that reduce the amount of secondary waste.

Science Need: Basic engineering and materials science studies associated with metal surface cleaning are needed to develop advanced surface ablation methods or other techniques for rapid decontamination of metal objects.

D&D14 - Non-intrusive, remote characterization technology is needed to verify the existence or absence of contamination in drains, pipes, and associated equipment.

Science Need: Fundamental sensor and instrumentation development studies are needed to support development of technology for remote inspection of inaccessible areas.

D&D15 - Improved concrete decontamination technologies are needed that are faster, more cost effective, nondestructive (for a reusable concrete surface) and that reduce the amount of secondary waste.

Science Need: A basic understanding of the chemistry and surface science of porous surfaces is needed to develop improved decontamination methods for wood, concrete, and asbestos.

D&D16 - Fixatives are used to fix dispersible contaminants in place where decontamination operations are not feasible or during periods prior to decontamination. Improved fixatives are required which are more easily applied & removed and have longer life.

Science Need: Fundamental chemistry and interfacial science of polymer fixatives are required for development of new materials which are more easily applied, long lived, and easily removed.

Technology Development and Science Needs related to the MIxed Waste Technology Focus Area

MWFA8 - Chelated nickel is produced during bioremediation and must be removed from processed water to comply with regulations.

Science Need: Fundamental chemistry of biomolecule coordinated nickel is needed to understand reactions and conditions necessary for release of chelated nickel produced during bioremediation.

Technology Development and Science Needs related to the Plutonium Technology Focus Area

PFA09 - An improved understanding of plutonium phosphate chemistry in solution and solid states is needed to develop selective phosphate ligands for separation and remediation applications.
Science Need: Basic separations chemistry of plutonium and phosphate systems is needed to develop selective phosphate separations and remediation processes.

PFA10 - Optimization of polymer filtration processes is needed. An understanding of polymer functionality is required in terms of process parameters including metal ion loading, pH, polymer concentration, metal ion separation, and ionic strength.
Science Need: Fundamental separations chemistry is needed to develop more efficient and effective aqueous actinide liquid waste treatment processes.

Technology Development and Science Needs related to the Spent Nuclear Fuel Technology Focus Area

SNF14 - Removal of MSRE material. Develop technology to remove, stabilize, transport and store spent fuel stored in the Molten Salt Reactor Experiment. Define ways to re-establish a fluorine balance or alternatives to salt removal.
Science Need: Fundamental chemical studies of molten salts reactor fuel are needed to treat and stabilize the fuel.

Technology Development and Science Needs related to the Sub-Surface Contaminants Technology Focus Area

SCFA01 - Cost effective monitoring strategy. Need cost effective monitoring strategy for containment of radionuclides, metals, and organic systems.
Science Need: Fundamental biological studies are needed for collection of data related to long term monitoring using natural systems to monitor for radionuclides, metals, and organic molecules. Fundamental studies to relate ecological change to contamination level.

SCFA03 - Active groundwater remediation. Need for cheaper, active groundwater remediation to replace expensive pump and treat methods for radionuclides and metals in groundwater; include bioremediation and permeable reactive barriers if feasible.
Science Need: Basic biological and geochemical studies are needed to understand methods, mechanisms, and routes to actively remediate ground water in place.

SCFA04 - Long term (200-500 years) performance monitoring. Also include modeling/prediction for landfill closure cover for both arid and humid climates.
Science Need: Fundamental engineering science studies are needed to understand aging effects and structural longevity using the aging phenomena associated with natural structures.

SCFA06 - DNAPL mass removal technologies. Techniques for DNAPL source reduction by mobilization and mass removal of DNAPLs (TCE) from lenticular pockets and as residual stringers in the soil column; Y-12 plant, K-25 site, Paducah and Portsmouth GD Plants.
Science Need: Fundamental hydrogeological studies are desired to support removal of TCE from lenticular pockets and residual stringers in soil columns by characterization of TCE binding to soil particles.

SCFA07 - In situ immobilization of radionuclides in groundwater. Need in situ methods to treat water contaminated with Cs-137, Sr-90, U, Pu, and Co-60; application in fractured basalt 200-400 feet below the surface.
Science Need: Basic biological and separations chemical studies are needed to understand methods and mechanisms of capture of Cs and Sr using biological or active barrier methods.

SCFA08 - DNAPL source characterization and delineation. Characterization and detection of residual and pooled DNAPL and VOC sources in subsurface soils to facilitate remediation technologies; OR sites: Y-12 plant, K-25 site, Paducah and Portsmouth GD Plants.
Science Need: Fundamental hydrogeological studies are desired to support removal of TCE from lenticular pockets and residual stringers in soil columns by characterization of TCE binding to soil particles.

Oak Ridge Operations Office

Oak Ridge Reservation

OR-38111 - Mixed Low Level Waste Management

Problem Area: Mixed Waste
Life-Cycle Cost in 2007+: $2,198,000,000
DOE Project Manager: S. P. Riddle, 423-576-7666, riddlesp@oro.doe.gov
Contractor Manager: T. W. Morris, 423-241-4921, morristw@ornl.gov
For More Information: http://www.doe.gov/em52/pbs/or-38111.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: High **Worker:** Medium **Environment:** High

Technical Approach Provided by Project Manager:

Mixed Low Level Waste on the Oak Ridge Reservation will be managed as a set of waste group projects where the ultimate goal of each project will be to eliminate the current inventory of stored mixed low level wastes in that group on the reservation by the end of FY 2006 and to reach a point when MLLW is stored with the only purpose of accumulation of sufficient quantities to facilitate treatment, and disposal. Waste quantities shown in this Project Baseline Summary (PBS) after steady state is reached represent newly generated waste only. These projects are structured to manage all activities required to remove waste from inventory, characterize, transport, treat (as necessary), and provide final disposition. The four waste group projects are:

1. Mixed Low Level Waste Wastewaters to Existing Facilities,
2. Mixed Low Level Waste Incinerables,
3. Mixed Low Level Waste Process Residues, and
4. Mixed Low Level Waste Balance of Inventory.

Two additional work elements make up the remainder of the Mixed Low Level Waste Management project:
1. Mixed Low Level Waste Orders and Agreements, and
2. Mixed Low Level Waste Project Management and Integration.

There are over 60 permitted MLLW storage facilities on the Oak Ridge Reservation supported by this project. These facilities house the MLLW inventory on the reservation. This inventory will be eliminated by treating and disposition, and, as the inventory is reduced, the number of facilities required will be reduced to a minimum number that will support accumulation of waste only to facilitate steady state treatment and disposal (typically assumed to be one year's generation).

Treatment activities include operation of wastewater treatment facilities at Y-12 and ETTP and the TSCA Incinerator at ETTP. They also include acquisition of commercial treatment capability for the quantity of wastes on the ORR that have no currently existing disposition path (the Balance of Inventory [BOI] project element) through commercial treatment and disposal, including the Broad Spectrum Procurement. This PBS includes all costs that are anticipated to be associated with the Broad Spectrum contract(s) including treatment, characterization, transportation, and disposal. The Commissioner's Order provides milestones and outyear targets for treatment of RCRA mixed low level wastes that DOE must meet. The enforceable milestones and outyear targets that are set each year for a rolling three-year period, and targets for outyears are included. The PCB FFCA requires development of a treatment plan and schedule. Under the current target funding profile for this PBS the MLLW inventory on the ORR is eliminated by the end of FY 2006, which is generally consistent with the principles negotiated in the Commissioner's Order.

The project sub-elements for disposal under each waste group include all activities associated with disposal of those wastes that can be disposed of directly without treatment. These activities include staging, repackaging, characterization, transportation, and direct disposal costs.

Post 2006 Project Scope Provided by Project Manager:

The scope of this project after FY 2006 is to maintain a steady state compliance with the requirements of RCRA and TSCA for newly generated waste in which waste is accumulated only to facilitate treatment and disposal.

Project End State Provided by Project Manager:

The final end-state is to reach and maintain a steady state compliance with the requirements of RCRA and TSCA for newly generated waste in which waste is accumulated only to facilitate treatment and disposal.

The full list of science research awards that have the potential to address projects such as this one, which deals with Mixed Waste problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "Mixed Waste".

Oak Ridge Operations Office

Oak Ridge Reservation

OR-42101 - Y-12 East Fork Poplar Creek Remedial Action

Problem Area: Remedial Action
Life-Cycle Cost in 2007+: $287,000,000
DOE Project Manager: Robert C. Sleeman, 423-576-0715, sleemanrc@oro.doe.gov
Contractor Manager: T. W. Morris, 423-241-4921, morristw@ornl.gov
For More Information: http://www.doe.gov/em52/pbs/or-42101.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Medium **Worker:** Medium **Environment:** Medium

Technical Approach Provided by Project Manager:

The technical approaches described below for forecast remedial and removal action projects are taken from the project baselines. These approaches are subject to be modified by Records of Decisions or other CERCLA or RCRA decision documents.

For the UEFPC East End DNAPL forecast removal action subproject it is assumed that five extraction wells (average depth of 400') and five package treatment systems will be installed to perform filtration, air stripping and carbon absorption. It is assumed that the wells and treatment systems will allow treatment at a total rate of 150 gpm and will capture the plume contributing to the offsite contaminant migration and cut off the migration pathway. Treated water will be discharged to Upper East Fork Poplar Creek. An additional ten monitoring wells will be installed to monitor the effectiveness of the action. This action will not "retrieve" contaminated groundwater already in offsite areas, rather once the source area is cut off, the offsite contaminated groundwater is assumed to naturally attenuate.

The Upper EFPC Sumps forecast remedial action subproject will use six existing building sumps which are use to dewater process building basements as collection points for a shallow contaminated groundwater plume located in the interior of the Y-12 Plant. This subproject will construct 8,000' of 2-in. piping to collect the sump water and transfer the water to existing treatment plants. The treated water will be discharged to Upper East Fork Poplar Creek.

The Upper EFPC Sub-basin forecast remedial action subproject will construct collection points for low volume, high concentration surface water streams which contribute relatively high percentages of contaminants into Upper East Fork Poplar Creek. It is assumed that water will be treated at a total rate of 40 gpm and that at the time of implementation, existing water treatment facilities will be able to handle this treatment rate. The treated water will be discharged to Upper East Fork Poplar Creek.

The Upper EFPC Hydraulic Isolation and Groundwater Treatment forecast remedial action subproject will address three localized volatile-contaminated groundwater plumes. It is assumed that three extraction wells (average depth 40') and three package treatment systems will be installed to perform filtration, air stripping and carbon absorption at a rate of 5 gpm per well. An additional 6 monitoring wells will be installed to monitor the effectiveness of the action.

The Upper EFPC Shallow Groundwater forecast remedial action subproject will construct three shallow wells to intercept shallow groundwater plumes prior to discharge into Upper East Fork Poplar Creek or the storm drain system which acts as the headwaters of the creek. It is assumed that the wells will be installed in areas of upward hydraulic gradients. The extracted groundwater will be treated at package treatment systems (using filtration, air stripping and carbon adsorption) and will be reinjected.

The Upper EFPC Soil Remediation forecast remedial action subproject will address contaminated surface and shallow-subsurface soils in the interior of the Y-12 Plant. It is assumed that a total of 10 acres will be capped with associated grading for surface water control. Caps will be multi-layer (RCRA-like). In addition, it is assumed that 4,000 cubic yards of contaminated soils will be excavated and disposed of in the EM Waste Management Facility.

The Upper EFPC Firing Range Soil Remediation removal action subproject will address the excavation of approximately 5,000 cy of lead-contaminated soils. Disposition of the soils is still to be determined. If mechanical separation is conducted to remove spent bullets, soils will be placed back in the area.

The Salvage Yard Soil Remediation removal action subproject will address contaminated surface and shallow-subsurface soils in the vicinity of the former Drum Deheader in the Y-12 Salvage Yard. Approximately 1,000 cy of soil will be excavated and disposed of in the EM Waste Management Facility.

The Upper EFPC Storm Sewer forecast remedial action subproject will clean and reline 2,000' of storm sewer piping and will remove 50 cubic yards of contaminated sediments from the storm sewer. The contaminated sediments will be disposed of in the EM Waste Management Facility.

It is assumed that the remedial action for the Upper EFPC Coal Pile Trench and Beta-4 Security Pit forecast subproject will include excavation and removal of wastes in the trenches, excavation of contaminated soils, packaging and shipment of waste and soils to a classified section of the EM Waste Management Facility. For the uranium oxide removed from the Uranium Vault it is assumed that the waste will be placed in drums, and will be process through the uranium chip oxidizer prior to disposal in the Chestnut Ridge Uranium Oxide Vaults.

At the Upper EFPC UST Legacy Remediation forecast subproject existing wells will be used to inject organic nutrients into an LNAPL plume to enhance natural bioremediation. The system will be operable for ten years.

For the three subprojects associated with the UEFPC Watershed ROD project (RMPE, Union Valley, RCRA Closures), the following addresses the technical approach. Maintenance and operation of the East End Mercury Treatment and the Central Mercury Treatment systems will continue. In addition, there are plans to move from the success of the pilot mercury air-stripping test facility into a permanent system to address mercury-contaminated shallow groundwater. Finally, studies are underway on the effects of Lake Reality on mercury loading into Upper East Fork Poplar Creek. This lined lake located on the east end of the plant was built for spill containment purposes. Mercury-contaminated sediment which has accumulated on the lake bottom appears to act as a secondary contaminant source during dry weather flow conditions. Field work and/or final documentation has been completed on the RCRA closures and Union Valley subprojects. Deferral of remnant soil contamination to the UEFPC Watershed ROD project at one of the RCRA Closure sites is proposed.

The following addresses the technical approach to be taken at the sites located on Chestnut Ridge. The remedial action at the Filled Coal Ash Pond subproject included removal of vegetation and filling of void space on the pond's dam. In addition, a wetlands located at the foot of the dam which was damaged during dam stabilization was reestablished further downgradient in Upper McCoy Branch. For the East Chestnut Ridge Waste Pile, a RCRA waste pile closure is proposed where 2,000 cubic yards of soils will be removed and disposed of in the EM Waste Management Facility. After closure a CERCLA No Further Action ROD will be approved. At the other RCRA closed units on Chestnut Ridge (CRSPs and CRSDB) existing RCRA documentation and environmental data will be used to obtain CERCLA No Further Action RODs which will adopt the RCRA closures as protective and will defer to RCRA postclosure care requirements. For the Rogers Quarry/Lower McCoy Branch subproject, existing data will be used to propose an institutional controls and monitoring Record of Decision. For the Arboretum Spring subproject, six groundwater wells (average depth of 400') will be installed to evaluate the potential for contamination migration from the Chestnut Ridge Security Pits to offsite springs along Scarboro Creek. It is assumed that the associated ROD for this subproject will propose continued spring and well monitoring.

S&M activities include routine tasks to ensure facilities and release sites remain in compliance with established criteria that protect human health, the environment and DOE assets. This includes maintenance and operation of treatment systems or caps constructed to mitigate environmental liabilities. It also includes monitoring and inspections. to establish the effectiveness of treatment systems or caps. Scope also includes special, one-time site stabilizations (such as the now-completed Bldg. 9201-4 tray room cleanup subproject) to realize cost-reduction, risk-reduction or meet management initiatives.

The following technologies including associated cost savings have been incorporated into this project baseline:

Subsurface Contaminants Focus Area - Reactive Barriers
Subsurface Contaminants Focus Area - Waste Source Grouting
Subsurface Contaminants Focus Area - Uranium Stabilization Using Phosphate Grout

Characterization, Monitoring and Sensor Technology Crosscutting Program - Direct Sampling Ion Trap Mass Spectrometry
Characterization, Monitoring and Sensor Technology Crosscutting Program - Performance Verification Monitoring

In addition, other technologies identified below will be considered pending funding and technological considerations:

Decontamination and Decommissioning Focus Area - Y-12 S&M Reduction
Efficient Separation and Processing Crosscutting Program - Polymer Filtration
Subsurface Contaminants Focus Area - Barrier/collector Emplacement Technology
Subsurface Contaminants Focus Area - Fluidless Directional Drilling
Subsurface Contaminants Focus Area - Horizontal Barriers

The subprojects included in this project are:
Chestnut Ridge Security Pits
Filled Coal Ash Pond/Upper McCoy Branch
Chestnut Ridge Sediment Disposal Basin
Rogers Quarry/Lower McCoy Branch
East Chestnut Ridge Waste Pile
Arboretum Spring
UEFPC Watershed ROD
Reduction of Mercury in Plant Effluents
Y-12 RCRA Closures
UEFPC Sumps
UEFPC Sub-basin
UEFPC Hydraulic Isolation & Groundwater Treatment
UEFPC Shallow Groundwater
UEFPC Soil Remediation
UEFPC Storm Sewer
UEFPC Coal Pile Trench and Beta-4 Security Pits
UEFPC UST Legacy Remediation
Y-12 Remedial Action Surveillance & Maintenance
Y-12 Decommissioning Surveillance & Maintenance
Y-12 Long Term S&M
UEFPC Firing Range
Soil Remediation
UEFPC Salvage Yard Soil Remediation

Post 2006 Project Scope Provided by Project Manager:

In the Upper East Fork Poplar Creek Watershed and Chestnut Ridge area, six forecast remedial action subprojects extend beyond FY2006 to the FY2009-2010 timeframe. These actions include waste excavation at classified burial trenches, groundwater treatment (conventional pump and treat), surface water collection and treatment, and soil consolidation and capping activities.

Surveillance and maintenance requirements from RCRA postclosure and CERCLA decision documents will continue post-FY2006.

Project End State Provided by Project Manager:

The proposed end use for the main Y-12 Plant and support areas on Chestnut Ridge are controlled access, restricted industrial use and open space/recreational. Prevention of contaminant migration from sources areas will be mainly addressed with localized water collection and treatment remedial actions and soil consolidation and capping. DOE will maintain restricted access areas for secure storage and disposal of nuclear materials and waste. Barriers and security fences will prevent access by unauthorized persons. In areas where industrial use is allowed for nonDOE entities, groundwater usage restrictions will be put in place. Groundwater remedial actions will be conducted to meet containment goals, only. It is assumed that the surveillance and maintenance for these remedial actions will continue to 2070.

The full list of science research awards that have the potential to address projects such as this one, which deals with Remedial Action problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "Remedial Action".

The following awards were identified through systems engineering to have the potential to address the specific needs of this Project. Those research awards that may have the strongest link to this project are designated by the symbol "§".

Award ID	Page #	Award Title
§ 55014-AL	B-1	Kinetics and Mechanisms of Metal Retention/Release in Geochemical Processes in Soil
§ 54898-AZ	B-5	Molecular Dissection of the Cellular Mechanisms Involved in Nickel Hyperaccumulation in Plants
§ 55396-CA	B-33	Sorption of Colloids, Organics, and Metals onto Gas-Water Interfaces: Transport Mechanisms and Potential Remediation Technology
§ 60328-CA	B-37	High Frequency Electromagnetic Impedance Measurements for Characterization, Monitoring and Verification Efforts
§ 55011-CA	B-43	Surface and Borehole Electromagnetic Imaging of Conducting Contaminant Plumes
§ 54860-CA	B-59	Sorption of Heavy Metals and Radionuclides on Mineral Surfaces in the Presence of Organic Co-Contaminants
§ 54926-CA	B-75	Novel Ceramic-Polymer Composite Membranes for the Separation of Hazardous Liquid Waste
§ 54661-DE	B-91	Electrochemical Processes for In-Situ Treatment of Contaminated Soils
§ 54893-FL	B-99	Research Program to Determine Redox Properties and Their Effects on Speciation and Mobility of Pu in DOE Wastes
§ 55218-GA	B-107	Seismic Surface-Wave Tomography of Waste Sites
§ 54837-GA	B-109	Phytoremediation of Ionic and Methyl Mercury Pollution
§ 54834-IN	B-143	An Investigation of Homogeneous and Heterogeneous Sonochemistry for Destruction of Hazardous Waste
§ 60199-KS	B-159	Seismic-Reflection and Ground Penetrating Radar for Environmental Site Characterization
§ 54683-MA	B-173	Speciation and Structural Characterization of Plutonium and Actinide-organic Complexes in Surface and Groundwaters
§ 54888-MA	B-175	Manipulating Subsurface Colloids to Enhance Cleanups of DOE Waste Sites
§ 55300-MA	B-179	3-D Spectral IP Imaging: Non-Invasive Characterization of Contaminant Plumes
§ 60271-NH	B-199	Characterization of a New Family of Metal Transport Proteins
§ 54857-NM	B-245	Surface Nuclear Magnetic Resonance Imaging of Water Content Distribution in the Subsurface
§ 54639-NM	B-251	Development of an In-Situ Microsensor for the Measurements of Chromium and Uranium in Groundwater at DOE Sites
§ 54122-PA	B-281	A Broad Spectrum Catalytic System for Removal of Toxic Organics from Water By Deep Oxidation
§ 55205-SC	B-299	A Fundamental Study of Laser-Induced Breakdown Spectroscopy Using Fiber Optics for Remote Measurements of Trace Metals
§ 55119-TN	B-315	Phase Equilibria Modification by Electric Fields
§ 60197-TN	B-329	Microsensors for In-situ Chemical, Physical, and Radiological Characterization of Mixed Waste
60370-CA	B-39	Rational Design of Metal Ion Sequestering Agents
54546-CA	B-61	Engineered Antibodies for Monitoring of Polynuclear Aromatic Hydrocarbons
55012-CO	B-89	Extraction and Recovery of Mercury and Lead from Aqueous Waste Streams Using Redox-active Layered Metal Chalcogenides
60141-DC	B-95	Gamma Ray Imaging for Environmental Remediation
55247-IL	B-119	Sensors Using Molecular Recognition in Luminescent, Conductive Polymers
55294-IL	B-121	Superconducting Open-Gradient Magnetic Separation for the Pretreatment of Radioactive or Mixed Waste Vitrification Feeds

Awards Related to OR-42101 Continued

Award ID	Page #	Award Title
55211-IL	B-141	Cavitational Hydrothermal Oxidation: A New Remediation Process
54791-KS	B-153	Managing Tight-binding Receptors for New Separations Technologies
60231-MD	B-165	Novel Miniature Spectrometer for Remote Chemical Detection
59977-MD	B-169	Synthesis and Characterization of Templated Ion Exchange Resins for the Selective Complexation of Actinide Ions
54571-MA	B-181	Removal of Heavy Metals and Organic Contaminants from Aqueous Streams by Novel Filtration Methods
55223-MO	B-197	De Novo Design of Ligands for Metal Separation
54724-NM	B-205	Synthesis of New Water-Soluble Metal-Binding Polymers: Combinatorial Chemistry Approach
54751-NM	B-209	High Fluence Neutron Source for Nondestructive Characterization of Nuclear Waste
54770-NM	B-213	New Anion-Exchange Resins for Improved Separations of Nuclear Materials
59967-NM	B-217	Aqueous Electrochemical Mechanisms in Actinide Residue Processing
55387-NM	B-237	Photooxidation of Organic Wastes Using Semiconductor Nanoclusters
60474-OH	B-273	Develop and Demonstrate Novel Ultrahigh Sensitivity Heavy Noble Gas Detectors for Long-Term Monitoring of Spent Fuel and TRU Waste
60041-OK	B-275	Removal of Radioactive Cations and Anions from Polluted Water Using Ligand-Modified Colloid-Enhanced Ultrafiltration
60017-PA	B-285	Removal of Technetium, Carbon Tetrachloride, and Metals from DOE Properties
54856-PA	B-289	Structural Biology of the Sequestration & Transport of Heavy Metal Toxins: NMR Structure Determination of Proteins Containing the -Cys-X-Y-Cys-metal Binding Motifs
54973-TN	B-301	A Novel Energy-Efficient Plasma Chemical Process for the Destruction of Volatile Toxic Compounds
55103-TN	B-311	Utilization of Kinetic Isotope Effects for the Concentration of Tritium
54735-TX	B-343	Development of Inorganic Ion Exchangers for Nuclear Waste Remediation
54679-WA	B-367	Architectural Design Criteria for F-Block Metal Ion Sequestering Agents
54996-WA	B-371	Ionizing Radiation Induced Catalysis on Metal Oxide Particles
54897-WA	B-391	The Sonophysics and Sonochemistry of Liquid Waste Quantification and Remediation
60050-WA	B-395	Chemical Speciation of Inorganic Compounds under Hydrothermal Conditions

Oak Ridge Operations Office

Oak Ridge Reservation

OR-43202 - ORNL Melton Valley Watershed Remedial Action

Problem Area:	Decontamination and Decommissioning
Life-Cycle Cost in 2007+:	$228,000,000
DOE Project Manager:	Robert C. Sleeman, 423-576-0715, sleemanrc@oro.doe.gov
Contractor Manager:	T. W. Morris, 423-241-4921, morristw@ornl.gov
For More Information:	http://www.doe.gov/em52/pbs/or-43202.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: High **Worker:** High **Environment:** Urgent

Technical Approach Provided by Project Manager:

After approval of the ROD for the watershed, individual subprojects will be performed to implement the actions required by the ROD. The subprojects and technical scopes are as follows: 1) Melton Valley Contaminated Soils; remediation of contaminated soil in the watershed by excavation, grouting in place, or institutional control; 2) Solid Waste Storage Area 4 Seep control; grouting of selected buried waste trenches to retard leaching of contaminants into seeps; 3) Solid Waste Storage Area 4 Remediation; grouting of additional buried waste trenches followed by capping and hydrologic isolation; 4) Solid Waste Storage Area 5 Remediation; capping and hydrologic isolation of buried waste trenches; 5) Old Hydrofracture Facility Pond/Tanks Remediation; grouting of contaminated sediments in pond and remediation of 5 empty underground tank shells after removal of TRU sludges (removal of sludges addressed in PBS OR-43203); 6) Process Waste Sludge Basin; grouting of contaminated sediments in pond; 7) Remediation Technology Demos; Environmental Restoration (ER) portion of joint ER/Technology Development cryogenic barrier technology demonstration to retard contaminated seeps; 8) Solid Waste Storage Area 6 Remediation; capping of buried waste disposal areas and installation of cutoff walls to provide hydrologic isolation; 9) LLLW Disposal Pits and Trenches; in situ vitrification (ISV) of seepage pits and trenches that received liquid low-level waste; 10) Pits and Trenches Secondary Sources; capping of contaminated soil between vitrified trenches and collection of contaminated groundwater seeps; 11) HFIR/TRU Waste Collection Basins; removal of contaminated soil and sediments from four collection basins; 12) Homogeneous Reactor Experiment Pond; In situ Vitrification (ISV) of filled in settling basin to control migration of contaminants; 13) Hydrofracture Injection/Monitoring Wells; plugging and abandonment of four injection wells and 46 monitoring wells (some wells may be upgraded for continued use as monitoring wells); 14) ORNL Cesium Research Areas; excavation of hot spots; 15) Plugging & Abandonment (P&A) of unneeded monitoring wells in Melton Valley; 16) White Oak Creek Remediation; excavation of hot spots in creek bed and floodplain; grouting of excavated floodplain sediments and lake bottom sediments in bottom of White Oak Lake; White Oak Creek rerouted and White Oak Lake and Embayment filled in over the top of the grouted sediments.

Unless otherwise noted, excavated waste and contaminated media are assumed to be placed in the Environmental Management Waste Management Facility (EMWMF), an on-site facility for CERCLA wastes located near the Y-12 plant on the Oak Ridge Reservation. The FS to evaluate the construction of this facility versus off-site disposal has recently been submitted to the regulators for review and comment. Construction and operation of the facility is not included in this PBS but in PBSs OR-48101 and OR-44901, respectively. Transportation of the waste to the facility is included in this PBS.

Surveillance and Maintenance (S&M) for the release sites in this PBS is included in PBS OR-43203. Long-term S&M for the release sites after remediation is completed is included in PBS OR-43203.

The following technologies including associated cost savings have been incorporated into this project baseline: in situ vitrification; reactive barriers; waste source grouting; direct sampling ion trap mass spectrometry; performance verification monitoring; cryogenic barrier.

In addition, other technologies such as barrier/collector emplacement technology; ISV of buried waste; fluidless directional drilling; and horizontal barriers will be considered pending funding and technological considerations.

Other technologies such as inorganic sorbents for radionuclide separations, magnetic seed filtration, TUCS/phosphate immobilization of actinides, and in-situ sorption of technetium will be considered pending funding and technological considerations.

Post 2006 Project Scope Provided by Project Manager:

Process Waste Sludge Basin: This subproject will have started in FY 2006 and will continue through FY 2009. Remediation for this 0.17-acre, (Poly Vinyl Chlorinated) PVC-lined basin consists of stabilizing sediments by mixing with grout and filling the basin with soil. The area will be maintained so that only shallow-rooted vegetation will grow in the pond area.

Homogeneous Reactor Experiment Pond: This subproject will have started in FY 2003 and will continue through FY 2008. The filled-in pond and contaminated pond sediments will be remediated using in-situ vitrification.

LLLW Disposal Pits and Trenches: This subproject will have started in FY 2003 and will continue through FY 2012. More than 40 million gallons of liquid waste including 1.1 million Ci of activity were disposed of in 4 pits, 3 trenches, and 3 fuel wells. The assumed baseline remediation technology is in situ vitrification.

Melton Valley Contaminated Soils: This subproject will have started in FY 2005 and will continue through FY 2009. This project will either provide remediation or designate requirements for institutional controls for 30 contaminated soil areas. Two soil sites will be excavated, backfilled, seeded, and mulched. Five sites will be grouted as a remedial action and LLLW pipelines throughout Melton Valley will be grouted or removed.

White Oak Creek Remediation: This subproject will have started in FY 2005 and will continue through FY 2013. Contaminated sediments and floodplain soils in White Oak Creek (WOC) will be removed or stabilized in place as necessary. Contaminated sediments will be placed in White Oak Lake (WOL). WOL and WOC embayment will be grouted in place, the lake filled with soil, and seeded. The lower portion of WOC will be rerouted through a clean area.

Melton Valley Well Plugging & Abandonment: This subproject will have started in FY 2004 and will continue through FY 2007. Approximately five hundred unneeded wells in Melton Valley will be plugged and abandoned.

Pits and Trenches Secondary Sources: This subproject will have started in FY 2006 and will continue through FY 2010. Secondary contaminated media near the LLLW disposal pits and trenches will be addressed through grouting of pipelines, a collection system for 4 seeps, and hydrologic capping. Water treatment will take place at the Melton Valley treatment system built for the SWSA 4 remediation project.

SWSA 6 Remediation: This subproject will have started in FY 2004 and will continue through FY 2007. This site, which includes a 19-acre waste disposal area and an explosives detonation trench, will be remediated in two phases. Phase I will provide hydrological isolation for a total of 10 acres in three high-activity areas through installation of caps and cutoff walls. Phase II includes installation of additional caps for a total of 32 acres capped.

Project End State Provided by Project Manager:

Currently, determination of the end use/end state for the Melton Valley area of ORNL is still in progress. The Oak Ridge Environmental Management Site Specific Advisory Board is working with the public to develop recommendations to DOE on the end use of the area. A CERCLA FS has been submitted to the regulators evaluating remediation alternatives representing progressively more aggressive remedial action objectives. The formal determination of the end use will be completed when the CERCLA ROD is signed by DOE, EPA, and the State of Tennessee in FY 1999. The CERCLA ROD will also define the actions required to reach the selected end use At completion of this project and Melton Valley Watershed D&D (PBS OR-43201), the ER scope for the Melton Valley area will be complete except for long-term monitoring and operation of treatment systems.

The assumed end use for the Melton Valley area of ORNL is a mixture of controlled access, restricted industrial, and open space/recreational. Buried waste will remain isolated in place with engineered and institutional controls as appropriate to permit these uses. Releases from sources will be controlled so that surface water quality standards are met. Groundwater will have a "no use" designation and will be monitored. Remediation of groundwater plumes will only occur if surface water is impacted or the groundwater poses on offsite risk. Because of the long-lived contamination in the burial grounds and grout sheets, groundwater will require monitoring indefinitely, but the long-term monitoring is included in PBS OR-43203. Most waste and contaminated media are controlled in place, but the small amount of excavated material that leaves the valley will be transported to the EMWMF near Y-12 on the Oak Ridge Reservation. French drains will be installed at several locations as part of hydrologic isolation of sources. The collected water will be treated in an onsite treatment unit to be constructed as part of the scope of this PBS. Long-term operation of the treatment unit is included in PBS OR-43203. Melton Valley will require DOE institutional control many years into the future.

Additional detail on end state: The radioactive waste burial grounds will be hydrologically isolated to control migration of contaminants. Contaminated sediments in settling basins will be either removed or stabilized in place. Contaminated soils will have been removed, stabilized in place, or designated as requiring institutional control, depending on the cleanup criteria established in the ROD. Contaminated sediments in White Oak Creek, White Oak Lake, and White Oak Creek Embayment will have been stabilized within the lakebed and embayment area, the lake will be filled in, and the creek will be rerouted through a clean channel on top of the old lakebed. The monitoring and injection wells for the hydrofracture operations will have either been plugged with grout to control migration of contaminants or will have been upgraded for long-term use as monitoring wells. Hydrofracture grout sheets (contaminated grout injected approx. 900 feet underground) will be monitored to ensure that contamination does not migrate off-site. Five empty inactive tank shells will have been filled with grout. LLLW Disposal Pits and Trenches will have been remediated using in situ vitrification (ISV) to immobilize the primary contamination, followed by hydrologic isolation to contain contaminants in the secondary media.

D&D facilities within the same geographic area will be addressed in PBS OR-43201. Long-term S&M for Melton Valley after remediation is complete is included in PBS OR-43203.

The full list of science research awards that have the potential to address projects such as this one, which deals with Decontamination and Decommissioning problems, are listed in the <u>Index of Research Awards by Environmental Management Problem Area</u>, in the back of this appendix, under the heading "Decontamination and Decommissioning".

The following awards were identified through systems engineering to have the potential to address the specific needs of this Project. Those research awards that may have the strongest link to this project are designated by the symbol "§".

Award ID	Page #	Award Title
§ 54914-CA	B-73	Atmospheric-Pressure Plasma Cleaning of Contaminated Surfaces
§ 55380-IL	B-127	In-Situ Spectro-Electrochemical Studies of Radionuclide Contaminated Surface Films on Metals and the Mechanism of their Formation and Dissolution
§ 60283-IL	B-133	Waste Volume Reduction Using Surface Characterization and Decontamination by Laser Ablation
§ 54724-NM	B-205	Synthesis of New Water-Soluble Metal-Binding Polymers: Combinatorial Chemistry Approach
§ 60041-OK	B-275	Removal of Radioactive Cations and Anions from Polluted Water Using Ligand-Modified Colloid-Enhanced Ultrafiltration
60328-CA	B-37	High Frequency Electromagnetic Impedance Measurements for Characterization, Monitoring and Verification Efforts
55249-CA	B-47	Experimental Determination of Contaminant Metal Mobility as a Function of Temperature Time and Solution Chemistry
60141-DC	B-95	Gamma Ray Imaging for Environmental Remediation
60424-ID	B-113	High Temperature Condensed Phase Mass Spectrometric Analysis
55247-IL	B-119	Sensors Using Molecular Recognition in Luminescent, Conductive Polymers
60247-IL	B-139	Miniature Nuclear Magnetic Resonance Spectrometer for In-Situ and In-Process Analysis and Monitoring
60231-MD	B-165	Novel Miniature Spectrometer for Remote Chemical Detection
59981-NM	B-219	Real-Time Broad Spectrum Characterization of Hazardous Waste by Membrane Introduction Mass Spectrometry
60163-NM	B-249	Investigation of Techniques to Improve Continuous Air Monitors Under Conditions of High Dust Loading in Environmental Setting
54639-NM	B-251	Development of an In-Situ Microsensor for the Measurements of Chromium and Uranium in Groundwater at DOE Sites
54674-OH	B-271	Design and Development of a New Hybrid Spectroelectrochemical Sensor
60158-OR	B-279	Development of Radon-222 as a Natural Tracer for Monitoring the Remediation of NAPL Contamination in the Subsurface
60197-TN	B-329	Microsensors for In-situ Chemical, Physical, and Radiological Characterization of Mixed Waste
60218-TN	B-333	Novel Mass Spectrometry Mutation Screening for Contaminant Impact Analysis
55185-TX	B-349	New Strategies for Designing Inexpensive but Selective Bioadsorbants for Environmental Pollutants: Selection of Specific Ligands & Their Cell Surface Expression
54635-WA	B-361	Molecular-Level Process Governing the Interaction of Contaminants with Iron and Manganese Oxides
54897-WA	B-391	The Sonophysics and Sonochemistry of Liquid Waste Quantification and Remediation

Oak Ridge Operations Office

Oak Ridge Reservation

OR-43203 - ORNL Bethel Valley Remedial Action

Problem Area:	Remedial Action
Life-Cycle Cost in 2007+:	$484,000,000
DOE Project Manager:	Robert C. Sleeman, 423-576-0715, sleemannnrc@oro.doe.gov
Contractor Manager:	T. W. Morris, 423-241-4921, morristw@ornl.gov
For More Information:	http://www.doe.gov/em52/pbs/or-43203.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Medium **Worker:** Medium **Environment:** High

Technical Approach Provided by Project Manager:

After approval of the ROD for the watershed, individual subprojects will be performed to implement the actions required by the ROD. The subprojects and technical scopes are as follows: 1) Remediation of inactive LLLW tanks; some will be removed and some will be grouted in place; 2) Solid Waste Storage Area 1 Remediation; capping and hydrologic isolation of buried radioactive waste; 3) Bethel Valley Contaminated Soils; remediation of 4 mercury contaminated soil areas by excavation, acid washing to remove mercury, and disposal at the Environmental Management Waste Management Facility (EMWMF), excavation of 3 radioactively contaminated soil areas and grouting in place of 5 radioactively contaminated soil areas; 4) Corehole 8 plume source; stabilize contaminated soil and pump contaminated groundwater from existing wells that intercept plume; chemically stabilize contaminants in the groundwater plume in situ through injection of chemicals into the plume 5) SWSA 3 remediation; grouting of selected buried waste trenches followed by capping and hydrologic isolation of buried radioactive waste; 6) unneeded monitoring wells and piezometers will be plugged and abandoned; and 7) OHF Tank Sludges Removal; liquid and sludge are removed from 5 inactive liguid LLW tanks.

This ROD will also select the D&D alternatives for the D&D buildings and inactive NMFS buildings in Bethel Valley. Implementation of D&D will be covered in PBS OR-43204.

Two major subprojects will have individual RODs. A ROD has been approved for removal of the sludges from 8 of the Gunite tanks. These sludges will be moved to the Melton Valley Storage Tanks (stainless steel, doubly-contained) at ORNL. The interior surfaces of the Gunite tanks will be cleaned to remove contamination that has seeped into the concrete. Remediation of the empty Gunite tank shells and surrounding contaminated soil will be addressed in the Bethel Valley Watershed ROD. A separate ROD was also recently signed for remediation of the four surface impoundments. The remediation scenario selected by the ROD is to remove contaminated sediments from the pond for off-site disposal; however, the remediation scenario in the baseline which supports this PBS describes in situ closure of the ponds. Because there has not been sufficient time between the selection of the remedy and the preparation of the PBSs to change the baseline, this PBS will discuss the baseline scenario. Contaminated sediments will be moved from the upper large pond to the lower large pond. A clay-lined, clay-capped consolidation cell will be constructed in the location of the upper pond, and the sediments will be moved to the consolidation cell. Residual contaminated soils near the surface impoundments will be addressed with the other contaminated soils in Bethel Valley.

S&M prior to remediation is included in this PBS for all remedial action release sites at ORNL, including those in Melton Valley. Long-term S&M is included in this PBS for all facilities and release sites at ORNL after remediation, including those in Melton Valley.

Unless otherwise noted, excavated waste and contaminated media is assumed to be placed in the EMWMF, a CERCLA onsite waste management facility located near the Y-12 plant on the Oak Ridge Reservation. The FS to evaluate the construction of this facility versus off-site disposal has recently been submitted to the regulators for review and comment. Construction and operation of the facility is not included in this PBS. Transportation of the waste to the facility is included in this PBS.

The following technologies including associated cost savings have been incorporated into this project baseline: 1) solid/liquid separation for Gunite and Associated Tanks Treatability Studies 2) reactive barriers 3) waste source grouting; 4) direct ion trap mass spectrometry; 5) performance verification monitoring; and 6) in situ grouting. In addition, other technologies such as waste dislodging and conveyance; in-situ grouting; Houdini (robot); barrier/collector emplacement technology; laser fluorescence imaging; horizontal barriers; fluidless directional drilling; and modified light-duty utility arm will be considered pending funding and technological considerations. Other technologies such as inorganic sorbents for radionuclide separations, magnetic seed filtration, crystalline siliocotitantes; and in-situ sorption of technetium will be considered pending funding and technological considerations.

Post 2006 Project Scope Provided by Project Manager:

Bethel Valley Contaminated Soils: This subproject will be initiated in FY 2006, and will continue through FY 2011. Mercury contaminated soils at four locations and LLLW-contaminated soil at 34 locations, primarily LLLW pipeline leak areas. Mercury-contaminated soil will be excavated, acid-washed, and sent to the EMWMF. Three radiologically contaminated areas will be excavated for disposal, and five grouted in place. Pipelines associated with the LLLW system will be removed and grouted in place. White Oak Creek floodplains soils and sediments in Bethel Valley will be stabilized or removed, as required.

ORNL Long Term S&M: The scope of this task includes any surveillance, monitoring, operations or maintenance required after remediation of release sites and D&D of facilities at ORNL are complete. This task is expected to continue through the end of the FY 2070.

Project End State Provided by Project Manager:

Currently, determination of the end use/end state for the Bethel Valley area of ORNL is still in progress. The Oak Ridge Environmental Management Site Specific Advisory Board is working with the public to develop recommendations to DOE on the end use of the area. A CERCLA RI/FS will be submitted to the regulators evaluating remediation alternatives representing various end uses. The formal determination of the end use will be completed when the CERCLA ROD is signed by DOE, EPA, and the State of Tennessee in FY 2000. The CERCLA ROD will also define the actions required to reach the selected end use. The end use described in this PBS represents an end use that DOE-OR believes will be similar to the alternative proposed for implementation.

The assumed end use for the Bethel Valley area of ORNL is a mixture of open space/recreational, restricted industrial, and controlled access. Buried waste will remain isolated in place with engineered and institutional controls as appropriate to permit these uses. Releases from sources will be controlled so that surface water quality standards are met. Except for the Corehole 8 plume, groundwater will have a "no use" designation and will be monitored. Remediation of groundwater plumes will only occur if surface water is impacted or the groundwater poses on offsite risk. The corehole 8 plume will be remediated as determined by the CERCLA decision documents to be prepared for the plume remediation. At this time, it is assumed that the plume will be chemically treated to precipitate the contamination in situ. Because of the long-lived contamination in the burial grounds and contaminated media groundwater will require monitoring indefinitely. Most of the contaminated media are remediated in situ, but hot spots, including the mercury-contaminated soils, will be excavated. The excavated material that leaves the valley will be transported to the EMWMF, a CERCLA waste management facility near Y-12 on the Oak Ridge Reservation. French drains will be installed at a few locations as part of hydrologic isolation of sources. The collected water will be treated in an existing water treatment plant at ORNL. Bethel Valley will require DOE institutional control for many years into the future.

At the completion of this project and Bethel Valley D&D (PBS (OR-43204), the current Environmental Restoration (ER) scope for the Bethel Valley area will be complete, except for long-term monitoring and operation of treatment systems. Active ORNL operations will continue in the Bethel Valley area during remediation and after remediation activities are complete.

Additional detail is as follows: The mercury contaminated soils will be excavated and treated by acid washing to remove the mercury, followed by transport to the EMWMF. Additional areas of radioactively contaminated soils and inactive contaminated pipelines will either be removed or stabilized in place, depending on final cleanup criteria as determined by the CERCLA ROD. Sludges will be removed from the Gunite tanks, the tank interior walls will be cleaned, and the tanks will be filled with grout. Other inactive LLLW tanks will be removed or stabilized in place by filling with grout. Surface impoundment sediments will be isolated in a consolidation cell constructed at the current location of one of the impoundments. White Oak Creek floodplain soils and sediments will be stabilized in place as necessary to meet water quality standards. The migration of the Corehole 8 contaminated groundwater plume will be retarded. Radioactive waste burial grounds will be hydrologically isolated to control migration of contaminants. The area will require long-term institutional control, operation of treatment systems, and monitoring of residual contamination.

The full list of science research awards that have the potential to address projects such as this one, which deals with Remedial Action problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "Remedial Action".

The following awards were identified through systems engineering to have the potential to address the specific needs of this Project. Those research awards that may have the strongest link to this project are designated by the symbol "§".

Award ID	Page #	Award Title
§ 54834-IN	B-143	An Investigation of Homogeneous and Heterogeneous Sonochemistry for Destruction of Hazardous Waste
§ 60271-NH	B-199	Characterization of a New Family of Metal Transport Proteins
§ 54122-PA	B-281	A Broad Spectrum Catalytic System for Removal of Toxic Organics from Water By Deep Oxidation
§ 60197-TN	B-329	Microsensors for In-situ Chemical, Physical, and Radiological Characterization of Mixed Waste
55318-CA	B-23	Improved Analytical Characterization of Solid Waste-Forms by Fundamental Development of Laser Ablation Technology
60370-CA	B-39	Rational Design of Metal Ion Sequestering Agents
55012-CO	B-89	Extraction and Recovery of Mercury and Lead from Aqueous Waste Streams Using Redox-active Layered Metal Chalcogenides
60141-DC	B-95	Gamma Ray Imaging for Environmental Remediation
55247-IL	B-119	Sensors Using Molecular Recognition in Luminescent, Conductive Polymers
55211-IL	B-141	Cavitational Hydrothermal Oxidation: A New Remediation Process
59977-MD	B-169	Synthesis and Characterization of Templated Ion Exchange Resins for the Selective Complexation of Actinide Ions
54571-MA	B-181	Removal of Heavy Metals and Organic Contaminants from Aqueous Streams by Novel Filtration Methods
55223-MO	B-197	De Novo Design of Ligands for Metal Separation
54724-NM	B-205	Synthesis of New Water-Soluble Metal-Binding Polymers: Combinatorial Chemistry Approach
54751-NM	B-209	High Fluence Neutron Source for Nondestructive Characterization of Nuclear Waste
54770-NM	B-213	New Anion-Exchange Resins for Improved Separations of Nuclear Materials
59967-NM	B-217	Aqueous Electrochemical Mechanisms in Actinide Residue Processing
55387-NM	B-237	Photooxidation of Organic Wastes Using Semiconductor Nanoclusters
54595-NM	B-255	f-Element Ion Chelation in Highly Basic Media
60041-OK	B-275	Removal of Radioactive Cations and Anions from Polluted Water Using Ligand-Modified Colloid-Enhanced Ultrafiltration
54856-PA	B-289	Structural Biology of the Sequestration & Transport of Heavy Metal Toxins: NMR Structure Determination of Proteins Containing the -Cys-X-Y-Cys-metal Binding Motifs
55103-TN	B-311	Utilization of Kinetic Isotope Effects for the Concentration of Tritium
54735-TX	B-343	Development of Inorganic Ion Exchangers for Nuclear Waste Remediation
54679-WA	B-367	Architectural Design Criteria for F-Block Metal Ion Sequestering Agents
54996-WA	B-371	Ionizing Radiation Induced Catalysis on Metal Oxide Particles
54897-WA	B-391	The Sonophysics and Sonochemistry of Liquid Waste Quantification and Remediation
55146-WA	B-393	Adsorption/Membrane Filtration as a Contaminant Concentration and Separation Process for Mixed Wastes and Tank Wastes
60050-WA	B-395	Chemical Speciation of Inorganic Compounds under Hydrothermal Conditions

Oak Ridge Operations Office

Oak Ridge Reservation

OR-43204 - ORNL Bethel Valley Deactivation and Decommissioning

Problem Area:	Decontamination and Decommissioning
Life-Cycle Cost in 2007+:	$112,000,000
DOE Project Manager:	Robert C. Sleeman, 423-576-0715, sleemanrc@oro.doe.gov
Contractor Manager:	T. W. Morris, 423-241-4921, morristw@ornl.gov
For More Information:	http://www.doe.gov/em52/pbs/or-43204.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Low **Worker:** Medium **Environment:** Low

Technical Approach Provided by Project Manager:

Individual subprojects have been identified to implement the D&D actions for this project. The subprojects and technical scopes are as follows: 1) Metal Recovery Facility: decontaminate process cell walls, dismantle building; contaminated debris transported to the Environmental Management Waste Management Facility (EMWMF); and clean debris grouted into below grade areas at the Oak Ridge Research Reactor; 2) Fission Product Development Laboratory: remove equipment and send to the EMWMF; decontaminate cell walls; and dismantle building to grade; 3) Fission Product Pilot Plant: dismantle building and send to the EMWMF; 4) Low Intensity Test Reactor: dismantle building to grade; contaminated equipment and debris transported to the EMWMF; and clean debris grouted into belowgrade areas of the Oak Ridge Research Reactor; 5) Oak Ridge Graphite Reactor: entomb graphite reactor core, maintaining outer shell intact; remove unneeded equipment; and preserve building and appropriate equipment and systems as a Registered National Historic Landmark; 6) High Level Chemical Development Laboratory: dismantle to grade and transport equipment and rubble to the EMWMF; 7) Oak Ridge Research Reactor: remove contaminated equipment and structures and send to the EMWMF; dismantle all aboveground structures and auxiliary facilities; and grout clean debris from other D&D facilities into belowgrade areas, followed by clean debris from D&D of the ORRR; 8) Bulk Shielding Facility: remove contaminated equipment and structures and send to the EMWMF; buildings dismantled to grade; and clean debris grouted into belowgrade areas; 9) High Radiation Level Analytical Laboratory (3019B): remove contaminated equipment and structures and send to the EMWMF; building dismantled to grade; 10) Isotopes Facilities: remove contaminated equipment and structures and send to onsite waste management facility; and buildings dismantled to grade; 11) Tritium Target Preparation Facility (7025): remove contaminated equipment and structures and send to the EMWMF; and building dismantled to grade.

This PBS contains the scope for surveillance and maintenance of all ORNL D&D facilities, including facilities in Melton Valley, until D&D is complete to maintain the inactive facilities in a safe condition and protect ORNL workers and the environment. Scope is included for small projects to reduce S&M costs in D&D buildings by selective removal or deactivation of equipment or materials. Long-term S&M of these facilities after D&D is complete is covered by the Bethel Valley Remedial Action project, PBS OR-43203.

The following technologies including associated cost savings have been incorporated into this baseline: 1) ORNL Facility D&D remote tooling

In addition, other technologies such as laser fluorescence imaging, large scale D&D, metal recycle technology systems, and internal duct characterization system will be considered pending funding and technological considerations.

Post 2006 Project Scope Provided by Project Manager:

Bulk Shielding Reactor: This subproject will be initiated in FY 2006 and will continue through FY 2009. The reactor and auxiliary facilities will be dismantled. Contaminated material will be transported to the EMWMF, and clean debris will be transported to the Y-12 landfill.

Fission Product Development Laboratory: This subproject will be initiated in FY 2006 and will continue through FY 2008. Contaminated piping and equipment will be drained, flushed, removed, and cut-up or dismantled. Concrete walls will be cut-up, removed, and transported to the EMWMF. Clean debris will be grouted into below-grade areas of the lab.

High Level Chemical Development Lab: This project will be initiated in FY 2006 and will continue through FY 2008. The building will be decontaminated as required, equipment removed, and the building demolished. Debris will be transported to the EMWMF.

High Radiation Level Analytical Lab (3019B): This subproject will be initiated in FY 2006 and will continue through FY 2008. The building will be dismantled and sent to the EMWMF.

Isotope Facilities: This subproject will be initiated in FY 2006 and will continue through FY 2010. Contaminated equipment will be removed and the buildings dismantled to grade. Contaminated equipment and debris will be sent to the EMWMF. Clean debris will either be used as fill for below-grade structures or sent to the Y-12 landfill.

Low Intensity Test Reactor: This subproject will be initiated in FY 2006 and will continue through FY2008. Equipment will be removed and transported to the EMWMF, along with other contaminated debris. All clean construction debris will be transported to a local landfill.

Oak Ridge Research Reactor: This subproject will be initiated in FY 2006 and will continue through FY2010. The building will be dismantled to grade and contaminated equipment removed from below-grade areas. Contaminated debris will be sent to the EMWMF, and clean debris will be grouted into subsurface cells.

Project End State Provided by Project Manager:

Currently, determination of the end use/end state for the Bethel Valley area of ORNL is still in progress. The Site Specific Advisory Board is working with the public to develop recommendations to DOE on the end use of the area. A CERCLA Remedial Investigation/Feasibility Study (RI/FS) will be submitted to the regulators evaluating remediation alternatives representing various end uses. D&D buildings in Bethel Valley are included in the CERCLA decision document for Bethel Valley. The formal determination of the end use will be completed when the CERCLA ROD is signed by DOE, EPA, and the State of Tennessee in FY 2000. The CERCLA ROD will also define the actions required to reach the selected end use. The end use described in this PBS represents an end use that DOE-OR believes will be similar to the alternative proposed for implementation.

The assumed end use for the Bethel Valley area of ORNL is a mixture of open space/recreational, restricted industrial, and controlled access. Buried waste will remain isolated in place with engineered and institutional controls as appropriate to permit these uses. Releases from sources will be controlled so that surface water quality standards are met. Because of the long-lived contamination in the burial grounds and contaminated media, groundwater will require monitoring indefinitely. Most of the contaminated media are remediated in situ, but hot spots, including the mercury-contaminated soils, will be excavated and transported to the EMWMF near Y-12 on the Oak Ridge Reservation. D&D buildings will be stripped of contaminated equipment and materials and then dismantled to grade. Clean rubble will be grouted into below grade areas of the facilities. Contaminated rubble and equipment will be transported to the EMWMF. Bethel Valley will require DOE institutional control for many years into the future.

At the completion of this project and Bethel Valley Remedial Action(PBS OR-43203), the current ER scope for the Bethel Valley area will be complete. Active ORNL operations will continue in the Bethel Valley area during remediation and after remediation activities are complete.

Additional information on end state:

The Fission Product Pilot Plant and High Level Chemical Development Laboratory will be dismantled and transported to the EMWMF. The following facilities will be dismantled to grade, with contaminated materials transported to the EMWMF and uncontaminated debris grouted into the below grade areas of the ORRR: Oak Ridge Research Reactor; Low-Intensity Test Reactor, auxiliary buildings associated with the two reactors, and the Metal Recovery Facility. The core of the ORNL Graphite Reactor will be entombed, preserving the outer shell and most of the building and facility as a Registered National Historic Landmark. Equipment in the Fission Product

Development Laboratory will be removed for disposal, the cells decontaminated, and the building will be dismantled to grade. The Bulk Shielding Facility, High Radiation Level Analytical Laboratory, Isotopes Facilities, and the Tritium Target Preparation Facility will have contaminated equipment and structures removed and sent to the EMWMF. The buildings will be dismantled to grade and clean debris grouted into below grade areas or transported to a sanitary landfill. The area will require long-term institutional control because of residual contamination stabilized in place, primarily associated with the remedial action sites.

The full list of science research awards that have the potential to address projects such as this one, which deals with Decontamination and Decommissioning problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "Decontamination and Decommissioning".

The following awards were identified through systems engineering to have the potential to address the specific needs of this Project. Those research awards that may have the strongest link to this project are designated by the symbol "§".

Award ID	Page #	Award Title
§ 54914-CA	B-73	Atmospheric-Pressure Plasma Cleaning of Contaminated Surfaces
§ 55380-IL	B-127	In-Situ Spectro-Electrochemical Studies of Radionuclide Contaminated Surface Films on Metals and the Mechanism of their Formation and Dissolution
§ 60283-IL	B-133	Waste Volume Reduction Using Surface Characterization and Decontamination by Laser Ablation
§ 54724-NM	B-205	Synthesis of New Water-Soluble Metal-Binding Polymers: Combinatorial Chemistry Approach
§ 60363-NM	B-241	Optimization of Thermochemical, Kinetic, and Electrochemical Factors Governing Partitioning of Radionuclides during Melt Decontamination of Radioactively Contaminated Stainless Steel
§ 60041-OK	B-275	Removal of Radioactive Cations and Anions from Polluted Water Using Ligand-Modified Colloid-Enhanced Ultrafiltration
55249-CA	B-47	Experimental Determination of Contaminant Metal Mobility as a Function of Temperature Time and Solution Chemistry
60141-DC	B-95	Gamma Ray Imaging for Environmental Remediation
55247-IL	B-119	Sensors Using Molecular Recognition in Luminescent, Conductive Polymers
60231-MD	B-165	Novel Miniature Spectrometer for Remote Chemical Detection
59981-NM	B-219	Real-Time Broad Spectrum Characterization of Hazardous Waste by Membrane Introduction Mass Spectrometry
55100-NY	B-261	Human Genetic Marker for Resistance to Radiations and Chemicals
60218-TN	B-333	Novel Mass Spectrometry Mutation Screening for Contaminant Impact Analysis
55185-TX	B-349	New Strategies for Designing Inexpensive but Selective Bioadsorbants for Environmental Pollutants: Selection of Specific Ligands & Their Cell Surface Expression
54635-WA	B-361	Molecular-Level Process Governing the Interaction of Contaminants with Iron and Manganese Oxides
54897-WA	B-391	The Sonophysics and Sonochemistry of Liquid Waste Quantification and Remediation

Oak Ridge Operations Office

Oak Ridge Reservation

OR-44301 - East Tennessee Technology Park (ETTP) Remedial Action

Problem Area: Remedial Action
Life-Cycle Cost in 2007+: $413,000,000
DOE Project Manager: Robert C. Sleeman, 423-576-0715, sleemanrc@oro.doe.gov
Contractor Manager: T. W. Morris, 423-241-4921, morristw@ornl.gov
For More Information: http://www.doe.gov/em52/pbs/or-44301.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Medium **Worker:** Medium **Environment:** High

Technical Approach Provided by Project Manager:

The technical approach for the ETTP Remedial Action Project was developed by evaluating all available environmental data that had been collected at ETTP, and by reviewing operational information for all sites and facilities that had a probability of being sources of environmental contamination. This data and information revealed several areas where contamination exists and several areas where it was suspected, but had not yet been confirmed by environmental sampling. The nature and extent of contamination was used to develop subprojects that include the most probable remedial method for all of the currently known contaminant sources and contaminant plumes. The existing ETTP infrastructure, such as the industrial wastewater treatment plant, the Central Neutralization Facility (CNF), was included in the remedial scopes. Many of the sub-projects address groundwater contaminated by volatile organics that will be captured by intercepting french drains before the contaminant plumes reach discharge points, such as creeks or seeps. Capturing the contaminant plumes prevents exposure to the contaminants by humans or animals in the environment. Contaminated groundwater will be piped to the ETTP CNF. Contaminants will be removed from the groundwater at the CNF, which was recently upgraded to treat water contaminated with volatile organics. The requirements of the Clean Water Act will be met by monitoring the CNF discharge in accordance with a National Pollutant Discharge Elimination System permit.

Other projects include excavation of contaminated soils or secondary sources of subsurface contamination. The environmental data used to determine areas of groundwater contamination were also used to determine areas where excavation will be necessary. Also, some additional data may be required to determine the exact limits of the areas that will require excavation. The groundwater data that had been collected throughout the years of environmental investigation were used in conjunction with operational histories of sites and facilities to determine the areas where high levels of soil contamination exist. Excavated soils will be either treated to reduce contaminant levels or stored in facilities licensed for storage of mixed and/or hazardous wastes. Many subprojects include treatment of low levels of soil contamination with vapor extraction systems. Frequently, the unsaturated soil over contaminated groundwater is also contaminated because of the tendency for the dissolved contaminants to evaporate, migrate upward through the overlying soil in gaseous phase, and contaminate the soil. The soil vapor extraction systems are subsurface piping systems in which negative pressures, or vacuums, are induced to extract the contaminant vapors from the areas of contamination. The extracted vapors are usually treated with filters before being discharged to the atmosphere in order to comply with the requirements of the Clean Air Act.

Sequencing of subprojects was based on the risk reduction expected by implementing the most probable remedial method. Information currently available on each site to be addressed by a subproject was compiled along with relevant environmental data collected in the vicinity of the site or facility, and the relative risk posed by the site was determined. A relative score of "high," "medium," or "low" was then assigned to each site or facility using the "Relative Risk Ranking Evaluation for DOE Oak Ridge Operations" model. The same evaluation was applied to the expected end state of the sites and facilities after implementing the most probable remedial method. The risk reduction resulting from the difference in these two evaluations yielded the total risk reduction by implementing the subproject. In general, subprojects that produced the most risk reduction are planned for the near term; those for sites with lesser risks are planned for later in the Accelerated Clean-up Plan. In order to develop costs estimates for the subprojects, specific assumptions pertaining to construction details, such as length and depth of intercepting drains, discharge rates of contaminant plumes, and volumes of soil to be treated or excavated were assumed. Costs for these parameters were applied along with the costs for design, management, waste disposal, and other construction project requirements, such as safety equipment, to determine the costs for each subproject.

The following technologies including associated cost savings have been incorporated into this project baseline: reactive barriers; waste source grouting; direct ion mass trap spectrometry; performance verification monitoring.

In addition, other technologies such as barrier/collector emplacement technology; fluidless directional drilling; and horizontal barriers will be considered pending funding and technological considerations.

Post 2006 Project Scope Provided by Project Manager:

The only scope that is assumed to remain in this project in the year 2006 will be Long-term Surveillance and Maintenance which includes post remedial operation and monitoring of remedial systems, the Scrap Metal sub-project, and the Legacy Container Disposition. The scrap metal sub-project will include bartering nickel ingots for disposition of over 50,000 tons of radioactive scrap metal. Legacy Containers will include proper disposition of containers filled with legacy wastes.

Project End State Provided by Project Manager:

The end state of this project will be a former uranium enrichment facility in which contamination has been remediated and facilities have been decontaminated, decommissioned, and in many cases, demolished. This end state will result from actions that will be taken in accordance with a CERCLA ROD that will be prepared for the ETTP. These actions will result in contaminated media, facility equipment, and construction debris being taken preferentially to the on-site waste management facility. Material that does not require disposal in a waste management facility will be disposed of in place. Areas of land that are uncontaminated will be identified and removed from the provisions of CERCLA. The existing ETTP infrastructure will provide collection of contaminated groundwater, regardless of any changes in the use of the buildings that are required for groundwater collection. Equipment will be removed from buildings for metal recycle or reuse. Process equipment will be decontaminated and recycled. Burial grounds will be hydrologically isolated, excavated, or capped to prevent contaminant release. Contaminated groundwater that poses an unacceptable human health or environmental risk will be intercepted and treated. Uranium deposits that present a criticality risk will be removed from process buildings to allow reuse of buildings and process equipment. The exact requirements for the duration of Long-term S&M are unknown. This end state has not been agreed to with regulators and stakeholders. There is an approximate 25% confidence level in the assumed definition of the end state described herein. In order to accomplish the scope of this project, the following projects will also need to be implemented:

OR38111 - Mixed Low Level Waste Management
OR38112 - Low level Waste Treatment OR38113 - Hazardous Waste Management
OR38110 - Sanitary/ Industrial Waste Management
OR44101 - ETTP Landlord
OR44303 - ETTP D&D
OR44304 - ETTP Facility Safety Upgrades
OR44302 - ETTP Process Equipment D&D
OR49301 - Directed Support
OR44901 - On-site Waste Management Facility
OR28101 - Program Direction

Land -
a) Contaminant Disposition -
Because this PBS includes several different types of activities for different parcels of land, some restricted, and some unrestricted, contamination remaining will be consistent with the expected land use. That is, contamination in some parcels, which are located outside the reindustrialization footprint of the ETTP will be removed or excavated. On the other hand, contamination in parcels that are inside the reindustrialization footprint will be contained or consolidated.

b) Clean-up levels -
Because this PBS includes several different types of activities for different parcels of land, some restricted, and some unrestricted clean-up levels of land parcels will also be consistent with expected use. In areas outside the

reindustrialization footprint, clean-up levels are expected to be dictated by exposure scenarios that are consistent with recreational uses. In areas inside the reindustrialization footprint, clean-up levels are expected to be dictated by exposure scenarios that are consistent with industrial worker exposure scenarios.

c) Remaining Waste Management Facilities -
The waste treatment, storage or disposal facilities that are expected to remain at ETTP after the activities included in this PBS are completed are burial grounds where classified wastes have been disposed of. Other waste treatment facilities may remain if needed by future tenants, but they are not expected to be part of the long-term responsibilities of the federal government.

d) Planned Land Use
The land use planned for the current area occupied by ETTP is expected to be a mixture of unrestricted recreational use and industrial use.

Groundwater - Clean-up levels of groundwater at ETTP will be those consistent with industrial use of groundwater. Target concentrations will be consistent with exposure levels that pose a risk less then 10-6. Restrictions on the use of groundwater will be required for the life of the 2006 plan, because of the long-term requirements of treatment technologies available. The exact requirements for the duration of long term monitoring are unknown, but are expected to be needed until at least the year 2016.

Facilities - The final end state for legacy facilities and closure requirements for storage, treatment, and disposal facilities will be discussed in other PBSs. The exact requirements for the duration of long term monitoring are unknown, but are expected to be needed until at least the year 2016.

The status of waste, nuclear materials, spent fuel, and high level waste is not applicable to this PBS.

The full list of science research awards that have the potential to address projects such as this one, which deals with Remedial Action problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "Remedial Action".

The following awards were identified through systems engineering to have the potential to address the specific needs of this Project. Those research awards that may have the strongest link to this project are designated by the symbol "§".

Award ID	Page #	Award Title
§ 55014-AL	B-1	Kinetics and Mechanisms of Metal Retention/Release in Geochemical Processes in Soil
§ 55164-AL	B-3	Advanced Experimental Analysis of Controls on Microbial Fe(III) Oxide Reduction
§ 54898-AZ	B-5	Molecular Dissection of the Cellular Mechanisms Involved in Nickel Hyperaccumulation in Plants
§ 55097-CA	B-15	Heavy Metal Pumps in Plants
§ 55278-CA	B-17	Molecular Genetics of Metal Detoxification: Prospects for Phytoremediation
§ 54698-CA	B-19	Rapid Mass Spectrometric DNA Diagnostics for Assessing Microbial Community Activity During Bioremediation
§ 55264-CA	B-21	Subsurface High Resolution Definition of Subsurface Heterogeneity for Understanding the Biodynamics of Natural Field Systems: Advancing the Ability for Scaling to Field Conditions
§ 55343-CA	B-25	Enzyme Engineering for Biodegradation of Chlorinated Organic Pollutants
§ 55396-CA	B-33	Sorption of Colloids, Organics, and Metals onto Gas-Water Interfaces: Transport Mechanisms and Potential Remediation Technology
§ 60328-CA	B-37	High Frequency Electromagnetic Impedance Measurements for Characterization, Monitoring and Verification Efforts
§ 55011-CA	B-43	Surface and Borehole Electromagnetic Imaging of Conducting Contaminant Plumes
§ 55249-CA	B-47	Experimental Determination of Contaminant Metal Mobility as a Function of Temperature Time and Solution Chemistry

Awards Related to OR-44301 Continued

Award ID	Page #	Award Title
§ 55284-CA	B-55	Aquifer Transport of Th, U, Ra, and Rn in Solution and on Colloids
§ 54666-CA	B-57	Mechanisms, Chemistry, and Kinectics of Anaerobic Biodegradation of Cis-Dichloroethylene and Vinyl Chloride
§ 54860-CA	B-59	Sorption of Heavy Metals and Radionuclides on Mineral Surfaces in the Presence of Organic Co-Contaminants
§ 54681-CA	B-67	Dynamics of Coupled Contaminant and Microbial Transport in Heterogeneous Porous Media
§ 55118-CA	B-71	Plant Rhizosphere Effects on Metal Mobilization and Transport
§ 55061-CA	B-77	Fundamental Studies of the Removal of Contaminants from Ground and Waste Waters via Reduction by Zero-Valent Metals
§ 55041-CA	B-79	Molecular Characterization of a Novel Heavy Metal Uptake Transporter from Higher Plants & its Potential for Use in Phytoremediation
§ 54661-DE	B-91	Electrochemical Processes for In-Situ Treatment of Contaminated Soils
§ 55218-GA	B-107	Seismic Surface-Wave Tomography of Waste Sites
§ 54837-GA	B-109	Phytoremediation of Ionic and Methyl Mercury Pollution
§ 55416-ID	B-111	Control of Biologically Active Degradation Zones by Vertical Heterogeneity: Applications in Fractured Media
§ 55374-IL	B-125	Use of Sonication for In-Well Softening of Semivolatile Organic Compounds
§ 55388-IL	B-131	Stable Isotopic Investigations of in situ Bioremediation of Chlorinated Organic Solvents
§ 60199-KS	B-159	Seismic-Reflection and Ground Penetrating Radar for Environmental Site Characterization
§ 59786-MD	B-167	Design and Construction of Deinococcus radiodurans for Biodegradation of Organic Toxins at Radioactive DOE Waste Sites
§ 55152-MD	B-171	Molecular Profiling of Microbial Communities from Contaminated Sources: Use of Subtractive Cloning Methods and rDNA Spacer Sequences
§ 54683-MA	B-173	Speciation and Structural Characterization of Plutonium and Actinide-organic Complexes in Surface and Groundwaters
§ 55300-MA	B-179	3-D Spectral IP Imaging: Non-Invasive Characterization of Contaminant Plumes
§ 55105-MI	B-183	Complete Detoxification of Short Chain Chlorinated Aliphatics: Isolation of Halorespiring Organisms and Biochemical Studies of the Dehalogenating Enzyme Systems
§ 54680-MI	B-187	The Migration and Entrapment of DNAPLs in Physically and Chemically Heterogeneous Porous Media
§ 60271-NH	B-199	Characterization of a New Family of Metal Transport Proteins
§ 54741-NM	B-207	Characterization of Contaminant Transport Using Naturally-Occurring U-Series Disequilibria
§ 55395-NM	B-239	Physics of DNAPL Migration and Remediation in the Presence of Heterogeneities
§ 54857-NM	B-245	Surface Nuclear Magnetic Resonance Imaging of Water Content Distribution in the Subsurface
§ 54639-NM	B-251	Development of an In-Situ Microsensor for the Measurements of Chromium and Uranium in Groundwater at DOE Sites
§ 54585-OH	B-269	Permanganate Treatment of DNAPLs in Reactive Barriers and Source Zone Flooding Schemes
§ 55196-OR	B-277	In Situ, Field Scale Evaluation of Surfactant Enhanced DNAPL Recovery Using a Single-Well, Push-Pull Test
§ 54122-PA	B-281	A Broad Spectrum Catalytic System for Removal of Toxic Organics from Water By Deep Oxidation
§ 55205-SC	B-299	A Fundamental Study of Laser-Induced Breakdown Spectroscopy Using Fiber Optics for Remote Measurements of Trace Metals
§ 55013-TN	B-303	Biofiltration of Volatile Pollutants: Engineering Mechanisms for Improved Design, Long-term Operation, Prediction and Implementation

Awards Related to OR-44301 Continued

Award ID	Page #	Award Title
§ 55033-TN	B-305	Characterization of Chemically Modified Hyperthermophilic Enzymes for Chemical Syntheses and Bioremediation Reactions
§ 55036-TN	B-307	Colloid Transport and Retention in Fractured Deposits
§ 55108-TN	B-313	Monitoring Genetic & Metabolic Potential for In Situ Bioremediation: Mass Spectrometry
§ 55267-TN	B-317	Containment of Toxic Metals and Radionuclides in Porous and Fractured Media: Optimizing Biogeochemical Reduction versus Geochemical Oxidation
§ 60197-TN	B-329	Microsensors for In-situ Chemical, Physical, and Radiological Characterization of Mixed Waste
§ 55185-TX	B-349	New Strategies for Designing Inexpensive but Selective Bioadsorbants for Environmental Pollutants: Selection of Specific Ligands & Their Cell Surface Expression
§ 60069-VT	B-355	Least-Cost Groundwater Remediation Design Using Uncertain Hydrogeological Information
§ 54635-WA	B-361	Molecular-Level Process Governing the Interaction of Contaminants with Iron and Manganese Oxides
§ 55031-WA	B-373	Genetic Analysis of Stress Responses in Soil Bacteria for Enhanced Bioremediation of Mixed Contaminants
§ 60355-WA	B-377	Mineral Surface Processes Responsible for the Decreased Retardation (or Enhanced Mobilization) of 137Cs from HLW Tank Discharges
§ 54889-WA	B-389	Using Trees to Remediate Groundwaters Contaminated with Chlorinated Hydrocarbons
§ 54790-CAN-ON	B-407	Microbial Mineral Transformations at the Fe(II)/Fe(III) Redox Boundary for Solid Phase Capture of Strontium and Other Metal/Radionuclide Contaminants
54546-CA	B-61	Engineered Antibodies for Monitoring of Polynuclear Aromatic Hydrocarbons
54847-CO	B-87	Photocatalytic and Chemical Oxidation of Organic Compounds in Supercritical Carbon Dioxide
55012-CO	B-89	Extraction and Recovery of Mercury and Lead from Aqueous Waste Streams Using Redox-active Layered Metal Chalcogenides
60141-DC	B-95	Gamma Ray Imaging for Environmental Remediation
55042-GA	B-105	Quantifying Silica Reactivity in Subsurface Environments: Controls of Reaction Affinity and Solute Matrix on Quartz and SiO2 Glass Dissolution Kinetics
55247-IL	B-119	Sensors Using Molecular Recognition in Luminescent, Conductive Polymers
60231-MD	B-165	Novel Miniature Spectrometer for Remote Chemical Detection
54571-MA	B-181	Removal of Heavy Metals and Organic Contaminants from Aqueous Streams by Novel Filtration Methods
54584-NJ	B-201	Comparison of the Bioavailability of Elemental Waste Laden Soils Using in vivo and in vitro Analytical Methodology, and Refinement of Exposure/Dose Models
54751-NM	B-209	High Fluence Neutron Source for Nondestructive Characterization of Nuclear Waste
60474-OH	B-273	Develop and Demonstrate Novel Ultrahigh Sensitivity Heavy Noble Gas Detectors for Long-Term Monitoring of Spent Fuel and TRU Waste
60041-OK	B-275	Removal of Radioactive Cations and Anions from Polluted Water Using Ligand-Modified Colloid-Enhanced Ultrafiltration
55103-TN	B-311	Utilization of Kinetic Isotope Effects for the Concentration of Tritium
55115-TX	B-345	The Adsorption and Reaction of Halogenated Volatile Organic Compounds (VOC's) on Metal Oxides
54897-WA	B-391	The Sonophysics and Sonochemistry of Liquid Waste Quantification and Remediation

Oak Ridge Operations Office

Oak Ridge Reservation

OR-44302 - East Tennessee Technology Park (ETTP) Process Equipment D&D

Problem Area:	Decontamination and Decommissioning
Life-Cycle Cost in 2007+:	$67,000,000
DOE Project Manager:	Vince Adams, 423-576-1803, vin@ornl.gov
Contractor Manager:	N/A
For More Information:	http://www.doe.gov/em52/pbs/or-44302.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Low **Worker:** N/A **Environment:** Low

Technical Approach Provided by Project Manager:

The technical approach of the ETTP Process Equipment D&D Project is based on accomplishment of the stated scope using two distinct fixed-price prime contracts. Under the contracted effort the detailed approach is summarized as follows:
1. Regulatory Authority - The work will be conducted as CERCLA Non-Time-Critical Removal Action(s).
2. Permits - The contractor(s) will obtain all applicable permits and licenses before beginning of field work.
3. Equipment Removal - The contractor(s) will remove all process equipment and related materials from the interior of the five buildings. These activities include decoupling, disassembly, size reduction, packaging and shipping to either an off site, commercial decontamination facility, or removal from ETTP and release to scrap sales. Platforms, cell housing, and equipment pedestals will be removed flush with concrete floors. Equipment and materials that cannot be decontaminated to release standards/criteria will be disposed of as DOE waste by the contractor.
4. Removal of Uranium Deposits - Detection and removal of all uranium deposits from within the piping, valves, converters, and compressors will be performed by the contractor(s). The contractor(s) will take temporary possession until transfer of ownership to an NRC Class-I nuclear material licensee. The contractor(s) will ensure that all material transfers meet criteria of the Atomic Energy Act and associated regulations. DOE will be responsible for removal of large uranium deposits known to exist in K-29, K-27, and K-25 prior to turn over of buildings to the contractor(s).
5. Project End Point Criteria - End Point Criteria have been established for Phase I that address: (1) services that are to remain in place; (2) contamination release levels for RAD, asbestos, PCBs, HAZ Waste, and Mixed Waste, and (3) post-decontamination repairs. The contamination release levels are provided in the "Engineering Evaluation/Cost Analysis for Equipment Removal and Building Decontamination for the K-29, K-31, and K-33 Buildings, K-25 Site, Oak Ridge, Tennessee, DOE/OR/02-1579" (EE/CA).
6. Surveillance and Maintenance Services - The contractor(s) will assume financial and operational responsibility for Surveillance & Maintenance (S&M) of the physical plants of the buildings involved in D&D.
7. Recycling Activities - The contractor(s) will be responsible for all project material recycle activities to the most economical means of dispositioning. DOE Order 5400.5 supplemented by NRC Regulatory Guide 1.86 will be employed for determination of recycle release. The overall D&D project costs to DOE are estimated to be reduced nearly 20% due to the recapture of equipment and metal value through recycle revenues collected by the contractor(s).
8. Project Wastes - The contractor(s) will deal with DOE wastes (primary wastes) and non-DOE wastes (secondary wastes). The contractor(s) will segregate such wastes and separately manifest these wastes for disposal. The contractor(s) will be responsible for disposal of all project wastes.
9. Building Decontamination - After equipment removal, the contractor(s) will decontaminate building interior surfaces of RAD and chemical contamination to release criteria established in the Project End Point Criteria.
10. Plans/Reports - The contractor(s) will prepare all project specific plans for approval by DOE. Included in the list are: (a) Security Plan, (b) Quality Assurance Plan, © Safety Management System, (d) Radiation Protection Plan, (e) Waste Management Plan, (f) Emergency Preparedness Plan, (g) Material Control and Accountability Plan, and (h) Removal Action Work Plan. Approval of plans will precede turn over of buildings to the contractor(s). Scheduled reporting includes labor, cost, milestones, building D&D certification, and TSCA/LLW/MW projection reports.

The intent of this project is to find the best economical match between the government's desire to have the buildings cleaned up and available for alternative use, and to minimize the overall cost of accomplishing the task. BNFL, contractor for Phase I, brings their expertise in cleaning up similar diffusion facilities in Great Britain and industrial contacts, to take over the surveillance and maintenance of the buildings, execute cleanup, and tailor the entire process to minimize the quantity of material shipped for disposal. The decontamination and recycle enterprises will be negotiated and established by BNFL. Recyclable materials will be recovered and delivered to these enterprises in forms that meet the acceptance, and fulfill the specialized and focused needs of BNFL's business associates.

In this approach, savings occur due to a combination of effects including (1) reduced engineering and management overhead and fees, (2) reduced surveillance and maintenance cost, (3) efficiencies in the approach to recycle and building decontamination based on BNFL's successful experiences at Capenhurst, (4) reduced contingency due also to BNFL's experience and confidence based on Capenhurst D&D, and (5) DOE's assignment of all materials in the three buildings to BNFL. In return for these benefits, BNFL takes responsibility for recycle/salvage activities through whatever means BNFL selects, including waste containers fabricated from recycled metal. BNFL is following an approach that disposes of more low-valued metal than in previous estimates ("Gaseous Diffusion Decontamination & Decommissioning Estimate Report", Lockheed Martin Energy Systems, December, 1995, ES/ER/TM-171, Rev. 2); and BNFL is using the least-net-cost method for decontamination and recycle of other assets.

Additional benefits to the Department from ETTP Process Equipment D&D Project include:
- Risk to the public, workers, and the environment will be reduced by accomplishing D&D of the buildings sooner than planned. Risk is related to the deposited uranium products left in the GDP systems at shutdown coupled with the fact that neither the systems nor buildings are designed for long term storage of nuclear materials.
- Risk is assumed by the contractor during cleanup, including risks of waste handling and disposal.
- Removal of process systems eliminates fissile material holdup, as well as risk of potential criticality accidents. This is consistent with requirements within the DNFSB 94-1 Implementation Plan.
- The approach leaves buildings standing that will be used by DOE and CROET in efforts to reindustrialize ETTP.
- The approach results in the further establishment and verification of efficient D&D methods that will be made available to DOE for D&D of other facilities.
- Incidental benefits include the establishment of equipment/metal decontamination and recycle capabilities in Oak Ridge which will maintain jobs in the region. BNFL's approach for Phase I allows for M&O worker transition to the private sector and will create some 400 replacement jobs.

Post 2006 Project Scope Provided by Project Manager:

The remaining 25% of the Phase II cleanup (for Building K-25) will be completed in the last year of the PBS, FY2007.

Project End State Provided by Project Manager:

The end state for the ETTP Process Equipment D&D Project is:
- By 2003 the three LEU buildings of the GDP cascade (K-29, K-31, and K-33) will be decontaminated for reuse in a brownfield industrial state/standard. DOE-ORO will conduct independent evaluation/oversight of the prime contractor(s) survey and certification operations to assure reuse may occur without radiological concerns.
- By 2008 the two HEU buildings of the GDP cascade (K-25 and K-27) will be decontaminated to levels allowing the buildings to be rubbleized in place as the method of demolition.

Project End Point Criteria have been established for Phase I that address: (1) services that are to remain in place in the LEU buildings; (2) contamination release levels for RAD, asbestos, PCBs, HAZ Waste, and Mixed Waste, and (3) post-decontamination repairs of the LEU buildings. The contamination release levels are provided in the "Engineering Evaluation/Cost Analysis for Equipment Removal and Building Decontamination for the K-29, K-31, and K-33 Buildings, K-25 Site, Oak Ridge, Tennessee, DOE/OR/02-1579" (EE/CA).

The full list of science research awards that have the potential to address projects such as this one, which deals with Decontamination and Decommissioning problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "Decontamination and Decommissioning".

The following awards were identified through systems engineering to have the potential to address the specific needs of this Project. Those research awards that may have the strongest link to this project are designated by the symbol "§".

Award ID	Page #	Award Title
§ 54914-CA	B-73	Atmospheric-Pressure Plasma Cleaning of Contaminated Surfaces
§ 55380-IL	B-127	In-Situ Spectro-Electrochemical Studies of Radionuclide Contaminated Surface Films on Metals and the Mechanism of their Formation and Dissolution
§ 60283-IL	B-133	Waste Volume Reduction Using Surface Characterization and Decontamination by Laser Ablation
§ 54724-NM	B-205	Synthesis of New Water-Soluble Metal-Binding Polymers: Combinatorial Chemistry Approach
§ 60363-NM	B-241	Optimization of Thermochemical, Kinetic, and Electrochemical Factors Governing Partitioning of Radionuclides during Melt Decontamination of Radioactively Contaminated Stainless Steel
§ 60040-NY	B-257	Development of Monitoring and Diagnostic Methods for Robots Used in Remediation of Waste Sites
§ 60041-OK	B-275	Removal of Radioactive Cations and Anions from Polluted Water Using Ligand-Modified Colloid-Enhanced Ultrafiltration
§ 55052-SC	B-295	Advanced Sensing and Control Techniques to Facilitate Semi-Autonomous Decommissioning
55318-CA	B-23	Improved Analytical Characterization of Solid Waste-Forms by Fundamental Development of Laser Ablation Technology
60328-CA	B-37	High Frequency Electromagnetic Impedance Measurements for Characterization, Monitoring and Verification Efforts
60370-CA	B-39	Rational Design of Metal Ion Sequestering Agents
60319-CA	B-51	Thermodynamics of the Volatilization of Actinide Metals in the High-Temperature Treatment of Radioactive Wastes
55137-CA	B-53	Investigation of Novel Electrode Materials for Electrochemically-Based Remediation of High- and Low-Level Mixed Wastes in the DOE Complex
54546-CA	B-61	Engineered Antibodies for Monitoring of Polynuclear Aromatic Hydrocarbons
54890-CA	B-69	On-Line Slurry Viscosity and Concentration Measurement as a Real-Time Waste Stream Characterization Tool
54926-CA	B-75	Novel Ceramic-Polymer Composite Membranes for the Separation of Hazardous Liquid Waste
60162-CO	B-85	Enhancements to and Characterization of the Very Early Time Electromagnetic (VETEM) Prototype Instrument and Applications to Shallow Subsurface Imaging at Sites in the DOE Complex
54847-CO	B-87	Photocatalytic and Chemical Oxidation of Organic Compounds in Supercritical Carbon Dioxide
55012-CO	B-89	Extraction and Recovery of Mercury and Lead from Aqueous Waste Streams Using Redox-active Layered Metal Chalcogenides
60141-DC	B-95	Gamma Ray Imaging for Environmental Remediation
54893-FL	B-99	Research Program to Determine Redox Properties and Their Effects on Speciation and Mobility of Pu in DOE Wastes
55218-GA	B-107	Seismic Surface-Wave Tomography of Waste Sites
60424-ID	B-113	High Temperature Condensed Phase Mass Spectrometric Analysis
55247-IL	B-119	Sensors Using Molecular Recognition in Luminescent, Conductive Polymers
60247-IL	B-139	Miniature Nuclear Magnetic Resonance Spectrometer for In-Situ and In-Process Analysis and Monitoring

Awards Related to OR-44302 Continued

Award ID	Page #	Award Title
55211-IL	B-141	Cavitational Hydrothermal Oxidation: A New Remediation Process
54834-IN	B-143	An Investigation of Homogeneous and Heterogeneous Sonochemistry for Destruction of Hazardous Waste
54942-IN	B-147	Spectroscopy, Modeling and Computation of Metal Chelate Solubility in Supercritical CO_2
54791-KS	B-153	Managing Tight-binding Receptors for New Separations Technologies
54864-KS	B-157	Supramolecular Chemistry of Selective Anion Recognition for Anions of Environmental Relevance
60199-KS	B-159	Seismic-Reflection and Ground Penetrating Radar for Environmental Site Characterization
60231-MD	B-165	Novel Miniature Spectrometer for Remote Chemical Detection
59977-MD	B-169	Synthesis and Characterization of Templated Ion Exchange Resins for the Selective Complexation of Actinide Ions
55300-MA	B-179	3-D Spectral IP Imaging: Non-Invasive Characterization of Contaminant Plumes
54571-MA	B-181	Removal of Heavy Metals and Organic Contaminants from Aqueous Streams by Novel Filtration Methods
60070-MS	B-193	The Development of Cavity Ringdown Spectroscopy as a Sensitive Continuous Emission Monitor for Metals
55223-MO	B-197	De Novo Design of Ligands for Metal Separation
60271-NH	B-199	Characterization of a New Family of Metal Transport Proteins
54770-NM	B-213	New Anion-Exchange Resins for Improved Separations of Nuclear Materials
59981-NM	B-219	Real-Time Broad Spectrum Characterization of Hazardous Waste by Membrane Introduction Mass Spectrometry
55387-NM	B-237	Photooxidation of Organic Wastes Using Semiconductor Nanoclusters
60403-NM	B-243	Phase Chemistry of Tank Sludge Residual Components
60163-NM	B-249	Investigation of Techniques to Improve Continuous Air Monitors Under Conditions of High Dust Loading in Environmental Setting
54639-NM	B-251	Development of an In-Situ Microsensor for the Measurements of Chromium and Uranium in Groundwater at DOE Sites
54595-NM	B-255	f-Element Ion Chelation in Highly Basic Media
55100-NY	B-261	Human Genetic Marker for Resistance to Radiations and Chemicals
55179-NY	B-267	Acoustic Probe for Solid-Gas-Liquid Suspensions
54674-OH	B-271	Design and Development of a New Hybrid Spectroelectrochemical Sensor
54122-PA	B-281	A Broad Spectrum Catalytic System for Removal of Toxic Organics from Water By Deep Oxidation
55171-PA	B-283	Development of Advanced In-Situ Techniques for Chemistry Monitoring and Corrosion Mitigation in SCWO Environments
54856-PA	B-289	Structural Biology of the Sequestration & Transport of Heavy Metal Toxins: NMR Structure Determination of Proteins Containing the -Cys-X-Y-Cys-metal Binding Motifs
55205-SC	B-299	A Fundamental Study of Laser-Induced Breakdown Spectroscopy Using Fiber Optics for Remote Measurements of Trace Metals
54973-TN	B-301	A Novel Energy-Efficient Plasma Chemical Process for the Destruction of Volatile Toxic Compounds
55033-TN	B-305	Characterization of Chemically Modified Hyperthermophilic Enzymes for Chemical Syntheses and Bioremediation Reactions
55087-TN	B-309	Design and Synthesis of the Next Generation of Crown Ethers for Waste Separations: An Inter-Laboratory Comprehensive Proposal
55103-TN	B-311	Utilization of Kinetic Isotope Effects for the Concentration of Tritium
55276-TN	B-319	Fundamental Chemistry and Thermodynamics of Hydrothermal Oxidation Processes
60197-TN	B-329	Microsensors for In-situ Chemical, Physical, and Radiological Characterization of Mixed Waste

Awards Related to OR-44302 Continued

Award ID	Page #	Award Title
60096-TN	B-339	Rational Synthesis of Imprinted Organofunctional Sol-Gel Materials for Toxic Metal Separation
54735-TX	B-343	Development of Inorganic Ion Exchangers for Nuclear Waste Remediation
55185-TX	B-349	New Strategies for Designing Inexpensive but Selective Bioadsorbants for Environmental Pollutants: Selection of Specific Ligands & Their Cell Surface Expression
54679-WA	B-367	Architectural Design Criteria for F-Block Metal Ion Sequestering Agents
54996-WA	B-371	Ionizing Radiation Induced Catalysis on Metal Oxide Particles
54897-WA	B-391	The Sonophysics and Sonochemistry of Liquid Waste Quantification and Remediation
55146-WA	B-393	Adsorption/Membrane Filtration as a Contaminant Concentration and Separation Process for Mixed Wastes and Tank Wastes
60050-WA	B-395	Chemical Speciation of Inorganic Compounds under Hydrothermal Conditions
60150-WA	B-399	Genetic Engineering of a Radiation-Resistant Bacterium for Biodegradation of Mixed Wastes

Oak Ridge Operations Office

Oak Ridge Reservation

OR-44303 - East Tennessee Technology Park (ETTP) D&D

Problem Area: Decontamination and Decommissioning
Life-Cycle Cost in 2007+: $70,000,000
DOE Project Manager: Robert C. Sleeman, 423-576-0715, sleemanrc@oro.doe.gov
Contractor Manager: T. W. Morris, 423-241-4921, morristw@ornl.gov
For More Information: http://www.doe.gov/em52/pbs/or-44303.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Medium **Worker:** High **Environment:** Low

Technical Approach Provided by Project Manager:

The technical approach for the ETTP D&D Project was developed by evaluating all information about inactive facilities at the ETTP site. This evaluation resulted in grouping the inactive facilities so that similar facilities will be addressed together in a subproject. The subprojects include the most probable remedial method, either decontamination only, or decontamination and demolition, for all of the currently known inactive facilities. Environmental regulators have tentatively agreed to assumptions about waste disposal resulting from the demolition projects; most will be stored at the EMWMF, the scope of which is included in separate PBSs OR-44901 and OR-48101. The existing ETTP infrastructure, such as the industrial waste water treatment plant, the Central Neutralization Facility (CNF), was included in the subproject scopes. Several individual subprojects were developed which are expected to become incentivized tasks that will be tracked according to the scope, schedule and budget for that task. Also, some additional data may be required to determine the exact disposition of waste streams generated as part of decontamination or demolition.

Sequencing of subprojects was based on the risk reduction expected by implementing the most probable remedial method. Information currently available on each facility to be addressed was compiled along with relevant environmental and safety and health data and the relative risk posed by the facility was determined. A relative score of "high," "medium," or "low" was then assigned to each facility using the "Relative Risk Ranking Evaluation for DOE Oak Ridge Operations" model. The same evaluation was applied to the expected end state of the sites and facilities after implementing the most probable remedial method. The risk reduction resulting from the difference in these two evaluations yielded the total risk reduction by implementing the subproject. In general, subprojects that produced the most risk reduction are planned for the near term; those with lesser risk reduction are planned for later in the Draft 2006 Plan. In order to develop costs estimates for the subprojects planned for the future, specific assumptions were made such as those pertaining to construction details, square footage of floor space, extent of contamination, and type of construction materials. Costs for these parameters were applied along with the costs for design, management, waste disposal, and other construction project requirements, such as safety equipment, to determine the costs for each subproject.

Technologies such as large-scale metal recycle system, associated particle imaging, internal duct characterization system, small pipe characterization system, ROSIE, mobile automation characterization system, crane systems, control systems, and electrokinetic decontamination of concrete will be considered pending funding and technological considerations.

Post 2006 Project Scope Provided by Project Manager:

The scope remaining after the year 2006 will be decontamination of centrifuge facilities, demolition of gaseous diffusion process facilities, and demolition of some of the auxiliary process facilities. Funds for long-term surveillance and maintenance of areas where facilities were demolished is included in another PBS, ETTP RA, OR-44301.

Project End State Provided by Project Manager:

The end state of this project will be a former uranium enrichment facility in which contamination has been remediated and facilities have been decontaminated, decommissioned, and in many cases, demolished. This end state will result from actions that will be taken in accordance with a CERCLA ROD that will be prepared for the ETTP. These actions will result in contaminated media, facility equipment, and construction debris being taken preferentially to the on-site waste management facility. Material that does not require disposal in a waste management facility will be disposed of in place. Areas of land that are uncontaminated will be identified and removed from the provisions of CERCLA. The existing ETTP infrastructure will provide collection of contaminated groundwater, regardless of any changes in the use of the buildings that are required for groundwater collection. Equipment will be removed from buildings for metal recycle or reuse. Process equipment will be decontaminated and recycled. Burial grounds will be hydrologically isolated, excavated, or capped to prevent contaminant release. Contaminated groundwater that poses an unacceptable human health or environmental risk will be intercepted and treated. Uranium deposits that present a criticality risk will be removed from process buildings to allow reuse of buildings and process equipment. The exact requirements for the duration of Long-term S&M are unknown. This end state has not been agreed to with regulators and stakeholders. There is an approximate 25% confidence level in the assumed definition of the end state described herein. In order to accomplish the scope of ETTP D&D, the following projects will also need to be implemented:

OR38111 - Mixed Low Level Waste Management
OR38112 - Low level Waste Treatment
OR38113 - Hazardous Waste Management
OR38110 - Sanitary/ Industrial Waste Management
OR44101 - ETTP Landlord
OR44301 - ETTP Remedial Action
OR44304 - ETTP Facility Safety Upgrades
OR44302 - ETTP Process Equipment D&D
OR49301 - Directed Support
OR44901 - On-site Waste Management Facility
OR28101 - Program Direction

Land -
a) Contaminant Disposition -
Because this PBS includes several different types of activities for different parcels of land, some restricted, and some unrestricted, contamination remaining will be consistent with the expected land use. That is, contamination in some parcels, which are located outside the reindustrialization footprint of the ETTP, will be removed or excavated. On the other hand, contamination in parcels that are inside the reindustrialization footprint will be contained or consolidated.

b) Clean-up levels -
Because this PBS includes several different types of activities for different parcels of land, some restricted and some unrestricted, clean-up levels of land parcels will also be consistent with expected use. In areas outside the reindustrialization footprint, clean-up levels are expected to be dictated by exposure scenarios that are consistent with recreational uses. In areas inside the reindustrialization footprint, clean-up levels are expected to be dictated by exposure scenarios that are consistent with industrial worker exposure scenarios.

c) Remaining Waste Management Facilities -
The waste treatment, storage or disposal facilities that are expected to remain at ETTP after the activities included in this PBS are completed are burial grounds where classified waste and demolition debris has been disposed of. Other waste treatment facilities may remain if needed by future tenants, but they are not expected to be part of the long-term responsibilities of the federal government.

d) Planned Land Use
The land use planned for the current area occupied by ETTP is expected to be a mixture of unrestricted recreational use and industrial use.

Groundwater - Clean-up levels of groundwater at ETTP will be those consistent with industrial use of groundwater. Target concentrations will be consistent with exposure levels that pose a risk less then 10-6. Restrictions on the use of groundwater will be required for the life of the 2006 plan, because of the long-term requirements of treatment technologies available. The requirements for the duration of long term monitoring are unknown, but are expected to be needed until at least the year 2016.

Facilities - The final end state for legacy facilities that are not leased as part of the reindustrialization effort are expected to be demolished. The closure requirements for storage, treatment, and disposal facilities will be discussed in other PBSs. Long-term monitoring and surveillance and maintenance requirements are assumed to be required at least until the year 2016.

The status of waste, nuclear materials, spent fuel, and high level waste is not applicable to this PBS.

The full list of science research awards that have the potential to address projects such as this one, which deals with Decontamination and Decommissioning problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "Decontamination and Decommissioning".

The following awards were identified through systems engineering to have the potential to address the specific needs of this Project. Those research awards that may have the strongest link to this project are designated by the symbol "§".

Award ID	Page #	Award Title
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§ 55380-IL	B-127	In-Situ Spectro-Electrochemical Studies of Radionuclide Contaminated Surface Films on Metals and the Mechanism of their Formation and Dissolution
§ 60283-IL	B-133	Waste Volume Reduction Using Surface Characterization and Decontamination by Laser Ablation
§ 54724-NM	B-205	Synthesis of New Water-Soluble Metal-Binding Polymers: Combinatorial Chemistry Approach
§ 60363-NM	B-241	Optimization of Thermochemical, Kinetic, and Electrochemical Factors Governing Partitioning of Radionuclides during Melt Decontamination of Radioactively Contaminated Stainless Steel
§ 60040-NY	B-257	Development of Monitoring and Diagnostic Methods for Robots Used in Remediation of Waste Sites
§ 60041-OK	B-275	Removal of Radioactive Cations and Anions from Polluted Water Using Ligand-Modified Colloid-Enhanced Ultrafiltration
§ 55052-SC	B-295	Advanced Sensing and Control Techniques to Facilitate Semi-Autonomous Decommissioning
55318-CA	B-23	Improved Analytical Characterization of Solid Waste-Forms by Fundamental Development of Laser Ablation Technology
60328-CA	B-37	High Frequency Electromagnetic Impedance Measurements for Characterization, Monitoring and Verification Efforts
60370-CA	B-39	Rational Design of Metal Ion Sequestering Agents
60319-CA	B-51	Thermodynamics of the Volatilization of Actinide Metals in the High-Temperature Treatment of Radioactive Wastes
55137-CA	B-53	Investigation of Novel Electrode Materials for Electrochemically-Based Remediation of High- and Low-Level Mixed Wastes in the DOE Complex
54546-CA	B-61	Engineered Antibodies for Monitoring of Polynuclear Aromatic Hydrocarbons
54890-CA	B-69	On-Line Slurry Viscosity and Concentration Measurement as a Real-Time Waste Stream Characterization Tool
54926-CA	B-75	Novel Ceramic-Polymer Composite Membranes for the Separation of Hazardous Liquid Waste
60162-CO	B-85	Enhancements to and Characterization of the Very Early Time Electromagnetic (VETEM) Prototype Instrument and Applications to Shallow Subsurface Imaging at Sites in the DOE Complex
54847-CO	B-87	Photocatalytic and Chemical Oxidation of Organic Compounds in Supercritical Carbon Dioxide

Awards Related to OR-44303 Continued

Award ID	Page #	Award Title
55012-CO	B-89	Extraction and Recovery of Mercury and Lead from Aqueous Waste Streams Using Redox-active Layered Metal Chalcogenides
60141-DC	B-95	Gamma Ray Imaging for Environmental Remediation
54893-FL	B-99	Research Program to Determine Redox Properties and Their Effects on Speciation and Mobility of Pu in DOE Wastes
55218-GA	B-107	Seismic Surface-Wave Tomography of Waste Sites
60424-ID	B-113	High Temperature Condensed Phase Mass Spectrometric Analysis
55247-IL	B-119	Sensors Using Molecular Recognition in Luminescent, Conductive Polymers
60247-IL	B-139	Miniature Nuclear Magnetic Resonance Spectrometer for In-Situ and In-Process Analysis and Monitoring
55211-IL	B-141	Cavitational Hydrothermal Oxidation: A New Remediation Process
54834-IN	B-143	An Investigation of Homogeneous and Heterogeneous Sonochemistry for Destruction of Hazardous Waste
54942-IN	B-147	Spectroscopy, Modeling and Computation of Metal Chelate Solubility in Supercritical CO_2
54791-KS	B-153	Managing Tight-binding Receptors for New Separations Technologies
54864-KS	B-157	Supramolecular Chemistry of Selective Anion Recognition for Anions of Environmental Relevance
60199-KS	B-159	Seismic-Reflection and Ground Penetrating Radar for Environmental Site Characterization
60231-MD	B-165	Novel Miniature Spectrometer for Remote Chemical Detection
59977-MD	B-169	Synthesis and Characterization of Templated Ion Exchange Resins for the Selective Complexation of Actinide Ions
55300-MA	B-179	3-D Spectral IP Imaging: Non-Invasive Characterization of Contaminant Plumes
54571-MA	B-181	Removal of Heavy Metals and Organic Contaminants from Aqueous Streams by Novel Filtration Methods
60070-MS	B-193	The Development of Cavity Ringdown Spectroscopy as a Sensitive Continuous Emission Monitor for Metals
55223-MO	B-197	De Novo Design of Ligands for Metal Separation
60271-NH	B-199	Characterization of a New Family of Metal Transport Proteins
54770-NM	B-213	New Anion-Exchange Resins for Improved Separations of Nuclear Materials
59981-NM	B-219	Real-Time Broad Spectrum Characterization of Hazardous Waste by Membrane Introduction Mass Spectrometry
55387-NM	B-237	Photooxidation of Organic Wastes Using Semiconductor Nanoclusters
60403-NM	B-243	Phase Chemistry of Tank Sludge Residual Components
60163-NM	B-249	Investigation of Techniques to Improve Continuous Air Monitors Under Conditions of High Dust Loading in Environmental Setting
54639-NM	B-251	Development of an In-Situ Microsensor for the Measurements of Chromium and Uranium in Groundwater at DOE Sites
54595-NM	B-255	f-Element Ion Chelation in Highly Basic Media
55179-NY	B-267	Acoustic Probe for Solid-Gas-Liquid Suspensions
54674-OH	B-271	Design and Development of a New Hybrid Spectroelectrochemical Sensor
60474-OH	B-273	Develop and Demonstrate Novel Ultrahigh Sensitivity Heavy Noble Gas Detectors for Long-Term Monitoring of Spent Fuel and TRU Waste
54122-PA	B-281	A Broad Spectrum Catalytic System for Removal of Toxic Organics from Water By Deep Oxidation
55171-PA	B-283	Development of Advanced In-Situ Techniques for Chemistry Monitoring and Corrosion Mitigation in SCWO Environments
54856-PA	B-289	Structural Biology of the Sequestration & Transport of Heavy Metal Toxins: NMR Structure Determination of Proteins Containing the -Cys-X-Y-Cys-metal Binding Motifs

Awards Related to OR-44303 Continued

Award ID	Page #	Award Title
55205-SC	B-299	A Fundamental Study of Laser-Induced Breakdown Spectroscopy Using Fiber Optics for Remote Measurements of Trace Metals
54973-TN	B-301	A Novel Energy-Efficient Plasma Chemical Process for the Destruction of Volatile Toxic Compounds
55033-TN	B-305	Characterization of Chemically Modified Hyperthermophilic Enzymes for Chemical Syntheses and Bioremediation Reactions
55087-TN	B-309	Design and Synthesis of the Next Generation of Crown Ethers for Waste Separations: An Inter-Laboratory Comprehensive Proposal
55103-TN	B-311	Utilization of Kinetic Isotope Effects for the Concentration of Tritium
55276-TN	B-319	Fundamental Chemistry and Thermodynamics of Hydrothermal Oxidation Processes
60197-TN	B-329	Microsensors for In-situ Chemical, Physical, and Radiological Characterization of Mixed Waste
60218-TN	B-333	Novel Mass Spectrometry Mutation Screening for Contaminant Impact Analysis
60096-TN	B-339	Rational Synthesis of Imprinted Organofunctional Sol-Gel Materials for Toxic Metal Separation
54735-TX	B-343	Development of Inorganic Ion Exchangers for Nuclear Waste Remediation
55185-TX	B-349	New Strategies for Designing Inexpensive but Selective Bioadsorbants for Environmental Pollutants: Selection of Specific Ligands & Their Cell Surface Expression
54679-WA	B-367	Architectural Design Criteria for F-Block Metal Ion Sequestering Agents
54996-WA	B-371	Ionizing Radiation Induced Catalysis on Metal Oxide Particles
54897-WA	B-391	The Sonophysics and Sonochemistry of Liquid Waste Quantification and Remediation
55146-WA	B-393	Adsorption/Membrane Filtration as a Contaminant Concentration and Separation Process for Mixed Wastes and Tank Wastes
60050-WA	B-395	Chemical Speciation of Inorganic Compounds under Hydrothermal Conditions
60150-WA	B-399	Genetic Engineering of a Radiation-Resistant Bacterium for Biodegradation of Mixed Wastes

Oak Ridge Operations Office

Oak Ridge Reservation

OR-48101 - Offsite Remedial Action

Problem Area: Remedial Action
Life-Cycle Cost in 2007+: $413,000,000
DOE Project Manager: Robert C. Sleeman, 423-576-0715, sleemanrc@oro.doe.gov
Contractor Manager: T. W. Morris, 423-241-4921, morristw@ornl.gov
For More Information: http://www.doe.gov/em52/pbs/or-48101.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: High **Worker:** Medium **Environment:** Urgent

Technical Approach Provided by Project Manager:

It is assumed that the technical approach at those release sites where remedial action is to be completed (Atomic City Auto Parts, David Witherspoon, Oak Ridge Tool-Engineering) is a conventional construction approach. Soils, contaminated debris and PPE/decontamination wastes will be excavated or removed from the sites and will be disposed of in industrial landfills or the EMWMF with little pretreatment, except for size reduction. Some pretreatment by soil washing will occur at the David Witherspoon 901 site. Excavation areas will be regraded and in some cases backfilled with clean soil and seeded. It is further assumed that once these source areas remedial actions are completed, remnant groundwater contamination will be allowed to naturally attenuate and will be monitored, where appropriate.

The monitoring and assessment programs associated with the Clinch River/Poplar Creek and Watts Bar sites will continue and will be used to identify any increasing contaminant trends which might modify the ROD requirements.

The following technologies including associated cost savings have been incorporated into this project baseline: Performance Verification Monitoring.

It is assumed that approximately 85% of the ORR land will be delisted from the NPL by utilizing CERCLA 120(h) guidelines for identifying areas that are uncontaminated. This process is being supported by the Footprint Reduction/Site Evaluation program.

The proposed EMWMF is envisioned as an earthen, above-grade disposal cell complete with leachate collection and monitoring systems and necessary supporting ancillary facilities. The expected date for receipt of waste into the facility is July 2000. The total area of the facility will comprise an estimated 100-120 acres. The footprint of the disposal cell will cover approximately 35 acres with the remaining area consisting of supporting treatment, storage and staging facilities. The ultimate total capacity of the cell is approximately 1.9 million cubic yards. The cell design will include a robust, multi-component cap that is designed to comply with the performance objectives of the Uranium Mill Tailings Reclamation Act. A private vendor(s) selected through a competitive procurement process will be awarded a fixed price contract for the design and construction of the facility. At the time of contract signing, DOE will obligate sufficient funds to cover the investment of the vendor with an appropriate rate of return in the event that DOE cancels the contract for its convenience. Payment would be made from annual appropriations and by costing (outlay) of the original obligation for amortization of the capital costs. Under this privatization effort, DOE would be responsible for securing any required construction permits.

The Environmental Restoration Waste Treatment subproject scope includes RCRA/TSCA treatment required prior to the disposal of forecasted D&D and RA solid wastes. (Liquid waste streams are not included.) Waste types and associated treatment processes were identified (e.g., thermal desorption, macroencapsulation) and cost per kilogram of waste was assumed. Volumes were calculated according to the following assumptions: for Y-12 wastes, volumes were based on previous experience and site knowledge; for ORNL, volumes were based on contamination geometries of 35%, 50%, and 75%; for ETTP, 100% of waste streams were categorized as RCRA, TSCA or Mixed by project managers or were estimated as 5% of all other solid wastes (based on Group 1 Buildings forecasted waste volumes.)

Post 2006 Project Scope Provided by Project Manager:

Current baselines indicate that post-2006 project scope will include surveillance and maintenance, monitoring and assessment and the regulatory-required five-year reviews of RODs. Additional post-2006 scope will be the operation of the EMWMF and associated Waste Treatment.

Project End State Provided by Project Manager:

Eight of the release sites associated with this PBS are either bodies of water (i.e., waters of the state, some regulated by the Tennessee Valley Authority or the Corps of Engineers) or privately-owned businesses (some on the State of Tennessee Superfund list.) RODs have been approved for the water bodies and contamination was either removed (LEFPC action level of 400 ppm for mercury) to an on-site industrial landfill or existing TVA/COE dredging restrictions and fish consumption advisories were adopted to mitigate public exposure. Results from continued monitoring of conditions in the Clinch River/Poplar Creek/Watts Bar system will determine if the dredging restrictions and fish consumption advisories can be lifted in the future. Therefore, it appears that the lag time for recovery of the ecosystems in these bodies of water will require a "recreational with restriction" land use classification for many years. These end states have been agreed to with the regulators and stakeholders.

The David Witherspoon and Atomic City Auto Parts sites are currently industrial and are State of Tennessee Superfund sites. The forecast baseline contains improvements to an existing landfill, decontamination of structures and removal of debris and contaminated soils as proposed remedial actions with disposal in the proposed Environmental Management Waste Management Facility. TDEC Division of Superfund (DSF) will be determining the end state status at these privately-owned sites and future surveillance and monitoring requirements. TDEC-DSF will be the lead agency in any stakeholder activities.

The Footprint Reduction/Site Evaluation project will result in several thousand acres of the ORR being removed from the CERCLA process due to identification of acreage never being used or not being significantly impacted by any ORR operations.

Beyond PBS completion, the operation of the EMWMF will continue for the permanent disposal of CERCLA-generated environmental waste, including waste from D&D activities. In addition, beyond PBS completion, the Integrated Water Quality Program will continue to monitor water and biota on the ORR to assess remedial action effectiveness.

The full list of science research awards that have the potential to address projects such as this one, which deals with Remedial Action problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "Remedial Action".

The following awards were identified through systems engineering to have the potential to address the specific needs of this Project. Those research awards that may have the strongest link to this project are designated by the symbol "§".

Award ID	Page #	Award Title
§ 55014-AL	B-1	Kinetics and Mechanisms of Metal Retention/Release in Geochemical Processes in Soil
§ 55396-CA	B-33	Sorption of Colloids, Organics, and Metals onto Gas-Water Interfaces: Transport Mechanisms and Potential Remediation Technology
§ 54860-CA	B-59	Sorption of Heavy Metals and Radionuclides on Mineral Surfaces in the Presence of Organic Co-Contaminants
§ 54893-FL	B-99	Research Program to Determine Redox Properties and Their Effects on Speciation and Mobility of Pu in DOE Wastes
§ 54837-GA	B-109	Phytoremediation of Ionic and Methyl Mercury Pollution
§ 54888-MA	B-175	Manipulating Subsurface Colloids to Enhance Cleanups of DOE Waste Sites
§ 55119-TN	B-315	Phase Equilibria Modification by Electric Fields
55012-CO	B-89	Extraction and Recovery of Mercury and Lead from Aqueous Waste Streams Using Redox-active Layered Metal Chalcogenides
55294-IL	B-121	Superconducting Open-Gradient Magnetic Separation for the Pretreatment of Radioactive or Mixed Waste Vitrification Feeds
55211-IL	B-141	Cavitational Hydrothermal Oxidation: A New Remediation Process
54791-KS	B-153	Managing Tight-binding Receptors for New Separations Technologies
59977-MD	B-169	Synthesis and Characterization of Templated Ion Exchange Resins for the Selective Complexation of Actinide Ions
54571-MA	B-181	Removal of Heavy Metals and Organic Contaminants from Aqueous Streams by Novel Filtration Methods
54724-NM	B-205	Synthesis of New Water-Soluble Metal-Binding Polymers: Combinatorial Chemistry Approach
55387-NM	B-237	Photooxidation of Organic Wastes Using Semiconductor Nanoclusters
60363-NM	B-241	Optimization of Thermochemical, Kinetic, and Electrochemical Factors Governing Partitioning of Radionuclides during Melt Decontamination of Radioactively Contaminated Stainless Steel
60017-PA	B-285	Removal of Technetium, Carbon Tetrachloride, and Metals from DOE Properties
54856-PA	B-289	Structural Biology of the Sequestration & Transport of Heavy Metal Toxins: NMR Structure Determination of Proteins Containing the -Cys-X-Y-Cys-metal Binding Motifs
54973-TN	B-301	A Novel Energy-Efficient Plasma Chemical Process for the Destruction of Volatile Toxic Compounds
54735-TX	B-343	Development of Inorganic Ion Exchangers for Nuclear Waste Remediation
60050-WA	B-395	Chemical Speciation of Inorganic Compounds under Hydrothermal Conditions
59925-WV	B-403	Modeling of Diffusion of Plutonium in Other Metals and of Gaseous Species in Plutonium-Based Systems

Oak Ridge Operations Office

Paducah Gaseous Diffusion Plant

OR-45301 - Paducah Remedial Action

Problem Area: Remedial Action
Life-Cycle Cost in 2007+: $432,000,000
DOE Project Manager: Robert C. Sleeman, 423-576-0715, sleemanrc@oro.doe.gov
Contractor Manager: T. W. Morris, 423-241-4921, morristw@ornl.gov
For More Information: http://www.doe.gov/em52/pbs/or-45301.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: High **Worker:** High **Environment:** Urgent

Technical Approach Provided by Project Manager:

The technical approach for the RA Program includes strategies for establishing site priorities, remedial goals based on land use, source control actions, and RAs for groundwater and surface water contamination. The 208 SWMUs/AOCs have been divided into 30 WAGs (potential operable units [OUs]) based on common characteristics including contaminant types, geographic locations, media, remedial alternatives and other common factors. The WAGs were then prioritized for the purpose of undergoing the RA process to focus resources and ensure prompt actions are taken to address threats to human health and the environment. The WAGs were prioritized based on the following criteria:

1) Mitigate immediate threats in all media, either on- or off-site
2) Control "hot spots" associated with off-site contamination
3) Address suspected sources of off-site contamination
4) Address suspected sources of on-site contamination
5) Final actions for groundwater and surface water integrator units

The RA process for the various WAGs will typically include work plan development for sampling activities, remedial investigations, risk assessments, treatability studies, feasibility studies, remedy selection, remedial design, remedial construction, operation/surveillance, and maintenance, as appropriate.

The current and anticipated future use of the property that comprises PGDP will have a significant impact on the cleanup standards, types of RAs selected, and total costs for site remediation (e.g., industrial use vs. residential). Based on existing lease agreements, congressional plans to privatize USEC, the complex nature of site contamination, and stakeholder input gathered to date, the current land use of mixed industrial/recreational is expected to be the most likely future use at the site. Therefore, the following remedial goals and points of exposure have been established to provide the framework for developing cleanup standards at the site:

1) Protect industrial workers from direct contact of surface and subsurface soils (0'-10') for work conducted inside the security fence
2) Protect groundwater users at the DOE property boundary
4) Protect recreational users outside security fence
5) Protect sensitive ecosystems outside security fence

To accomplish these goals, the remedial strategy includes a combination of source-control actions at the individual SWMUs, followed by RAs for groundwater and surface water contamination also referred to as integrator units. Because integrator units typically encompass large geographic areas that collect releases from multiple source units, final actions for integrator units are deferred until releases from the contributing source units are mitigated. However, because integrator units also serve as migration pathways to potential receptors, interim actions early in the process may be necessary to ensure adequate protection to human health and the environment while source units are being addressed. Several interim actions addressing imminent risks and hot spots have already been implemented, and the need for additional interim actions will continually be considered during the remaining source unit investigations, as appropriate. Groundwater and surface water data collected during the individual source unit investigations will ultimately be combined to complete the RI data needs for the surface water and groundwater OUs.

Certain types of contamination cannot be effectively remediated to acceptable levels. TCE, which is a dense, nonaqueous-phase liquid (DNAPL), has been released to the environment and migrated downward to the groundwater, forming high concentration pools, thereby serving as long-term sources of groundwater contamination. EPA guidance (OSWER Directive 9234.2-25) published October 4, 1993, discusses the technical impracticability associated with DNAPL remediation. In such cases, containment technologies (e.g., barrier walls) may be more effective at achieving the site remedial goals for groundwater, rather than technologies involving mass removal. However, some innovative technologies currently under evaluation have shown some promise in removing these contaminants. One technology referred to as "Lasagna" was field tested at SWMU 91, and was recently deemed successful. Therefore, full-scale deployment of this technology for SWMU 91 is expected in the FY 1998/1999 time frame. However, this application is primarily limited to the unsaturated zone. Other promising technologies for DNAPL remediation currently being evaluated include dual-phase extraction, cosolvent/ surfactant flushing, in situ oxidation, dynamic underground stripping, and hydrous pyrolysis. The technical approach for these types of source areas will likely include a combination of actions including containment technologies for source areas, mass removal for high-concentration areas, and natural attenuation of the dissolved-phased plume. Landfills are assumed to be capped in place with long-term monitoring. However, some stakeholders have expressed a preference for excavation as opposed to the capping assumption.

Several WAGs at the Paducah Plant, designated under the site priorities as "Suspected sources of on-site contamination," are considered low-risk WAGs that may be good candidates for No Further Action (NFA). The RCRA Permits and FFA contain a schedule of compliance requiring a remedial investigation for these WAGs by a certain date. However, as part of the Accelerated Cleanup Plan strategy, site evaluations (PA/SIs) will be conducted for these units in an attempt to reach NFA decisions (the NFA is based on land use assumptions) prior to the scheduled RI/FS date. If the site is successful in obtaining early NFA decisions, a significant cost savings will be recognized compared to the original baseline which assumed these WAGs would be subject to the complete RA process. In the event some of the subject SWMUs require an RI/FS, additional funding will be required to comply with the RI/FS requirements of the RCRA Permits and FFA.

While full-scale D&D is not currently in the scope of the Accelerated Cleanup Plan, significant opportunities exist to utilize emerging, innovative D&D technologies or to provide for technology demonstration. However, it is likely that standard industry practices and technologies will be employed for D&D of Paducah facilities. D&D of the two current accepted facilities is being delayed to integrate these with the total plant D&D, and thus gain efficiency of scale during project implementation. Detailed planning or design for these D&D projects has not been conducted, but preliminary plans include decontamination and reuse of certain facilities as part of a reindustrialization scenario with dismantlement and on-site entombment of wastes from the balance of the plant facilities.

Operations and Maintenance (O&M) at groundwater plume pump and treat facilities and postremedial sites utilize accepted techniques consistent with regulatory requirements and best-management practices. Deficiencies identified from surveillance and inspection will be corrected as appropriate. Generally, the requirements outlined in DOE Orders or standard industry practices are applied in the conduct of maintenance at DOE support facilities. Maintenance will be performed to correct identified deficiencies or as a preventive measure to retard degradation or improve operation factors.

Post 2006 Project Scope Provided by Project Manager:

All RA activity is expected to be complete by FY 2006, with the exception of WAG 24 and the groundwater (WAG 26) and surface water (WAGs 18 and 25) integrator units. WAG 24 is scheduled to be completed by FY 2009, dependant on the completion of scrap removal activities at SWMUs 14 and 15 by FY 2003 under the WM Project. However, it should be noted that WAGs 29 and 30, which are currently scheduled for an SE and NFA decision prior to FY 2006, could result in post-2006 scope due to the nature of these units. WAG 29 contains operating facilities that have been identified as SWMUs/AOCs due to historic practices. WAG 30 contains SWMUs located within or below facility structures with limited access. While the current baseline under the 2006 Plan is to seek early NFA decisions through the SE process, the nature of these units may require DOE to coordinate the investigation and, if appropriate, remediation of these units when they cease operation, and/or during D&D activities. If this occurs, a Baseline Change Proposal (BCP) will be implemented to reflect these changes.

Completion of the surface water and groundwater units is baselined to be completed after releases of contributing source areas (SWMUs/AOCs) have been mitigated. Based on this sequencing, the groundwater and surface water units will be completed by FY 2010. Activities following the remediation of these units will include long-term S&M to ensure remedial activities remain effective, and performance of five-year reviews for any remediation in which wastes or contamination is left in place, as required by CERCLA. Because wastes are assumed to remain in place at landfills and some burial grounds at the site, at least some portion of the site will be restricted from certain types of future uses (e.g., intrusive activities, residential development). Maintaining these institutional controls will be a portion of post-2006 scope for the Paducah Environmental Restoration Program. Groundwater plume pump and treat operations will continue. Long-term S&M of DOE facilities will continue in order to assure the continued stability of the sites.

Project End State Provided by Project Manager:

The final end state for the Paducah Program will be a long-term S&M with institutional controls. This condition is expected because of existence of several on-site WM units, such as landfills or burial grounds, that will be closed or remediated with wastes or contamination remaining in place. Kentucky regulations require a postclosure groundwater monitoring and care period of 30 years. Many of the wastes that will remain in place at Paducah are long half-life radionuclides, so a longer monitoring period will be required. For areas where contamination remains in place, five-year reviews of RAs will be performed as required by CERCLA.

The enrichment process will continue to operate under USEC control, or a successor organization. Reindustrialization or reuse of existing DOE facilities, or use of infrastructure, is a possibility, with deed restrictions or use limitations applied to areas that have contamination remaining in place. The final end state for D&D buildings is the effective cleanup of the contaminated facilities such that release for reuse is allowed, or the dismantlement of facilities that cannot be reused. While the 2006 Plan does not contain scope for actual D&D activities, preliminary assessments for both C-340 and C-410 facilities indicate that each facility will require dismantlement to the grade level with the potential for remediation of soils underlying each facility.

The full list of science research awards that have the potential to address projects such as this one, which deals with Remedial Action problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "Remedial Action".

The following awards were identified through systems engineering to have the potential to address the specific needs of this Project. Those research awards that may have the strongest link to this project are designated by the symbol "§".

Award ID	Page #	Award Title
§ 54898-AZ	B-5	Molecular Dissection of the Cellular Mechanisms Involved in Nickel Hyperaccumulation in Plants
§ 55396-CA	B-33	Sorption of Colloids, Organics, and Metals onto Gas-Water Interfaces: Transport Mechanisms and Potential Remediation Technology
§ 54893-FL	B-99	Research Program to Determine Redox Properties and Their Effects on Speciation and Mobility of Pu in DOE Wastes
§ 54888-MA	B-175	Manipulating Subsurface Colloids to Enhance Cleanups of DOE Waste Sites
§ 55119-TN	B-315	Phase Equilibria Modification by Electric Fields
§ 60197-TN	B-329	Microsensors for In-situ Chemical, Physical, and Radiological Characterization of Mixed Waste
55318-CA	B-23	Improved Analytical Characterization of Solid Waste-Forms by Fundamental Development of Laser Ablation Technology
60141-DC	B-95	Gamma Ray Imaging for Environmental Remediation
55247-IL	B-119	Sensors Using Molecular Recognition in Luminescent, Conductive Polymers
55294-IL	B-121	Superconducting Open-Gradient Magnetic Separation for the Pretreatment of Radioactive or Mixed Waste Vitrification Feeds
60247-IL	B-139	Miniature Nuclear Magnetic Resonance Spectrometer for In-Situ and In-Process Analysis and Monitoring
55211-IL	B-141	Cavitational Hydrothermal Oxidation: A New Remediation Process
54791-KS	B-153	Managing Tight-binding Receptors for New Separations Technologies
60231-MD	B-165	Novel Miniature Spectrometer for Remote Chemical Detection
59977-MD	B-169	Synthesis and Characterization of Templated Ion Exchange Resins for the Selective Complexation of Actinide Ions
54724-NM	B-205	Synthesis of New Water-Soluble Metal-Binding Polymers: Combinatorial Chemistry Approach
54751-NM	B-209	High Fluence Neutron Source for Nondestructive Characterization of Nuclear Waste
55387-NM	B-237	Photooxidation of Organic Wastes Using Semiconductor Nanoclusters
60363-NM	B-241	Optimization of Thermochemical, Kinetic, and Electrochemical Factors Governing Partitioning of Radionuclides during Melt Decontamination of Radioactively Contaminated Stainless Steel
60017-PA	B-285	Removal of Technetium, Carbon Tetrachloride, and Metals from DOE Properties
54856-PA	B-289	Structural Biology of the Sequestration & Transport of Heavy Metal Toxins: NMR Structure Determination of Proteins Containing the -Cys-X-Y-Cys-metal Binding Motifs
54973-TN	B-301	A Novel Energy-Efficient Plasma Chemical Process for the Destruction of Volatile Toxic Compounds
54735-TX	B-343	Development of Inorganic Ion Exchangers for Nuclear Waste Remediation
60050-WA	B-395	Chemical Speciation of Inorganic Compounds under Hydrothermal Conditions
59925-WV	B-403	Modeling of Diffusion of Plutonium in Other Metals and of Gaseous Species in Plutonium-Based Systems

Oak Ridge Operations Office

Portsmouth Gaseous Diffusion Plant

OR-46301 - Portsmouth Remedial Action

Problem Area:	Remedial Action
Life-Cycle Cost in 2007+:	$403,000,000
DOE Project Manager:	Robert C. Sleeman, 423-576-0715
Contractor Manager:	T. W. Morris, 423-241-4921, morristw@ornl.gov
For More Information:	http://www.doe.gov/em52/pbs/or-46301.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Medium **Worker:** High **Environment:** High

Technical Approach Provided by Project Manager:

The Portsmouth Gaseous Diffusion Plant is divided into four cleanup areas called quadrants based on groundwater flow direction. The tactics for completing remediation fro each quadrant will be as follows:
-removed well-defined sources of contamination;
-consolidate and integrate remedial actions, corrective measures, and RCRA closures for solid waste management units and solid waste management unit groups that have common contaminant sources or interrelated groundwater contaminant plumes;
-use risk-based closure criteria rather than "clean" closure criteria (where practical); and
-use the results of risk analyses to establish cleanup levels and the sequence of cleanup efforts.

In general, cleanup will be in accordance with decisions reached under the RCRA Corrective Action process for the site, in compliance with both RCRA and CERCLA regulations. Under that process, a Corrective Measures Study will develop cleanup alternatives for each site which requires action. The preferred alternative will then be selected by the regulators for Corrective Measures Implementation.

Remediation technologies will be selected that satisfy remediation goals, are technically feasible, and minimize the life cycle cost for the project. Remediation technologies are listed below in decreasing order or preference:
In-situ treatment with the emphasis on waste minimization
Waste isolation via multilayer cap, subsurface barriers, etc.
Removal action with treatment/disposal of the waste.

In addition, other technologies will be considered, pending funding and future technological considerations, such as:
- In-situ vitrification of buried waste
- Homogeneous advanced oxidation systems
- Reactive barriers
- Fluidless directional drilling

Post 2006 Project Scope Provided by Project Manager:

Operation of active and passive groundwater treatment systems with deed restrictions on some sites will be ongoing through FY 2052.

The Sitewide groundwater monitoring program will be ongoing through FY 2056.

Long Term Surveillance and Maintenance of Remedial Action units and D&D Facilities will be ongoing until cessation of plant operations, and decontamination and decommissioning of the plantsite.

Project End State Provided by Project Manager:

The plant remains operational and gaseous diffusion operations will remain at selected facilities. All Corrective Actions will have been implemented: groundwater treatment systems will be in place and operational; a waste storage facility will be established on-site to manage wastes generated by continuing operations; landfills and burial grounds will be hydrologically isolated and left in place. The following activities will be ongoing when the Project End State (steady state) is reached.

Operation of active and passive groundwater treatment systems
Sitewide Groundwater Monitoring Program
Long Term Surveillance and Maintenance of Remedial Action units and D&D facilities.

The full list of science research awards that have the potential to address projects such as this one, which deals with Remedial Action problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "Remedial Action".

The following awards were identified through systems engineering to have the potential to address the specific needs of this Project. Those research awards that may have the strongest link to this project are designated by the symbol "§".

Award ID	Page #	Award Title
§ 54898-AZ	B-5	Molecular Dissection of the Cellular Mechanisms Involved in Nickel Hyperaccumulation in Plants
§ 55061-CA	B-77	Fundamental Studies of the Removal of Contaminants from Ground and Waste Waters via Reduction by Zero-Valent Metals
§ 55374-IL	B-125	Use of Sonication for In-Well Softening of Semivolatile Organic Compounds
§ 54680-MI	B-187	The Migration and Entrapment of DNAPLs in Physically and Chemically Heterogeneous Porous Media
§ 55395-NM	B-239	Physics of DNAPL Migration and Remediation in the Presence of Heterogeneities
§ 54585-OH	B-269	Permanganate Treatment of DNAPLs in Reactive Barriers and Source Zone Flooding Schemes
§ 55196-OR	B-277	In Situ, Field Scale Evaluation of Surfactant Enhanced DNAPL Recovery Using a Single-Well, Push-Pull Test
§ 54122-PA	B-281	A Broad Spectrum Catalytic System for Removal of Toxic Organics from Water By Deep Oxidation
§ 60197-TN	B-329	Microsensors for In-situ Chemical, Physical, and Radiological Characterization of Mixed Waste
§ 55185-TX	B-349	New Strategies for Designing Inexpensive but Selective Bioadsorbants for Environmental Pollutants: Selection of Specific Ligands & Their Cell Surface Expression
§ 60069-VT	B-355	Least-Cost Groundwater Remediation Design Using Uncertain Hydrogeological Information
55012-CO	B-89	Extraction and Recovery of Mercury and Lead from Aqueous Waste Streams Using Redox-active Layered Metal Chalcogenides
60141-DC	B-95	Gamma Ray Imaging for Environmental Remediation
55247-IL	B-119	Sensors Using Molecular Recognition in Luminescent, Conductive Polymers
54571-MA	B-181	Removal of Heavy Metals and Organic Contaminants from Aqueous Streams by Novel Filtration Methods
54751-NM	B-209	High Fluence Neutron Source for Nondestructive Characterization of Nuclear Waste
60041-OK	B-275	Removal of Radioactive Cations and Anions from Polluted Water Using Ligand-Modified Colloid-Enhanced Ultrafiltration
55115-TX	B-345	The Adsorption and Reaction of Halogenated Volatile Organic Compounds (VOC's) on Metal Oxides
54897-WA	B-391	The Sonophysics and Sonochemistry of Liquid Waste Quantification and Remediation

Oakland Operations Office

Science Needs as Reported in the March 1998 *Accelerating Cleanup: Focus on 2006*, Table O.9.2

Oakneed20 - Flow in Fractured Rock

Oakland Operations Office

Separations Process Research Unit

SP-SPRU - Separations Process Research Unit (SPRU)

Problem Area: Decontamination and Decommissioning
Life-Cycle Cost in 2007+: $131,000,000
DOE Project Manager: James A. Davis, III, 510-637-1634, james.davisIII@oak.doe.gov
Contractor Manager: The Prime Contractor and site manager have not been chosen at time time.
For More Information: http://www.doe.gov/em52/pbs/sp-spru.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Low **Worker:** Medium **Environment:** Medium

Technical Approach Provided by Project Manager:

The objective of the SPRU Remediation project is to obtain regulatory release of the site to unrestricted use. Of the four basic decommissioning alternatives per NRC Regulatory Guide 1.86, the "Dismantlement" alternative is the one the Project will pursue. Dismantlement of the Facility includes removal of the SPRU structures, and remediation of the soil under/around the Facilities, as necessary, followed by the Nuclear Regulatory Commission inspections and release of the site to unrestricted use.

To achieve the above objective, the following D&D strategy will be developed. Prior to the start of D&D, selected materials and equipment will be removed from all SPRU Facilities salvaged and/or packaged for disposal. External electrical lines will be supplied to the systems essential for SPRU Facilities operations as necessary to avoid interruption of service and hazards inside the Facilities. These systems included the HEPA blowers, the air compressors, and the outlets for portable lighting and electrical equipment. This preparation phase will be followed by decontamination and dismantlement activities. Contaminated systems will be removed, packaged, and shipped to a low-level radioactive waste disposal facility. Decontamination of the SPRU Facilities will be performed concurrently with systems removal activities. There will be two parallel tasks during dismantlement: one will be the decontamination and dismantlement of Building H-2 and the rooms surrounding the main Building G-2 structure and the other will be the decontamination of the hot cells. Decontamination of Building H-2 and the rooms surrounding the main Building G-2 structure will include a variety of techniques; the predominant one will be abrasive cleaning of the concrete surfaces. The interior of the hot cells will be cleaned using remotely operated cleaning methods followed by abrasive cleaning.

After the cells are decontaminated, dismantlement of the Buildings will start as the final decontamination of the remaining rooms in the Facilities are completed. The roof will then be removed to allow dismantlement of the remaining cells. This will be followed with the dismantlement of the remaining walls and slabs.

The radioactively contaminated debris will result in the generation of LLW, MLLW, TRU, MTRU, and HLW. The low level radioactively contaminated debris will be packaged and shipped to a low-level radioactive waste disposal facility with due regard for waste minimization where practical (Oakland Site Technology Need No. 14). MLLW will be similarly addressed. TRU and MTRU will be packaged for disposal at WIPP. HLW will be packaged and shipped to Yucca mountain for disposal. Hazardous materials will be disposed of at a licensed hazardous waste depository. The remaining noncontaminated debris will be shipped to local landfills.

After the Facility is dismantled, the affected soil will be remediated. Contaminated soil will either be shipped to an off-site or temporary processing facility or shipped directly to the appropriately facilities for waste disposal. Following removal of all contamination, a comprehensive final radiation survey will be independently conducted, documented and submitted to the regulators with the objective of obtaining site release to unrestricted use.

Post 2006 Project Scope Provided by Project Manager:

Post 2006 activities include the majority of the implementation of the Decommissioning Plan (clean-up of all facilities) and the cleanup of all release sites. Post 2006 scope will also include the management of all generated waste streams.

Project End State Provided by Project Manager:

With a fourteen year funding profile, site release to unrestricted use is scheduled for 2014. All SPRU facilities will be demolished, release sites cleaned up and waste generated packaged and shipped to the appropriate facility for disposal.

The full list of science research awards that have the potential to address projects such as this one, which deals with Decontamination and Decommissioning problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "Decontamination and Decommissioning".

Ohio Field Office

Ohio Field Office

Fernald Environmental Management Project

OH-FN-07 - Silos

Problem Area:	Remedial Action
Life-Cycle Cost in 2007+:	$74,000,000
DOE Project Manager:	Nina Akgunduz, 513-648-3110, nina.akgunduz@fernald.gov
Contractor Manager:	Don Paine, 513-648-5310, donald.paine@fernald.gov
For More Information:	http://www.doe.gov/em52/pbs/oh-fn-07.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Medium **Worker:** Medium **Environment:** High

Technical Approach Provided by Project Manager:

-On July 22, 1997, DOE and EPA agreed to settle the informal dispute with a path forward establishing four new regulatory, enforcement milestones. Rebaseline to reflect the major scope and schedule changes has been approved for FY 98. Re-evaluation of treatment technologies for treatment of Silos 1 & 2 material is being conducted through multiple technology, multiple vendor proof-of-principles contracts and updating the current Feasibility Studies/Proposed Plan and ROD Amendment.
-Technology Needs: The following prioritized needs will be addressed: OH-F002 - Real-time personal alpha monitor to provide a rapid personnel monitoring device for alpha contamination from radon. LANL completed initial development. FEMP plans to fund some follow-on development, but may require OST support of follow-on work at LANL. Waste retrieval and treatment technologies are addressed by issuing Request for Proposals to potential vendors who have the technical expertise and proven technologies to implement on-site.
-The need for hydraulic/rheology information for K-65 feed slurry (OH-F007) is being addressed through a subcontract with Florida International University.
-There remains a need for a remote controlled vehicle-based manipulator (OH-F011). This need is to potentially assist in the removal of material from the Silos, is being addressed by the Houdini development sponsored by the Robotics cross-cutting area. Information on Houdini will be provided to all potential bidders of Waste Retrieval contract for consideration.
-There is a need for a method to stabilize the K-65 material, from Silos 1 and 2. This need (OH-F032) is being addressed by a program which includes support from the Mixed Waste Focus Area. Information from this program will be provided to potential bidders of Silos 1 & 2 remediation contract for consideration.
-Because of the potential approach to remove wastes from Silo-3 as a dry material, a need for information on the retrieval and collection of super-fine particles produced by pneumatic means (OH-F029) has been identified.
-The current approach is to convert the material to a slurry and retrieve into a transfer tank area. The requirement for information on (OH-F030) the ability of a water layer to restrict radon diffusion is necessary for design of radon-treatment and containment systems. This information will be provided to all potential bidders of the accelerated waste retrieval contract for consideration.
-Future major activities are aligned more in series rather than in parallel (lessons learned from the Vitrification Pilot Plant) to reduce up-front risks and bottlenecks and increase operational efficiencies for potential schedule recovery. There are five major activities planned for OU4: 1) Waste Retrieval/Transfer Tanks/Radon Control System, 2) Silos 1 and 2 Multiple Technology-Multiple Vendor Proof of Principle Testing, 3) Revise FS/PP and ROD Amendment, 4) Silos 1 and 2 Final Remediation Turnkey Contract, and 5) Silo 3 remediation.

Post 2006 Project Scope Provided by Project Manager:

Followup activities for FY2006 through FY2008 include finalization of treatment and disposal of Silos 1 and 2 wastes per the Amended Operable Unit 4 Record of Decision as consistent with our existing baseline.

It is planned that a sitewide PBS will be added to the existing 12 PBSs in the FY2000 submittal. This new sitewide PBS will include all of the post-closure (FY2009 - FY2038) activities which are not currently part of our existing baseline. These activities will include maintenance and standby of the Advanced Waste Water Treatment Facility (AWWT) to ensure full containment and capture of any residual contaminated groundwater plumes, monitoring and maintenance activities, D&D of the AWWT and related onsite and offsite pipelines and wells and related soils, and either shipment of this material offsite or disposal in Cell 8 of the OSDF.

Project End State Provided by Project Manager:

Completion of stabilization activities and removal of all facilities.

All stabilized material from the Silos, equipment, and debris not meeting OSDF WAC will be packaged and shipped to an appropriately permitted disposal facility. All facilities, equipment, debris, concrete silos, soils meeting OSDF WAC will be disposed of in OSDF otherwise, off-site at an appropriately permitted disposal facility.

The full list of science research awards that have the potential to address projects such as this one, which deals with Remedial Action problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "Remedial Action".

Richland Operations Office

Science Needs as Reported in the March 1998 *Accelerating Cleanup: Focus on 2006*, Table O.9.2

RL-DD014 - Fixatives for K-Basin
RL-DD022-S - Photon-Assisted Decontamination Chemistry
RL-DD023-S - Cesium Leak Dispersion Properties
RL-DD024-S - Colloidal Chemistry Of Basin Wastes
RL-DD025-S - Effluent Capture
RL-DD026-S - Contaminant Binding Science Need
RL-MW07-S - Non-Intrusive, Non-Destructive Characterization Methods for Non-Radionuclide Hazardous Components of Mixed Low-Level Waste
RL-MW08-S - Develop of Non-Destructive TRU/Non-TRU Characterization/Radionuclide Mapping Methods for Contaminated Remotely Handled (RH) TRU Waste
RL-MW09-S - Fundamental understanding of the mechanism for encapsulation of radionuclides and hazardous components during microencapsulation or stabilization
RL-MW10-S - Development of analytical techniques that extract information about a waste stream or sample without extracting any material
RL-MW11-S - Methods to remove radioactivity from an individual in case of accident
RL-MW12-S - Concepts/methods for the prevention of migration of radionuclides and hazardous components from buried radioactive wastes
RL-SS23-S - Chemical Speciation and Complexation in Site-Specific Groundwaters
RL-SS24-S - Chemical Binding on Site-Specific Mineral Surfaces
RL-SS25-S - Chemical Form and Mobility of Dense, Non-Aqueous Phase Liquids in Hanford Subsurface
RL-SS26-S - Reaction Rates for Key Contaminant Species and Complexes in Site-Specific Groundwaters
RL-SS27-S - Rates of Coupled Abiotic and Biogeochemical Reactions Involving Contaminants in Hanford Subsurface
RL-SS28-S - Rates of Colloid Formation and Colloidal Transport of Contaminants in Site-Specific Groundwaters
RL-SS29-S - Effect of Subsurface Heterogeneities on Chemical Reaction and Transport
RL-SS30-S - Cs Migration Beneath Waste Tanks
RL-SS31-S - Mathematical Formulations of Chemical Reaction/Material Transport
RL-SS32-S - Reactivity of Organics in the Hanford Subsurface
RL-SS33-S - Interaction of Remedial Processes with Hanford Subsurface
RL-SS34-S - Selectivity for Contaminants in the Hanford Subsurface
RL-SS35-S - Use of Chemical Surrogates for Contaminants
RL-SS36-S - Chemical Indicators of Remedial Technology Processes
RL-SS37-S - Chemical Sensor Principles
RL-WT031-S - Rapid Waste Characterization
RL-WT032-S - Monitoring of Key Waste Physical Properties during Retrieval and Transport
RL-WT033-S - Chemistry of Problem Constituents for HLW Vitrification
RL-WT034-S - Long-Term Performance of LAW Forms
RL-WT035-S - Moisture Flow and Contaminant Transport in Arid Conditions
RL-WT036-S - Alternate Waste Form Development
RL-WT037-S - Sludge Treatment
RL-WT038-S - Process Models for Sludge Treatment
RL-WT039-S - Advanced Methods for Achieving LLW Volume Minimization
RL-WT040-S - Mechanisms of Line Plugging
RL-WT041-S - Radionuclide Partitioning
RL-WT042-S - Flammable Gas Generation, Retention, and Release in HLW Tanks
RL-WT043-S - Effect of Human and Natural Influences on Long-Term Water Distribution
RL-WT044-S - Distribution of Recharge Rates
RL-WT045-S - Vadoze Zone Flow Simulation Tool Under Arid Conditions
RL-WT046-S - Getter Materials
RL-WT047-S - Tritium Separations
RL-WT048-S - Innovative Methods for Radionuclide Separation

RL-WT049-S - Effect of Processing on Waste Rheological and Sedimentation Properties
RL-WT050-S - Effect of Organic Constituents on Waste Processing
RL-WT051-S - Foam Generation and Stability
RL-WT052-S - Characterization of Organic Species in Waste Feed to LAW and HLW Treatment Facilities
RL-WT053-S - Contaminant Mobility Beneath Tank Farms
RL-WT054-S - Solids Yield and Deagglomeration
RL-WT055-S - Tank Integrity Verification
RL-WT056-S - Half-Lives of Se-79 and Sn-126
RL-WT057-S - Materials for Long-Term Waste Isolation

Research Identified Through the Complex-Wide Needs Survey, June 1996

CS-019 - Waste forms having long-term durability.
CS-020 - Prevent H_2 accumulation in drums resulting from radiolysis of plastic packaging or other hydrogenous materials during long term storage.
CS-033 - Develop non destructive testing (NDT) methods to verify integrity of SNM storage container closure weld.
CS-055 - Improved methods for removing surface (removable) Actinide contamination from non porous surfaces to <100 nCi/gm.
CS-058 - In-situ method for surface decontamination for uranium process equipment.
CS-060 - Systems/procedures for assuring that all radioactive material has been removed from tanks and pipes prior to dismantlement is necessary to avoid budget/schedule impact.
CS-061 - Simple and safe methods for digging and crushing concrete foundations is needed.
CS-062 - Cleanup, decommissioning, dismantling, and construction activities will require containment technologies to prevent the spread of contamination offsite or to uncontaminated areas on-site.
CS-063 - Cost effective and safe systems and procedures are required to size reduce and remove excess equipment.
CS-070 - Improve techniques for volume reduction of decommissioning waste such as sheet metal, piping, conduit and furniture.
CS-071 - In-situ capping of dismantled buildings to prevent contaminant migration into groundwater or release to air or surface water.
CS-073 - Best available technologies for demolition of concrete structures.
CS-075 - Best available technologies for safe removal of friable asbestos.
CS-076 - Best available technologies for safe removal of lead.
CS-077 - Methods for decontamination of concrete surfaces (walls, floors, ceilings) to <100 nCi/gm.
CS-078 - Contain airborne contamination during disassembly and demolition activities.
CS-081 - Install a method to limit natural groundwater recharge in the Industrial Area to prevent further groundwater contamination and movement of contaminants in the area.
CS-082 - Monitor to ensure groundwater controls and barriers are functioning and the caps and onsite waste facilities are not breached and are functioning properly following remediation.
CS-083 - Methods to monitor performance and integrity of barriers and containment techniques.
CS-084 - Reliability/failure analysis of containment barriers.
CS-085 - Monitor to determine the effectiveness of the RCRA Subtitle D sanitary landfill closure method.
CS-089 - Rapid (Field) non Invasive, real time *in-situ* measures to reduce cost of site characterization.
CS-091 - Location and characterization of high hazard waste and verification of remedial action.
CS-095 - Long term monitoring of dismantled and capped facilities to detect any environmental contamination.
CS-098 - Replace current batch sampling of surface water with a continuous monitoring systems maximizing information value of down-sized data collection.
CS-103 - Inexpensive methods for monitoring contaminant migration through the vadose zone.
CS-105 - Need inexpensive approach to characterizing burial grounds. Under current approaches it costs as much to characterize a burial ground as it would to retrieve all waste. No real-time analytical system. Analytical data are too costly to support real technical decisions.
CS-106 - Burial ground characterization.
CS-108 - Chromium contamination in soils and groundwater.
CS-109 - Acid mine drainage (AMD).
CS-110 - Nitrate - contaminated groundwater.
CS-111 - Cyanide leach ponds leaking into groundwater.
CS-112 - Cost effective remediation methods for DNAPLS found in unconsolidated, deep, subsurface sediments; i.e. sandy/clayey soils.

CS-113 - Cost effective, in-situ, and ex-situ, groundwater treatment methods for radioactive, voc's, and hazardous waste constituents in unconsolidated sandy/clayey soils.
CS-116 - Proper application of Electronic Soil remediation techniques to removal of metal ions and anions (including radionuclides) from contaminated soil.
CS-117 - Contaminated underground plumes.
CS-122 - Remove VOCs from groundwater using an in situ treatment method.
CS-123 - Install a subsurface impermeable barrier to contain the portion of a carbon tetrachloride groundwater plume that exceeds 100 x MCL.
CS-125 - Design and install three caps of 10 acres, 43 acres, and 13 acres after completion of site decommissioning. the caps must include a capillary break to enhance evapotranspiration, bioexclusion layer, a drainage layer, and impenetrable liner system.
CS-126 - Remove OU 5 landfill contents.
CS-127 - Develop a more extensive final cover over the Protected Area to resist infiltration and burrowing animals.
CS-128 - Environmental remediation of soils and other media adjacent to dismantled buildings.
CS-133 - Removal of ^{3}H, ^{129}I, and CCl_4 from large volumes of groundwater plumes.
CS-134 - Restoration of an aquifer. Principal contaminant is ^{90}Sr.
CS-136 - Characterization of Waste; Chemical characteristics and remediation; degradation of chlorinated hydrocarbons TRU/TRM/LL/LLM waste to be retrievable. Appropriate technology required.
CS-137 - Technical justification is necessary to establish the necessary (but not excessive) requirements for waste storage operations within an existing or new building.
CS-138 - Evaluate and determine the necessary upgrades to convert an existing building to use as a retrievable storage facility.
CS-139 - Make decision based on technical information whether to build a pre-engineered facility or a fully hardened facility for TRU/TRM Mixed Waste Storage.
CS-140 - Many organic contaminated wastes can be treated by removal of the organic chemical species.
CS-142 - Technical justification to allow waste from different waste categories to be placed within the same TRUPACT-II container. Allows for more efficient use of available volume.
CS-144 - Technical justification to increase Pu gram limit above 325g/TRUPACT-II container.
CS-145 - Efficient method to eliminate hydrogen buildings in TRU containers being shipped to WIPP that contain organics.
CS-146 - Faster, better, cheaper methods are desirable for waste certification prior to shipment for disposal.
CS-147 - Technical justification is necessary to establish appropriate waste packaging requirements for drums. Without this, the number of drum storage spaces required cannot be accurately estimated.
CS-150 - Characterization of radionuclide constituents and concentrations deterring waste classification.
CS-151 - Real time radiography is required for waste certification for shipment to WIPP. Improved techniques would speed this process.
CS-152 - Techniques for representative sampling of heterogeneous wastes.
CS-155 - Because of the different treatment requirements for LL, LLM, TRU, TRM and residue wastes, there is a technical need for accurate, fast determination of drum contents via Non-Destructive Assay (NDA) and Non-Destructive Evaluation (NDE).
CS-157 - Technology needed for improved characterization of LLM waste and ER waste.
CS-159 - Conduct headspace gas sampling and gas generations studies on residue drums destined for WIPP.
CS-160 - Technical justification is necessary to establish appropriate Pu gram limits for various choices of waste storage buildings. Without this, the number of drum storage spaces and buildings required cannot be accurately estimated.
CS-161 - TRU, TRM, and Residue wastes will require critically safe treatment and interim storage systems to minimize/eliminate the possibility of a nuclear criticality. Commercial disposal facilities have an upper acceptance limit of 10 nCi/g. Existing in-drum counter instrumentation cannot detect levels this low.
CS-164 - Radiological surveys are performed to establish the integrity of waste containers. Improvements in this technology would be more accurate and provide greater confidence in the results.
CS-165 - Waste assay is required for waste certification for shipment to WIPP. Improved techniques would speed this process.
CS-172 - Bioremediation of Mixed Waste.
CS-173 - Safe, reliable, clean methods to detoxify toxic materials--for example using specific catalysts.
CS-174 - Provide technical input to the design of a facility addressing the needs of specialty waste (e.g., radioactive PCB's and asbestos).
CS-177 - Many solid wastes will require volume reduction to minimize the volume of waste shipped for disposal - also to preserve storage capacity.

CS-179 - Offsite treatment of radioactive, hazardous, and mixed wastes is a consideration under ASAP II. Such facilities must be evaluated to ensure they provide adequate treatment, safety, and are licensable for these applications.
CS-183 - Some hazardous wastes will require oxidative treatment to minimize the hazardous component.
CS-184 - Stabilize ion exchange resins for repack and interim storage in new SNM storage facility.
CS-194 - Treatment of spent deionizers with long-lived radionuclides (carbon-14).
CS-198 - Detection and quantification of RCRA toxic metals in process offgases.

Technology Development and Science Needs related to the Decontamination and Decommissioning Technology Focus Area

D&D02 - Techniques are needed which allow/permit recycle and free-release of materials (metals) and which reduce secondary waste.
Science Need: Fundamental surface science studies are needed to improve removal of organic, inorganic, and radioactive species from materials requiring cleaning.
D&D03 - Current methods for locating buried objects (process equipment and piping) are inaccurate or ineffective in clay/silt environments and are often intrusive in nature.
Science Need: Basic studies leading to development of improved (object resolution and size recognition) methods for detection and location of buried metal and non-metal objects are required to develop improved technology for locating buried objects.
D&D04 - Study radioactive decay of materials in their disposed or recycled states to better understand the impact of residual radioactivity to the long-term integrity of the disposed or recycled materials. The impact of other factors such as temperature and material stress could be included in study.
Science Need: Fundamental material science studies related to mechanical property characterization are needed to determine the long-term integrity of disposed or recycled materials.
D&D05 - Real-time, field deployable characterization tools with sensitivities that will measure to free-release standards. Low-cost technologies which can differentiate between contaminated and non-contaminated equipment and materials are needed to aid in material segregation.
Science Need: Basic studies associated with non-intrusive, real time determination of chemical species in or on high density materials are needed to develop technology for sensing extremely low concentrations (PPM to PPB) concentrations of hazardous chemicals.
D&D06 - More durable, economical, and comfortable worker protection equipment, clothing, and breathing apparatus for both radioactive and non-radioactive environments are required to reduce the risk of exposure.
Science Need: Fundamental chemical and materials studies concerned with understanding the mechanism of penetration and diffusion of liquid materials through polymeric materials are needed to develop new personnel protection equipment.
D&D08 - Methods are needed to discern the type and depth of radioactive contamination in concrete. Current methods typically volatilize contaminants or create problems of cross contamination.
Science Need: Fundamental instrumentation studies concerned with development of non-intrusive, spatially resolved measurement of radioactive species inside structure bodies are needed to develop more sensitive characterization methods and technology.
D&D09 - A methodology to estimate the human health risk of exposures to radiation from recycled metal including stainless steel. Determine the underlying basis for public fear of free release of decontaminated materials.
Science Need: Basic human health risk studies are needed to understand the implications of reuse of volumetrically contaminated structural materials.
D&D10 - Current processes are not effective in cleaning non-metal complex configurations to free-release conditions and in reducing secondary waste associated with cleaning porous materials.
Science Need: A basic understanding of the chemistry and surface science of porous surfaces is needed to develop improved decontamination methods for wood, concrete, and asbestos.
D&D11 - Cost effective concrete decontamination technologies are needed to reduce the amount of secondary wastes.
Science Need: Basic understanding of chemistry and surface science of concrete are needed to develop decontamination processes that reduce the amount of secondary process waste.
D&D12 - Modifications of thermal treatment methods to prevent unacceptable releases of contaminants.
Science Need: Basic understanding of chemistry of species in high temperature environments is needed to formulate improved waste forms produced by thermal treatment processes and to design higher efficiency off-gas treatment systems.

D&D13 - Improved metal decontamination technologies are needed that are faster, more cost effective, and that reduce the amount of secondary waste.

Science Need: Basic engineering and materials science studies associated with metal surface cleaning are needed to develop advanced surface ablation methods or other techniques for rapid decontamination of metal objects.

D&D14 - Non-intrusive, remote characterization technology is needed to verify the existence or absence of contamination in drains, pipes, and associated equipment.

Science Need: Fundamental sensor and instrumentation development studies are needed to support development of technology for remote inspection of inaccessible areas.

D&D15 - Improved concrete decontamination technologies are needed that are faster, more cost effective, nondestructive (for a reusable concrete surface) and that reduce the amount of secondary waste.

Science Need: A basic understanding of the chemistry and surface science of porous surfaces is needed to develop improved decontamination methods for wood, concrete, and asbestos.

D&D16 - Fixatives are used to fix dispersible contaminants in place where decontamination operations are not feasible or during periods prior to decontamination. Improved fixatives are required which are more easily applied & removed and have longer life.

Science Need: Fundamental chemistry and interfacial science of polymer fixatives are required for development of new materials which are more easily applied, long lived, and easily removed.

Technology Development and Science Needs related to the MIxed Waste Technology Focus Area

MWFA2 - Trace metal removal from liquid effluents produced by DOE plant operations is required to comply with new proposed release limits.

Science Need: Fundamental chemistry and separations science studies are needed to develop improved material for capture and specific recovery of dilute concentrations of Cd, Pb, and Ag from waste water.

MWFA3 - Removal of sodium nitrate from low level waste destined for landfill disposal is required to comply with regulations.

Science Need: Basic studies associated with methods, chemistry, and kinetics of reduction of sodium nitrate are needed to treat liquid low level waste prior to landfill disposal.

MWFA4 - Radio assay improvements in data collection and analysis time are needed to reduce assay throughput bottlenecks.

Science Need: Fundamental studies leading to development of improved (sensitivity) gamma or neutron detectors, refinement of analysis algorithms, and improved neutron sources are needed to reduce uncertainty and measurement times.

MWFA6 - Improved remote handled TRU characterization is needed to support activities associated with certification of wastes for disposal.

Science Need: Fundamental instrumentation research is required to develop methods, sensors, and techniques that are functional for isotopic and plutonium determinations in high radiation environments.

MWFA7 - Data and analysis models of dioxin/furan formation in thermal treatment processes are needed to reduce or eliminate the potential of formation and release of these compounds.

Science Need: Basic computer modeling studies resulting in supporting data, methods of data measurement, and mechanisms of gas phase dioxin/furan production by thermal treatment processes are needed for improved process design and reduced emission recovery.

MWFA8 - Chelated nickel is produced during bioremediation and must be removed from processed water to comply with regulations.

Science Need: Fundamental chemistry of biomolecule coordinated nickel is needed to understand reactions and conditions necessary for release of chelated nickel produced during bioremediation.

Technology Development and Science Needs related to the Plutonium Technology Focus Area

PFA03 - A general understanding of the behavior of mixed oxidation states of plutonium-containing materials. This understanding should consider the time-dependent (aging-effects) chemical behavior of the materials, especially in direct contact with plutonium.

Science Need: Fundamental material science behavior of mixed oxidation states of Pu containing materials is needed for improved storage of residues and stabilized materials and to develop predictive tools.

PFA07 - Delineation of environmentally assisted cracking (EAC) of 304 stainless steels, used as container materials for >50% Pu with <1% water and trace Halides, is required to define a regime where minimal overall corrosion rate occurs.

Science Need: Basic materials science studies of corrosion of stainless steel are needed for process and plant life-time extension.

PFA08 - Improved understanding of the interaction of actinide compounds with surfaces is needed to develop the underlying science of surface complexation, physisorption, matrix diffusion, and entrainment mechanisms.

Science Need: Fundamental material science behavior of mixed oxidation states of Pu containing materials is needed for improved storage of residues and stabilized materials and to develop predictive tools.

PFA09 - An improved understanding of plutonium phosphate chemistry in solution and solid states is needed to develop selective phosphate ligands for separation and remediation applications.

Science Need: Basic separations chemistry of plutonium and phosphate systems is needed to develop selective phosphate separations and remediation processes.

PFA12 - Pu diffusion rates in important 94-1 materials of construction (such as stainless steel) must be measured under anticipated storage conditions.

Science Need: Basic material science studies associated with the diffusion of plutonium in stainless steel are needed for improved long-term storage of weapons grade material.

PFA13 - To solve issues associated with stabilization and storage of plutonium materials, an improved understanding of corrosion behavior of engineering materials used for storage containers is desired.

Science Need: Basic materials science studies of corrosion of stainless steel are needed for process and plant life-time extension.

Technology Development and Science Needs related to the Radioactive Waste Tanks Technology Focus Area

TFA02 - In-Situ Testing of LLW Glass Release. Propose a full-instrumented, in-situ, field experiment to validate computational model to calculate fluid-flow, release of contaminants from glass, and solute transport through soils.

Science Need: Basic geochemical studies are needed to support model validation of radionuclide leaching rates from fracture borosilicate glasses in unsaturated environments.

TFA03 - Waste Chemistry. Need for fundamental understanding of waste chemistry, including mineralization, aging, and unusual speciation with the objective of successful waste retrieval and processing.

Science Need: Basic materials science and geochemical studies are needed to develop an understanding of waste chemistry, mineralization, aging, and unusual speciation for improved waste retrieval and processing methods.

TFA04 - Cold Cap/Off-gas Thermodynamics Model. Need an improved immobilization or treatment process for volatile metals to lower cost and improve safety and reliability in handling the off-gas products.

Science Need: Fundamental chemical studies are needed to determine species concentration above molten glass solutions containing heavy metals, cesium, strontium, lanthanides, and actinides with and without a cold cap composed of unmelted material.

TFA05 - Waste Characterization for Technetium. Need to identify the amount of Tc in the waste and what impacts that may have upon pretreatment processing and subsequent waste form composition and disposal requirements.

Science Need: Fundamental analytical chemical studies are needed for improved separation processes, performance of waste forms, and characterization of Tc chemistry and materials science of waste forms.

TFA06 - Sludge Separations. Require sludge separations to pretreat tank sludges to meet feed acceptance criteria for the solidification system. May include sludge washing and solid/liquid separations.

Science Need: Basic engineering and separations science studies are required to support pretreatment activities, development of solid/liquid separations, and tank remediation of high solids loaded liquids.

TFA07 - Liquids/Solids Separations Studies. Need studies to support the development of advanced separations processes and equipment to minimize the volumes of TRU by separating treated liquid from fine precipitants which can be disposed of as solid waste.

Science Need: Basic engineering and separations science studies are required to support pretreatment activities, development of solid/liquid separations, and tank remediation of high solids loaded liquids.

TFA08 - Waste Characterization Strategy (physical and chemical) to Support Processing Needs. Need a strategy for obtaining characterization data to support processing, including retrieval, pretreatment, and immobilization.

Science Need: Basic analytical chemistry studies are needed to develop new methods for chemical and physical characterization of solids, liquids, and slurries and for development of advanced processing methodologies.

TFA12 - Bulk Sludge Mobilization and Slurry Transport. Slurry transport studies are needed to design pipeline systems for LLW sludges.
Science Need: Basic engineering and separations science studies are required to support pretreatment activities, development of solid/liquid separations, and tank remediation of high solids loaded liquids.

TFA13 - Sludge Waste Form Study. Need lab-scale vitrification and grouting studies with surrogates and actual waste samples to define the operational envelopes for these waste forms.
Science Need: Materials science studies of molten materials that simulate conditions anticipated during vitrification of HLW are needed to develop improved processes and formulations.

TFA14 - Field Methods for 3D Mapping of Waste Chemical and Radiological Properties. Need techniques that generate in situ characterization data to reduce cost of sample handling and analytical tasks in hot laboratories.
Science Need: Basic instrument development is needed to perform in situ radiological measurements and collect spatially resolved species and concentration data.

TFA15 - On-line Monitoring Waste Retrieval Process. Need characterization tools for on-line monitoring of the waste retrieval process and for final verification of the tank conditions following cleanup activities.
Science Need: Basic engineering and separations science studies are required to support pretreatment activities, development of solid/liquid separations, and tank remediation of high solids loaded liquids.

TFA17 - In-line Solids Monitoring. Need to demonstrate in-line solids monitors to assure accurate slurry content when transferring sludges in pipelines and to avoid pipeline plugging.
Science Need: Basic engineering and separations science studies are required to support pretreatment activities, development of solid/liquid separations, and tank remediation of high solids loaded liquids.

TFA22 - Develop Method to Remove Dry/Hardened Sludge.
Science Need: Basic engineering and separations science studies are required to support pretreatment activities, development of solid/liquid separations, and tank remediation of high solids loaded liquids.

TFA25 - Develop Electrochemical Treatment of Salt Solutions for Caustic Recovery and Recycle. Need technology to recover chemicals of value from salt solution and to reduce volume of waste disposed in saltstone.
Science Need: Fundamental chemical studies are needed concerning the electrochemistry of sodium nitrate/nitrite in complex brine solutions.

TFA26 - Develop Simulants.
Science Need: Basic engineering and separations science studies are required to support pretreatment activities, development of solid/liquid separations, and tank remediation of high solids loaded liquids.

TFA27 - Colloidal Transport. Need definitive data on the kinetics of agglomeration of tank solid waste to develop colloidal transport models.
Science Need: Basic engineering and separations science studies are required to support pretreatment activities, development of solid/liquid separations, and tank remediation of high solids loaded liquids.

TFA28 - Evaluation of Multi-phase Flow in a Dry Fractured Glass. Need to evaluate the multi-phase flow properties of radionuclides to determine the release rates from fractured glass.
Science Need: Basic geochemical studies are needed to support model validation of radionuclide leaching rates from fracture borosilicate glasses in unsaturated environments.

TFA29 - Hydrologic Properties of Fractured Glass Monoliths. Need to determine the rates of radionuclide release from fractured glass monoliths in soil environments.
Science Need: Basic geochemical studies are needed to support model validation of radionuclide leaching rates from fracture borosilicate glasses in unsaturated environments.

TFA30 - Decontamination of High Level Waste Salt Solutions. Evaluate alternative precipitating agents and ion exchange media for decontamination of high level waste salt solutions.
Science Need: Fundamental separations chemistry of precipitating agents and ion exchange media is needed to support development of improved methods for decontamination of HLW.

TFA31 - Alternative Salt Removal Techniques. Demonstrate alternative salt removal techniques, such as modified density gradient, steam circulate jets, water jets, agitators, etc. for salt dissolution.
Science Need: Basic engineering and separations science studies are required to support pretreatment activities, development of solid/liquid separations, and tank remediation of high solids loaded liquids.

TFA35 - Moisture Dependence -- diffusion of water into glass as a function of relative humidity
Science Need: Basic geochemical studies are needed to support model validation of radionuclide leaching rates from fracture borosilicate glasses in unsaturated environments.

TFA36 - Develop on-line and in situ method for measuring elemental composition and weight percent solids of HLW slurries.
Science Need: Basic engineering and separations science studies are required to support pretreatment activities, development of solid/liquid separations, and tank remediation of high solids loaded liquids.

TFA37 - Develop high-activity waste form equivalent to borosilicate glass that can be designated as an "equivalent specified technology" or can be granted treatment variance. Investigate direct immobilization of high-activity fraction of radionuclide separation.

Science Need: Materials science and heavy element chemistry of actinides in mixed oxide matrices are required to provide improved understanding of HLW vitrified materials and glasses.

Technology Development and Science Needs related to the Sub-Surface Contaminants Technology Focus Area

SCFA01 - Cost effective monitoring strategy. Need cost effective monitoring strategy for containment of radionuclides, metals, and organic systems.

Science Need: Fundamental biological studies are needed for collection of data related to long term monitoring using natural systems to monitor for radionuclides, metals, and organic molecules. Fundamental studies to relate ecological change to contamination level.

SCFA02 - Cs/Sr treatment in soil. Need methods to treat Cs and Sr contaminated soils; soil washing treatability study is underway.

Science Need: Basic biological and separations chemical studies are needed to understand methods and mechanisms of capture of Cs and Sr using biological or active barrier methods.

SCFA03 - Active groundwater remediation. Need for cheaper, active groundwater remediation to replace expensive pump and treat methods for radionuclides and metals in groundwater; include bioremediation and permeable reactive barriers if feasible.

Science Need: Basic biological and geochemical studies are needed to understand methods, mechanisms, and routes to actively remediate ground water in place.

SCFA04 - Long term (200-500 years) performance monitoring. Also include modeling/prediction for landfill closure cover for both arid and humid climates.

Science Need: Fundamental engineering science studies are needed to understand aging effects and structural longevity using the aging phenomena associated with natural structures.

SCFA07 - In situ immobilization of radionuclides in groundwater. Need in situ methods to treat water contaminated with Cs-137, Sr-90, U, Pu, and Co-60; application in fractured basalt 200-400 feet below the surface.

Science Need: Basic biological and separations chemical studies are needed to understand methods and mechanisms of capture of Cs and Sr using biological or active barrier methods.

Richland Operations Office

Hanford Site - Richland Operations Office

RL-ER01 - 100 Area Remedial Action

Problem Area:	Remedial Action
Life-Cycle Cost in 2007+:	$182,000,000
DOE Project Manager:	R.A. Holten, 509-376-7277, richard_a_holten@rl.gov
Contractor Manager:	V. R. Dronen, 509-372-9075, VERNON_R_DRONEN@RL.GOV
For More Information:	http://www.doe.gov/em52/pbs/rl-er01.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Medium **Worker:** Medium **Environment:** High

Technical Approach Provided by Project Manager:

The 100 Area Source Remedial Action Project will typically achieve cleanup goals by excavating the contaminated soils and solid wastes. The ER Waste Disposal Project transports the excavated soils to the ER Disposal Facility for final disposal. The estimated volume of soil and solid waste to be removed from the 100 Area is in excess of three million cubic yards.

The Hanford Site utilizes the Site Technology Coordination Group to identify technology needs for Hanford Projects. Once the needs are identified, they are presented to the Technology Management Council which determines the needs to forward as funding requests to DOE-HQ EM-50 National Focus Areas. When approved, the technology demonstration is performed as an integrated EM-40 and EM-50 activity. The following technology needs have been identified as high priority for Remedial Actions:
Detection and characterization of radioactive contaminants and metals in soils
In-situ remediation of radioactive contaminants and metals in soils
Better retrieval and handling methods for radioactive contaminants and metals in soils
Better ex-situ treatment methods for radioactive contaminants and metals in soils
Detection and declination of burial ground contents
Segregation of TRU for non-TRU debris from burial grounds
Segregation and handling of large pieces of debris from burial grounds

Post 2006 Project Scope Provided by Project Manager:

After FY 06, 111 waste sites will remain to be remediated.

Project End State Provided by Project Manager:

The 100 Area is essentially equivalent to the area referenced in the Hanford Site Strategic Plan as the Reactors on the River.

Reactors on the River Goal: Remove and/or stabilize spent fuel, surplus facilities, and waste sites to protect groundwater and the Columbia River, and ensure protection of people, the environment, and natural/cultural resources. Pending Congressional action on the Wild and Scenic River designation, use will continue to be restricted; sensitive ecological, cultural, and native American resources will be protected.

Soil Sites Endstate
? Soil sites remediated consistent with ROD cleanup standards.
? Final cleanup levels will be established within individual RODs or Permit Modifications.

The full list of science research awards that have the potential to address projects such as this one, which deals with Remedial Action problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "Remedial Action".

The following awards were identified through systems engineering to have the potential to address the specific needs of this Project. Those research awards that may have the strongest link to this project are designated by the symbol "§".

Award ID	Page #	Award Title
§ 55014-AL	B-1	Kinetics and Mechanisms of Metal Retention/Release in Geochemical Processes in Soil
§ 55396-CA	B-33	Sorption of Colloids, Organics, and Metals onto Gas-Water Interfaces: Transport Mechanisms and Potential Remediation Technology
§ 60328-CA	B-37	High Frequency Electromagnetic Impedance Measurements for Characterization, Monitoring and Verification Efforts
§ 55011-CA	B-43	Surface and Borehole Electromagnetic Imaging of Conducting Contaminant Plumes
§ 55249-CA	B-47	Experimental Determination of Contaminant Metal Mobility as a Function of Temperature Time and Solution Chemistry
§ 55284-CA	B-55	Aquifer Transport of Th, U, Ra, and Rn in Solution and on Colloids
§ 54860-CA	B-59	Sorption of Heavy Metals and Radionuclides on Mineral Surfaces in the Presence of Organic Co-Contaminants
§ 54926-CA	B-75	Novel Ceramic-Polymer Composite Membranes for the Separation of Hazardous Liquid Waste
§ 54661-DE	B-91	Electrochemical Processes for In-Situ Treatment of Contaminated Soils
§ 54893-FL	B-99	Research Program to Determine Redox Properties and Their Effects on Speciation and Mobility of Pu in DOE Wastes
§ 55218-GA	B-107	Seismic Surface-Wave Tomography of Waste Sites
§ 54834-IN	B-143	An Investigation of Homogeneous and Heterogeneous Sonochemistry for Destruction of Hazardous Waste
§ 60199-KS	B-159	Seismic-Reflection and Ground Penetrating Radar for Environmental Site Characterization
§ 54683-MA	B-173	Speciation and Structural Characterization of Plutonium and Actinide-organic Complexes in Surface and Groundwaters
§ 55300-MA	B-179	3-D Spectral IP Imaging: Non-Invasive Characterization of Contaminant Plumes
§ 60271-NH	B-199	Characterization of a New Family of Metal Transport Proteins
§ 54741-NM	B-207	Characterization of Contaminant Transport Using Naturally-Occurring U-Series Disequilibria
§ 55332-NM	B-235	A Hybrid Hydrologic-Geophysical Inverse Technique for the Assessment and Monitoring of Leachates in the Vadose Zone
§ 54857-NM	B-245	Surface Nuclear Magnetic Resonance Imaging of Water Content Distribution in the Subsurface
§ 54639-NM	B-251	Development of an In-Situ Microsensor for the Measurements of Chromium and Uranium in Groundwater at DOE Sites
§ 54122-PA	B-281	A Broad Spectrum Catalytic System for Removal of Toxic Organics from Water By Deep Oxidation
§ 55205-SC	B-299	A Fundamental Study of Laser-Induced Breakdown Spectroscopy Using Fiber Optics for Remote Measurements of Trace Metals
§ 55033-TN	B-305	Characterization of Chemically Modified Hyperthermophilic Enzymes for Chemical Syntheses and Bioremediation Reactions
§ 55036-TN	B-307	Colloid Transport and Retention in Fractured Deposits
§ 55267-TN	B-317	Containment of Toxic Metals and Radionuclides in Porous and Fractured Media: Optimizing Biogeochemical Reduction versus Geochemical Oxidation
§ 60197-TN	B-329	Microsensors for In-situ Chemical, Physical, and Radiological Characterization of Mixed Waste
§ 54635-WA	B-361	Molecular-Level Process Governing the Interaction of Contaminants with Iron and Manganese Oxides

Awards Related to RL-ER01 Continued

Award ID	Page #	Award Title
§ 60355-WA	B-377	Mineral Surface Processes Responsible for the Decreased Retardation (or Enhanced Mobilization) of 137Cs from HLW Tank Discharges
60370-CA	B-39	Rational Design of Metal Ion Sequestering Agents
54546-CA	B-61	Engineered Antibodies for Monitoring of Polynuclear Aromatic Hydrocarbons
54847-CO	B-87	Photocatalytic and Chemical Oxidation of Organic Compounds in Supercritical Carbon Dioxide
55012-CO	B-89	Extraction and Recovery of Mercury and Lead from Aqueous Waste Streams Using Redox-active Layered Metal Chalcogenides
60141-DC	B-95	Gamma Ray Imaging for Environmental Remediation
55042-GA	B-105	Quantifying Silica Reactivity in Subsurface Environments: Controls of Reaction Affinity and Solute Matrix on Quartz and SiO2 Glass Dissolution Kinetics
55247-IL	B-119	Sensors Using Molecular Recognition in Luminescent, Conductive Polymers
60247-IL	B-139	Miniature Nuclear Magnetic Resonance Spectrometer for In-Situ and In-Process Analysis and Monitoring
55211-IL	B-141	Cavitational Hydrothermal Oxidation: A New Remediation Process
54942-IN	B-147	Spectroscopy, Modeling and Computation of Metal Chelate Solubility in Supercritical CO_2
54791-KS	B-153	Managing Tight-binding Receptors for New Separations Technologies
54864-KS	B-157	Supramolecular Chemistry of Selective Anion Recognition for Anions of Environmental Relevance
60231-MD	B-165	Novel Miniature Spectrometer for Remote Chemical Detection
59977-MD	B-169	Synthesis and Characterization of Templated Ion Exchange Resins for the Selective Complexation of Actinide Ions
54571-MA	B-181	Removal of Heavy Metals and Organic Contaminants from Aqueous Streams by Novel Filtration Methods
55223-MO	B-197	De Novo Design of Ligands for Metal Separation
54724-NM	B-205	Synthesis of New Water-Soluble Metal-Binding Polymers: Combinatorial Chemistry Approach
54751-NM	B-209	High Fluence Neutron Source for Nondestructive Characterization of Nuclear Waste
54770-NM	B-213	New Anion-Exchange Resins for Improved Separations of Nuclear Materials
59967-NM	B-217	Aqueous Electrochemical Mechanisms in Actinide Residue Processing
55387-NM	B-237	Photooxidation of Organic Wastes Using Semiconductor Nanoclusters
60403-NM	B-243	Phase Chemistry of Tank Sludge Residual Components
60474-OH	B-273	Develop and Demonstrate Novel Ultrahigh Sensitivity Heavy Noble Gas Detectors for Long-Term Monitoring of Spent Fuel and TRU Waste
54856-PA	B-289	Structural Biology of the Sequestration & Transport of Heavy Metal Toxins: NMR Structure Determination of Proteins Containing the -Cys-X-Y-Cys-metal Binding Motifs
54973-TN	B-301	A Novel Energy-Efficient Plasma Chemical Process for the Destruction of Volatile Toxic Compounds
55103-TN	B-311	Utilization of Kinetic Isotope Effects for the Concentration of Tritium
55276-TN	B-319	Fundamental Chemistry and Thermodynamics of Hydrothermal Oxidation Processes
54735-TX	B-343	Development of Inorganic Ion Exchangers for Nuclear Waste Remediation
54679-WA	B-367	Architectural Design Criteria for F-Block Metal Ion Sequestering Agents
54996-WA	B-371	Ionizing Radiation Induced Catalysis on Metal Oxide Particles
54897-WA	B-391	The Sonophysics and Sonochemistry of Liquid Waste Quantification and Remediation
60050-WA	B-395	Chemical Speciation of Inorganic Compounds under Hydrothermal Conditions

Richland Operations Office

Hanford Site - Richland Operations Office

RL-ER02 - 200 Area Remedial Action

Problem Area: Remedial Action
Life-Cycle Cost in 2007+: $1,614,000,000
DOE Project Manager: R.A. Holten, 509-376-7277, richard_a_holten@rl.gov
Contractor Manager: V. R. Dronen, 509-372-9075, VERNON_R_DRONEN@RL.GOV
For More Information: http://www.doe.gov/em52/pbs/rl-er02.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Low **Worker:** Medium **Environment:** High

Technical Approach Provided by Project Manager:

The 200 Area Source Remedial Action Project will typically achieve cleanup goals by isolating the contaminated soils and isolating contamination with barriers. If remedial alternatives are established which require waste disposal, the ER Waste Disposal Project will transport the wastes to the ER Disposal Facility for final disposal.

The 200 Area remedial action includes placement of barriers over the waste sites and burial grounds (within the 200 east area and 200 west area fencelines) and excavation of contaminated soils (outside the fenceline). This remedy is a planning assumption only and does not indicate that any decisions have been made relative to the remediation of the 200 Area waste sites. Remedial actions that could be required will be evaluated once characterization is complete.

An existing prototype barrier testing and monitoring program is being used to generate performance assessment information to support the long-term use of barriers at Hanford. Additional data may also be required to address regulator and public stakeholders concerns regarding the use of barriers.

The Hanford Site utilizes the Site Technology Coordination Group to identify technology needs for Hanford Projects. Once the needs are identified, they are presented to the Technology Management Council which determines the needs to forward as funding requests to DOE-HQ EM-50 National Focus Areas. When approved, the technology demonstration is performed as an integrated EM-40 and EM-50 activity. The following technology needs have been identified as high priority for Remedial Actions:

- Detection and characterization of radioactive contaminants and metals in soils
- In-situ remediation of radioactive contaminants and metals in soils
- Better retrieval and handling methods of radioactive contaminants and metals in soils
- Better treatment methods for radioactive contaminants and metals in soils
- Detection and delineation of burial ground contents
- Segregation of TRU from non-TRU debris from burial grounds
- Segregation and handling of large pieces of debris from burial grounds

Post 2006 Project Scope Provided by Project Manager:

The balance of assessment activities would be completed by December 31, 2008, 592 waste site would remain to be remediated in the 200 Area

Project End State Provided by Project Manager:

The 200 Area is essentially equivalent to the area referenced in the Hanford Site Strategic Plan as the Central Plateau.

Central Plateau Goal: The 200 Areas and Central Plateau will be used for the management of nuclear materials and the collection and disposal of waste materials that remain onsite and for other related and compatible uses. Cleanup levels and disposal standards will be established that are consistent with these long-term uses.

Soil Sites Endstate

? Soil sites will be closed in place with surface barriers, or other remedial alternatives will be established within individual RODs or permit modifications.

The full list of science research awards that have the potential to address projects such as this one, which deals with Remedial Action problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "Remedial Action".

The following awards were identified through systems engineering to have the potential to address the specific needs of this Project. Those research awards that may have the strongest link to this project are designated by the symbol "§".

Award ID	Page #	Award Title
§ 60328-CA	B-37	High Frequency Electromagnetic Impedance Measurements for Characterization, Monitoring and Verification Efforts
§ 55011-CA	B-43	Surface and Borehole Electromagnetic Imaging of Conducting Contaminant Plumes
§ 55411-CA	B-49	Joint Inversion of Geophysical Data for Site Characterization and Restoration Monitoring
§ 54926-CA	B-75	Novel Ceramic-Polymer Composite Membranes for the Separation of Hazardous Liquid Waste
§ 54661-DE	B-91	Electrochemical Processes for In-Situ Treatment of Contaminated Soils
§ 54893-FL	B-99	Research Program to Determine Redox Properties and Their Effects on Speciation and Mobility of Pu in DOE Wastes
§ 55218-GA	B-107	Seismic Surface-Wave Tomography of Waste Sites
§ 54834-IN	B-143	An Investigation of Homogeneous and Heterogeneous Sonochemistry for Destruction of Hazardous Waste
§ 60199-KS	B-159	Seismic-Reflection and Ground Penetrating Radar for Environmental Site Characterization
§ 54683-MA	B-173	Speciation and Structural Characterization of Plutonium and Actinide-organic Complexes in Surface and Groundwaters
§ 55300-MA	B-179	3-D Spectral IP Imaging: Non-Invasive Characterization of Contaminant Plumes
§ 60271-NH	B-199	Characterization of a New Family of Metal Transport Proteins
§ 55332-NM	B-235	A Hybrid Hydrologic-Geophysical Inverse Technique for the Assessment and Monitoring of Leachates in the Vadose Zone
§ 54857-NM	B-245	Surface Nuclear Magnetic Resonance Imaging of Water Content Distribution in the Subsurface
§ 54639-NM	B-251	Development of an In-Situ Microsensor for the Measurements of Chromium and Uranium in Groundwater at DOE Sites
§ 54122-PA	B-281	A Broad Spectrum Catalytic System for Removal of Toxic Organics from Water By Deep Oxidation
§ 55205-SC	B-299	A Fundamental Study of Laser-Induced Breakdown Spectroscopy Using Fiber Optics for Remote Measurements of Trace Metals
§ 55033-TN	B-305	Characterization of Chemically Modified Hyperthermophilic Enzymes for Chemical Syntheses and Bioremediation Reactions
§ 60197-TN	B-329	Microsensors for In-situ Chemical, Physical, and Radiological Characterization of Mixed Waste
60370-CA	B-39	Rational Design of Metal Ion Sequestering Agents
54546-CA	B-61	Engineered Antibodies for Monitoring of Polynuclear Aromatic Hydrocarbons
54847-CO	B-87	Photocatalytic and Chemical Oxidation of Organic Compounds in Supercritical Carbon Dioxide

Awards Related to RL-ER02 Continued

Award ID	Page #	Award Title
55012-CO	B-89	Extraction and Recovery of Mercury and Lead from Aqueous Waste Streams Using Redox-active Layered Metal Chalcogenides
60141-DC	B-95	Gamma Ray Imaging for Environmental Remediation
55247-IL	B-119	Sensors Using Molecular Recognition in Luminescent, Conductive Polymers
60247-IL	B-139	Miniature Nuclear Magnetic Resonance Spectrometer for In-Situ and In-Process Analysis and Monitoring
55211-IL	B-141	Cavitational Hydrothermal Oxidation: A New Remediation Process
54942-IN	B-147	Spectroscopy, Modeling and Computation of Metal Chelate Solubility in Supercritical CO_2
54791-KS	B-153	Managing Tight-binding Receptors for New Separations Technologies
54864-KS	B-157	Supramolecular Chemistry of Selective Anion Recognition for Anions of Environmental Relevance
60231-MD	B-165	Novel Miniature Spectrometer for Remote Chemical Detection
59977-MD	B-169	Synthesis and Characterization of Templated Ion Exchange Resins for the Selective Complexation of Actinide Ions
54571-MA	B-181	Removal of Heavy Metals and Organic Contaminants from Aqueous Streams by Novel Filtration Methods
55223-MO	B-197	De Novo Design of Ligands for Metal Separation
54724-NM	B-205	Synthesis of New Water-Soluble Metal-Binding Polymers: Combinatorial Chemistry Approach
54751-NM	B-209	High Fluence Neutron Source for Nondestructive Characterization of Nuclear Waste
54770-NM	B-213	New Anion-Exchange Resins for Improved Separations of Nuclear Materials
59967-NM	B-217	Aqueous Electrochemical Mechanisms in Actinide Residue Processing
60015-NM	B-227	Long-term Risk from Actinides in the Environment: Modes of Mobility
55387-NM	B-237	Photooxidation of Organic Wastes Using Semiconductor Nanoclusters
60403-NM	B-243	Phase Chemistry of Tank Sludge Residual Components
60474-OH	B-273	Develop and Demonstrate Novel Ultrahigh Sensitivity Heavy Noble Gas Detectors for Long-Term Monitoring of Spent Fuel and TRU Waste
54856-PA	B-289	Structural Biology of the Sequestration & Transport of Heavy Metal Toxins: NMR Structure Determination of Proteins Containing the -Cys-X-Y-Cys-metal Binding Motifs
54973-TN	B-301	A Novel Energy-Efficient Plasma Chemical Process for the Destruction of Volatile Toxic Compounds
55103-TN	B-311	Utilization of Kinetic Isotope Effects for the Concentration of Tritium
55276-TN	B-319	Fundamental Chemistry and Thermodynamics of Hydrothermal Oxidation Processes
54735-TX	B-343	Development of Inorganic Ion Exchangers for Nuclear Waste Remediation
54679-WA	B-367	Architectural Design Criteria for F-Block Metal Ion Sequestering Agents
54996-WA	B-371	Ionizing Radiation Induced Catalysis on Metal Oxide Particles
54897-WA	B-391	The Sonophysics and Sonochemistry of Liquid Waste Quantification and Remediation
60050-WA	B-395	Chemical Speciation of Inorganic Compounds under Hydrothermal Conditions

Richland Operations Office

Hanford Site - Richland Operations Office

RL-ER03 - 300 Area Remedial Action

Problem Area: Remedial Action
Life-Cycle Cost in 2007+: $137,000,000
DOE Project Manager: R.A. Holten, 509-376-7277, richard_a_holten@rl.gov
Contractor Manager: V.R. Dronen, 509-372-9075, VERNON_R_DRONEN@RL.GOV
For More Information: http://www.doe.gov/em52/pbs/rl-er03.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Medium **Worker:** Medium **Environment:** High

Technical Approach Provided by Project Manager:

The 300 Area Source Remedial Action Project will typically achieve the cleanup goals by excavating the contaminated soils and solid wastes. The ER Waste Disposal Project transports the excavated soils to the ER Disposal Facility for final disposal. The estimated volume of soil and solid wastes to be removed from the 300 Area is in excess of 700,000 cubic yards.

The assumed 300 Area remedial approach is removal of contaminated soils and buried waste, with disposal in the ERDF. This is based on the initial Record of Decision in the 300 Areas.

The Hanford Site utilizes the Site Technology Coordination Group to identify technology needs for Hanford Projects. Once the needs are identified, they are presented to the Technology Management Council which determines the needs to forward as funding requests to DOE-HQ EM-50 National Focus Areas. When approved, the technology demonstration is performed as an integrated EM-40 and EM-50 activity. The following technology needs have been identified as high priority for Remedial Actions:

Detection and characterization of radioactive contaminants and metals in soils
In-situ remediation of radioactive contaminants and metals in soils
Better retrieval and handling methods for radioactive contaminants and metals in soils
Better ex-situ treatment methods for radioactive contaminants and metals in soils
Detection and declination of burial ground contents
Segregation of TRU for non-TRU debris from burial grounds
Segregation and handling of large pieces of debris from burial grounds

Post 2006 Project Scope Provided by Project Manager:

Approximately 100 waste sites will remain to be remediated in the 300 Area.

Project End State Provided by Project Manager:

The 300 Area includes the majority of the waste sites in the area referenced in the Hanford Site Strategic Plan as the South 600 Area.
South 600 Area Goal: The 300 Area waste sites, materials and facilities will be remediated to allow industrial and economic diversification opportunities. The Federal government will retain ownership of land in and adjacent to the 300 and 400 Areas, but will lease land for private and public uses to support regional industrial and economic development. Excess land within the 1100 area will be targeted for transition to non-Federal ownership.
Soil Sites Endstate
? Soil sites remediated consistent with ROD cleanup standards. Contaminated media will be consolidated and moved to the 200 Area for disposal.
? Final cleanup levels will be established within individual RODs or permit modifications.

The full list of science research awards that have the potential to address projects such as this one, which deals with Remedial Action problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "Remedial Action".

The following awards were identified through systems engineering to have the potential to address the specific needs of this Project. Those research awards that may have the strongest link to this project are designated by the symbol "§".

Award ID	Page #	Award Title
§ 55014-AL	B-1	Kinetics and Mechanisms of Metal Retention/Release in Geochemical Processes in Soil
§ 55396-CA	B-33	Sorption of Colloids, Organics, and Metals onto Gas-Water Interfaces: Transport Mechanisms and Potential Remediation Technology
§ 60328-CA	B-37	High Frequency Electromagnetic Impedance Measurements for Characterization, Monitoring and Verification Efforts
§ 55011-CA	B-43	Surface and Borehole Electromagnetic Imaging of Conducting Contaminant Plumes
§ 55249-CA	B-47	Experimental Determination of Contaminant Metal Mobility as a Function of Temperature Time and Solution Chemistry
§ 55284-CA	B-55	Aquifer Transport of Th, U, Ra, and Rn in Solution and on Colloids
§ 54860-CA	B-59	Sorption of Heavy Metals and Radionuclides on Mineral Surfaces in the Presence of Organic Co-Contaminants
§ 54926-CA	B-75	Novel Ceramic-Polymer Composite Membranes for the Separation of Hazardous Liquid Waste
§ 54661-DE	B-91	Electrochemical Processes for In-Situ Treatment of Contaminated Soils
§ 54893-FL	B-99	Research Program to Determine Redox Properties and Their Effects on Speciation and Mobility of Pu in DOE Wastes
§ 55218-GA	B-107	Seismic Surface-Wave Tomography of Waste Sites
§ 54834-IN	B-143	An Investigation of Homogeneous and Heterogeneous Sonochemistry for Destruction of Hazardous Waste
§ 60199-KS	B-159	Seismic-Reflection and Ground Penetrating Radar for Environmental Site Characterization
§ 54683-MA	B-173	Speciation and Structural Characterization of Plutonium and Actinide-organic Complexes in Surface and Groundwaters
§ 55300-MA	B-179	3-D Spectral IP Imaging: Non-Invasive Characterization of Contaminant Plumes
§ 60271-NH	B-199	Characterization of a New Family of Metal Transport Proteins
§ 54741-NM	B-207	Characterization of Contaminant Transport Using Naturally-Occurring U-Series Disequilibria
§ 55332-NM	B-235	A Hybrid Hydrologic-Geophysical Inverse Technique for the Assessment and Monitoring of Leachates in the Vadose Zone
§ 54857-NM	B-245	Surface Nuclear Magnetic Resonance Imaging of Water Content Distribution in the Subsurface
§ 54639-NM	B-251	Development of an In-Situ Microsensor for the Measurements of Chromium and Uranium in Groundwater at DOE Sites
§ 54122-PA	B-281	A Broad Spectrum Catalytic System for Removal of Toxic Organics from Water By Deep Oxidation
§ 55205-SC	B-299	A Fundamental Study of Laser-Induced Breakdown Spectroscopy Using Fiber Optics for Remote Measurements of Trace Metals
§ 55033-TN	B-305	Characterization of Chemically Modified Hyperthermophilic Enzymes for Chemical Syntheses and Bioremediation Reactions
§ 55036-TN	B-307	Colloid Transport and Retention in Fractured Deposits
§ 55267-TN	B-317	Containment of Toxic Metals and Radionuclides in Porous and Fractured Media: Optimizing Biogeochemical Reduction versus Geochemical Oxidation
§ 60197-TN	B-329	Microsensors for In-situ Chemical, Physical, and Radiological Characterization of Mixed Waste
§ 54635-WA	B-361	Molecular-Level Process Governing the Interaction of Contaminants with Iron and Manganese Oxides

Awards Related to RL-ER03 Continued

Award ID	Page #	Award Title
§ 60355-WA	B-377	Mineral Surface Processes Responsible for the Decreased Retardation (or Enhanced Mobilization) of 137Cs from HLW Tank Discharges
60370-CA	B-39	Rational Design of Metal Ion Sequestering Agents
54546-CA	B-61	Engineered Antibodies for Monitoring of Polynuclear Aromatic Hydrocarbons
54847-CO	B-87	Photocatalytic and Chemical Oxidation of Organic Compounds in Supercritical Carbon Dioxide
55012-CO	B-89	Extraction and Recovery of Mercury and Lead from Aqueous Waste Streams Using Redox-active Layered Metal Chalcogenides
60141-DC	B-95	Gamma Ray Imaging for Environmental Remediation
55042-GA	B-105	Quantifying Silica Reactivity in Subsurface Environments: Controls of Reaction Affinity and Solute Matrix on Quartz and SiO2 Glass Dissolution Kinetics
55247-IL	B-119	Sensors Using Molecular Recognition in Luminescent, Conductive Polymers
60247-IL	B-139	Miniature Nuclear Magnetic Resonance Spectrometer for In-Situ and In-Process Analysis and Monitoring
55211-IL	B-141	Cavitational Hydrothermal Oxidation: A New Remediation Process
54942-IN	B-147	Spectroscopy, Modeling and Computation of Metal Chelate Solubility in Supercritical CO_2
54791-KS	B-153	Managing Tight-binding Receptors for New Separations Technologies
54864-KS	B-157	Supramolecular Chemistry of Selective Anion Recognition for Anions of Environmental Relevance
60231-MD	B-165	Novel Miniature Spectrometer for Remote Chemical Detection
59977-MD	B-169	Synthesis and Characterization of Templated Ion Exchange Resins for the Selective Complexation of Actinide Ions
54571-MA	B-181	Removal of Heavy Metals and Organic Contaminants from Aqueous Streams by Novel Filtration Methods
55223-MO	B-197	De Novo Design of Ligands for Metal Separation
54724-NM	B-205	Synthesis of New Water-Soluble Metal-Binding Polymers: Combinatorial Chemistry Approach
54770-NM	B-213	New Anion-Exchange Resins for Improved Separations of Nuclear Materials
59967-NM	B-217	Aqueous Electrochemical Mechanisms in Actinide Residue Processing
55387-NM	B-237	Photooxidation of Organic Wastes Using Semiconductor Nanoclusters
60403-NM	B-243	Phase Chemistry of Tank Sludge Residual Components
60474-OH	B-273	Develop and Demonstrate Novel Ultrahigh Sensitivity Heavy Noble Gas Detectors for Long-Term Monitoring of Spent Fuel and TRU Waste
54856-PA	B-289	Structural Biology of the Sequestration & Transport of Heavy Metal Toxins: NMR Structure Determination of Proteins Containing the -Cys-X-Y-Cys-metal Binding Motifs
54973-TN	B-301	A Novel Energy-Efficient Plasma Chemical Process for the Destruction of Volatile Toxic Compounds
55103-TN	B-311	Utilization of Kinetic Isotope Effects for the Concentration of Tritium
55276-TN	B-319	Fundamental Chemistry and Thermodynamics of Hydrothermal Oxidation Processes
54735-TX	B-343	Development of Inorganic Ion Exchangers for Nuclear Waste Remediation
54679-WA	B-367	Architectural Design Criteria for F-Block Metal Ion Sequestering Agents
54996-WA	B-371	Ionizing Radiation Induced Catalysis on Metal Oxide Particles
54897-WA	B-391	The Sonophysics and Sonochemistry of Liquid Waste Quantification and Remediation
60050-WA	B-395	Chemical Speciation of Inorganic Compounds under Hydrothermal Conditions

Richland Operations Office

Hanford Site - Richland Operations Office

RL-ER04 - Environmental Restoration Disposal Facility

Problem Area: Mixed Waste
Life-Cycle Cost in 2007+: $258,000,000
DOE Project Manager: R.A. Holten, 509-376-7277, richard_a_holten@rl.gov
Contractor Manager: V.R. Dronen, 509-372-9075, vernon_r_dronen@rl.gov
For More Information: http://www.doe.gov/em52/pbs/rl-er04.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Low **Worker:** Medium **Environment:** Medium

Technical Approach Provided by Project Manager:

The ERDF is designed to provide disposal capacity, as needed, to accommodate projected ER waste volumes. The total estimated volume of materials to be disposed of in the ERDF is in access of four million cubic yards.

Any leachate collected from the ERDF will be treated at the 200 Area ETF, if required.
The ER Waste Disposal Project is being implemented through privatization of both the waste transportation and disposal facility operations. When it is time to expand the facility, the design and construction work will be competitively bid. The ER Waste Disposal Project is integrated with the Remedial Action Project to ensure coordination and maximum efficiency among the remediation, transportation and disposal facility operations contractors.

Post 2006 Project Scope Provided by Project Manager:

An additional 1.3 million cubic meters of waste will remain to be disposed from the 100 and 300 Areas after FY06.

Project End State Provided by Project Manager:

The ERDF is located in the area referenced in the Hanford Site Strategic Plan as the Central Plateau. The ERDF will be constructed, operated and closed support of the Central Plateau goal and endstates.
Central Plateau Goal: The 200 Areas and central plateau will be used for the management of nuclear materials and the collection and disposal of waste materials that remain onsite and for other related and compatible uses. Cleanup levels and disposal standards will be established that are consistent with these long-term uses.
Soil Sites Endstate
Soil Sites will be closed in place with surface barriers, or remedial alternatives will be established within individual RODs or Permit Modifications.
Groundwater Endstate
Groundwater use remains restricted for a yet to be determined period; groundwater intercepted or contained to within designated boundaries.
Final cleanup levels will be established within individual RODs or Permit Modifications.
Facilities Endstate
Dismantle, or close, through entombment, D&D facilities currently assigned to the ER program.
Remove non-essential, surplus buildings and facilities that don't have identified post-cleanup uses.

The full list of science research awards that have the potential to address projects such as this one, which deals with Mixed Waste problems, are listed in the <u>Index of Research Awards by Environmental Management Problem Area</u>, in the back of this appendix, under the heading "Mixed Waste".

Richland Operations Office

Hanford Site - Richland Operations Office

RL-ER05 - Facility Surveillance & Maintenance - ADS 3500

Problem Area:	Decontamination and Decommissioning
Life-Cycle Cost in 2007+:	$303,000,000
DOE Project Manager:	J.D. Goodenough, 509-376-0893
Contractor Manager:	J. J. Mc Guire, 509-373-7253
For More Information:	http://www.doe.gov/em52/pbs/rl-er05.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Low **Worker:** High **Environment:** Medium

Technical Approach Provided by Project Manager:

The S&M Project produces limited waste quantities.
Surveillance and Maintenance (S&M) of inactive facilities is required to identify and mitigate worker and environmental risks associated with the surplus facilities. Currently the ER Program is responsible for over 210 facilities in the S&M portion of the D&D project. These facilities have far exceeded their design life and most have had very little maintenance. The facilities do not meet current codes and pose a variety of hazards to the workers. The primary emphasis of the S&M program is to identify the potential human health and safety hazards through periodic scheduled surveillances and to address the risk through facility upgrades. In general, major repairs are planned every 5 years for major facilities, such as the reactors or canyon facilities, and roof replacements every 20 years. The facility systems utilized for S&M are also upgraded to reduce the frequency of S&M at the major facilities. New facilities entering the S&M program are coordinated with the Facility Transition program and will have established end point criteria that define the conditions of the facility as it enters the S&M project. The S&M program also includes the RARA program for the maintenance of contaminated soil sites by controlling vegetation growth at the waste sites, removing contaminated vegetation when it is found, and posting areas of surface/soil contamination. Remote sensory technologies are being implemented to minimize the frequency of entries to hazardous facilities.

Post 2006 Project Scope Provided by Project Manager:

S&M will continue as facilities are transitioned into the ER Project. Waste sites will continue to be maintained through the RARA project until they complete remediation.

Project End State Provided by Project Manager:

The S&M Project will support the goals and endstates for all areas of the Hanford Site. See other ER PBS for specific endstate information.

The full list of science research awards that have the potential to address projects such as this one, which deals with Decontamination and Decommissioning problems, are listed in the <u>Index of Research Awards by Environmental Management Problem Area</u>, in the back of this appendix, under the heading "Decontamination and Decommissioning".

Richland Operations Office

Hanford Site - Richland Operations Office

RL-ER06 - Decontamination and Decommissioning

Problem Area:	Decontamination and Decommissioning
Life-Cycle Cost in 2007+:	$1,596,000,000
DOE Project Manager:	J. D. Goodenough, 509-376-0893, richard_a_holten@rl.gov
Contractor Manager:	T.E. Logan, 509-373-4736
For More Information:	http://www.doe.gov/em52/pbs/rl-er06.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Medium **Worker:** High **Environment:** Medium

Technical Approach Provided by Project Manager:

The D&D Project will achieve cleanup goals through decontamination in conjunction with demolition and/or entombment of facilities. The wastes generated through the D&D Project will typically be disposed in the ERDF. Surplus facilities that are currently in the ER program will be characterized in preparation for D&D activities. Hazardous substances will be removed from the facilities and radiological contamination will be removed or fixed prior to demolition activities. Clean structures will be removed to below grade (3ft), collapsed in place, and covered with clean soil for site restoration. Contaminated facilities will be removed and disposed at the Environmental Restoration Disposal Facility (ERDF). Soil contamination sites in close proximity to the surplus facilities, and soil contamination under the facilities, may be remediated during D&D. If the contamination in the soil is extensive the work will transfer to the Remedial Action project.

The 100 Area ancillary facilities will be D&D with any wastes being disposed of in the ERDF. The 100 Area reactors are assumed to be placed in interim safe storage with final disposition being one-piece removal and burial in the 200 Area. The interim safe storage is a planning assumption only. Currently a team of regulators, DOE, and contractor staffs are negotiating a path forward for the 100 Area reactors.

The majority of 200 Area facilities will be D&D with any waste being disposed of in the ERDF. The exceptions are the 200 Area canyon facilities, which are assumed (for planning purposes only) to be demolished in place and covered by a barrier. The 200 Area Canyon Strategy development is being initiated in FY97. This activity will evaluate alternatives for the D&D of these facilities. The final decision will be through a Record of Decision.

The 300 Area facilities will be D&D with any waste being disposed of in the ER Disposal Facility.

The technologies used for D&D consist of standard construction demolition techniques (i.e., wrecking ball, shears, excaualer, explosives, etc.)

The Hanford Site utilizes the Site Technology Coordination Group to identify technology needs for Hanford projects. Once the needs are identified they are presented to the Technology Management Council, which determines the needs that should be forwarded as funding requests to DOE-HQ EM-50 National Focus Areas. When approved, the technology demonstration is performed as an integrated EM-40 and EM-50 activity. The following technology needs have been identified as high priority for D&D:

Cutting technologies for size reduction of radioactive equipment and materials.
Improved techniques foe removal of fixed surface contamination.
Improved characterization techniques for differentiation of contaminated and non-contaminated materials.
Improved techniques for the cleanup of reactor basin water.
The interim safe storage of the C Reactor is being utilized as an integrated demonstration of D&D technologies with EM-50.

Post 2006 Project Scope Provided by Project Manager:

102 facilities will remain to be D&D in the 100 Areas. Several hundred 200, and 300 Area facilities will remain to be D&D. Included in this group are five canyon facilities and the Plutonium Finishing Plant.

Project End State Provided by Project Manager:

The D&D Project will support the goals and endstates for the areas of the Hanford Site that are referenced in the Hanford Site Strategic Plan as the Reactors on the River, the Central Plateau, and the South 600 Area.

Reactors on the River Goal: Remove and/or stabilize spent fuel, surplus facilities, and waste sites to protect groundwater and the Columbia River, and ensure protection of people, the environment, and natural/cultural resources. Pending Congressional action on the Wild and Scenic River designation, use will continue to be restricted; sensitive ecological, cultural, and native American resources will be protected.

Facilities Endstate

? Reactors placed in interim safe storage for up to 75 years pending future removal.
? Reactor blocks transported to Central Plateau for disposal.
? Removal of non-essential, surplus buildings and facilities that do not have identified post-cleanup uses.

Central Plateau Goal: The 200 Areas and Central Plateau will be used for the management of nuclear materials and for the collection and disposal of waste materials that remain onsite and for other related and compatible uses. Cleanup levels and disposal standards will be established that are consistent with these long-term uses.

Facilities Endstate

? Dismantle, or close through entombment, D&D facilities currently assigned to the ER program.
? Remove non-essential, surplus buildings and facilities that don't have identified post-cleanup uses.

South 600 Area Goal: The 300 Area waste sites, materials and facilities will be remediated to allow industrial and economic diversification opportunities. The federal government will retain ownership of land in and adjacent to the 300 and 400 Areas, but will lease land for private and public uses to support regional industrial and economic development. Excess land within the 1100 area will be targeted for transition to non-federal ownership.

Facilities Endstate

? Reuse facilities for economic diversification where feasible.
? Remove non-essential, surplus buildings and facilities that don't have identified post-cleanup uses.

The full list of science research awards that have the potential to address projects such as this one, which deals with Decontamination and Decommissioning problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "Decontamination and Decommissioning".

The following awards were identified through systems engineering to have the potential to address the specific needs of this Project. Those research awards that may have the strongest link to this project are designated by the symbol "§".

Award ID	Page #	Award Title
§ 54914-CA	B-73	Atmospheric-Pressure Plasma Cleaning of Contaminated Surfaces
§ 55380-IL	B-127	In-Situ Spectro-Electrochemical Studies of Radionuclide Contaminated Surface Films on Metals and the Mechanism of their Formation and Dissolution
§ 60283-IL	B-133	Waste Volume Reduction Using Surface Characterization and Decontamination by Laser Ablation

Awards Related to RL-ER06 Continued

Award ID	Page #	Award Title
§ 54724-NM	B-205	Synthesis of New Water-Soluble Metal-Binding Polymers: Combinatorial Chemistry Approach
§ 60363-NM	B-241	Optimization of Thermochemical, Kinetic, and Electrochemical Factors Governing Partitioning of Radionuclides during Melt Decontamination of Radioactively Contaminated Stainless Steel
§ 60041-OK	B-275	Removal of Radioactive Cations and Anions from Polluted Water Using Ligand-Modified Colloid-Enhanced Ultrafiltration
§ 55052-SC	B-295	Advanced Sensing and Control Techniques to Facilitate Semi-Autonomous Decommissioning
60328-CA	B-37	High Frequency Electromagnetic Impedance Measurements for Characterization, Monitoring and Verification Efforts
60370-CA	B-39	Rational Design of Metal Ion Sequestering Agents
54926-CA	B-75	Novel Ceramic-Polymer Composite Membranes for the Separation of Hazardous Liquid Waste
54847-CO	B-87	Photocatalytic and Chemical Oxidation of Organic Compounds in Supercritical Carbon Dioxide
55012-CO	B-89	Extraction and Recovery of Mercury and Lead from Aqueous Waste Streams Using Redox-active Layered Metal Chalcogenides
60141-DC	B-95	Gamma Ray Imaging for Environmental Remediation
54893-FL	B-99	Research Program to Determine Redox Properties and Their Effects on Speciation and Mobility of Pu in DOE Wastes
60424-ID	B-113	High Temperature Condensed Phase Mass Spectrometric Analysis
55247-IL	B-119	Sensors Using Molecular Recognition in Luminescent, Conductive Polymers
60247-IL	B-139	Miniature Nuclear Magnetic Resonance Spectrometer for In-Situ and In-Process Analysis and Monitoring
55211-IL	B-141	Cavitational Hydrothermal Oxidation: A New Remediation Process
54834-IN	B-143	An Investigation of Homogeneous and Heterogeneous Sonochemistry for Destruction of Hazardous Waste
54942-IN	B-147	Spectroscopy, Modeling and Computation of Metal Chelate Solubility in Supercritical CO_2
54791-KS	B-153	Managing Tight-binding Receptors for New Separations Technologies
54864-KS	B-157	Supramolecular Chemistry of Selective Anion Recognition for Anions of Environmental Relevance
60231-MD	B-165	Novel Miniature Spectrometer for Remote Chemical Detection
59977-MD	B-169	Synthesis and Characterization of Templated Ion Exchange Resins for the Selective Complexation of Actinide Ions
54571-MA	B-181	Removal of Heavy Metals and Organic Contaminants from Aqueous Streams by Novel Filtration Methods
55223-MO	B-197	De Novo Design of Ligands for Metal Separation
54770-NM	B-213	New Anion-Exchange Resins for Improved Separations of Nuclear Materials
59967-NM	B-217	Aqueous Electrochemical Mechanisms in Actinide Residue Processing
59981-NM	B-219	Real-Time Broad Spectrum Characterization of Hazardous Waste by Membrane Introduction Mass Spectrometry
55387-NM	B-237	Photooxidation of Organic Wastes Using Semiconductor Nanoclusters
60403-NM	B-243	Phase Chemistry of Tank Sludge Residual Components
60163-NM	B-249	Investigation of Techniques to Improve Continuous Air Monitors Under Conditions of High Dust Loading in Environmental Setting
54639-NM	B-251	Development of an In-Situ Microsensor for the Measurements of Chromium and Uranium in Groundwater at DOE Sites
54595-NM	B-255	f-Element Ion Chelation in Highly Basic Media
54674-OH	B-271	Design and Development of a New Hybrid Spectroelectrochemical Sensor

Awards Related to RL-ER06 Continued

Award ID	Page #	Award Title
60158-OR	B-279	Development of Radon-222 as a Natural Tracer for Monitoring the Remediation of NAPL Contamination in the Subsurface
54122-PA	B-281	A Broad Spectrum Catalytic System for Removal of Toxic Organics from Water By Deep Oxidation
54856-PA	B-289	Structural Biology of the Sequestration & Transport of Heavy Metal Toxins: NMR Structure Determination of Proteins Containing the -Cys-X-Y-Cys-metal Binding Motifs
54973-TN	B-301	A Novel Energy-Efficient Plasma Chemical Process for the Destruction of Volatile Toxic Compounds
55033-TN	B-305	Characterization of Chemically Modified Hyperthermophilic Enzymes for Chemical Syntheses and Bioremediation Reactions
55103-TN	B-311	Utilization of Kinetic Isotope Effects for the Concentration of Tritium
55276-TN	B-319	Fundamental Chemistry and Thermodynamics of Hydrothermal Oxidation Processes
60197-TN	B-329	Microsensors for In-situ Chemical, Physical, and Radiological Characterization of Mixed Waste
60218-TN	B-333	Novel Mass Spectrometry Mutation Screening for Contaminant Impact Analysis
54735-TX	B-343	Development of Inorganic Ion Exchangers for Nuclear Waste Remediation
55185-TX	B-349	New Strategies for Designing Inexpensive but Selective Bioadsorbants for Environmental Pollutants: Selection of Specific Ligands & Their Cell Surface Expression
54679-WA	B-367	Architectural Design Criteria for F-Block Metal Ion Sequestering Agents
54996-WA	B-371	Ionizing Radiation Induced Catalysis on Metal Oxide Particles
54897-WA	B-391	The Sonophysics and Sonochemistry of Liquid Waste Quantification and Remediation
55146-WA	B-393	Adsorption/Membrane Filtration as a Contaminant Concentration and Separation Process for Mixed Wastes and Tank Wastes
60050-WA	B-395	Chemical Speciation of Inorganic Compounds under Hydrothermal Conditions

Richland Operations Office

Hanford Site - Richland Operations Office

RL-ER07 - Post Closure Surveillance & Maintenance

Problem Area:	Decontamination and Decommissioning
Life-Cycle Cost in 2007+:	$56,000,000
DOE Project Manager:	J. D. Goodenough, 509-376-0893, richard_a_holten@rl.gov
Contractor Manager:	J.J. McGuire, 509-373-7253
For More Information:	http://www.doe.gov/em52/pbs/rl-er07.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Low **Worker:** Low **Environment:** Low

Technical Approach Provided by Project Manager:

Long-term LS&M of remediated waste sites and facilities is required to identify and mitigate problems associated with site restoration activities. The success rate of the revegetation efforts will be monitored through routine surveys, environmental monitoring, and vegetation management. Specific LS&M will be determined at the time of facility closure, final environmental remediation, and/or facility decommissioning.

The long term S&M Project should not produce any waste quantities requiring disposal.

Post 2006 Project Scope Provided by Project Manager:

The LT S&M will continue past the final site remediation to ensure the effectiveness of the revegetation efforts to support future land uses.

Project End State Provided by Project Manager:

The long term S&M Project will support the goals and endstates for all areas of the Hanford Site. See other ER PBSs for endstate specifics.

The full list of science research awards that have the potential to address projects such as this one, which deals with Decontamination and Decommissioning problems, are listed in the <u>Index of Research Awards by Environmental Management Problem Area</u>, in the back of this appendix, under the heading "Decontamination and Decommissioning".

Richland Operations Office

Hanford Site - Richland Operations Office

RL-ER08 - Groundwater Management

Problem Area: Remedial Action
Life-Cycle Cost in 2007+: $336,000,000
DOE Project Manager: K. M. Thompson, 509-373-0750
Contractor Manager: G.C. Henckel, 509-372-9381, gchencke@bhi_erc.com
For More Information: http://www.doe.gov/em52/pbs/rl-er08.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: **Worker:** **Environment:**

Technical Approach Provided by Project Manager:

The Groundwater Management Project will produce waste from the treatment of the groundwater. These wastes will be disposed of in the ER Disposal Facility and other approved facilities. The 200 UP groundwater will be treated in the 200 Area ETF. Wastes produced from the 200 UP groundwater treatment will also be disposed of in the ER Disposal Facility.

The Hanford Site utilizes the Site Technology Coordination Group to identify technology needs for Hanford Projects. Once the needs are identified they are presented to the Technology Management Council which determines which needs should be forwarded as funding requests to DOE-HQ EM 50 National Focus Areas. When approved, the technology demonstration is performed as an integrated EM-40 and EM-50 activity.

The following technology needs have been identified as high priority for ground water remediation:

Detection and characterization of radioactive contaminants and metals in groundwater. In-situ treatment of radioactive contaminants and metals in groundwater.

Post 2006 Project Scope Provided by Project Manager:

The Groundwater Management Project will continue past FY06. Groundwater remediation activities will continue for 100 NR-2 through FY2007, and sitewide groundwater monitoring activities will continue through FY2043.

Project End State Provided by Project Manager:

The Groundwater Management Project will support the goals and endstates for the areas of the Hanford referenced in the Hanford Site Strategic Plan as the Reactors on the River, the Central Plateau, the South 600 Area and Central Core.

Reactors on the River Goal: Remove and/or stabilize spent fuel, surplus facilities, and waste sites to protect groundwater and the Columbia River and to ensure protection of people, the environment, and natural/cultural resources. Pending Congressional action on the Wild and Scenic River designation, use will continue to be restricted; sensitive ecological, cultural, and native American resources will be protected.

Groundwater Endstate: Groundwater use remains restricted for a yet to be determined period; groundwater intercepted or contained to protect the Columbia River and the environment. Final cleanup levels will be established within individual RODs or Permit Modifications.

Central Plateau Goal: The 200 Areas and central plateau will be used for the management of nuclear materials and the collection and disposal of waste materials that remain onsite and for other related and compatible uses. Cleanup levels and disposal standards will be established that are consistent with these long-term uses.

Groundwater Endstate: Groundwater use remains restricted for a yet to be determined period; groundwater will be intercepted or contained to within designated boundaries. Final cleanup levels will be established within individual RODs or Permit Modifications.

South 600 Area Goal: The 300 Area waste sites, materials, and facilities will be remediated to allow industrial and economic diversification opportunities. The federal government will retain ownership of land in and adjacent to the 300 and 400 Areas, but will lease land for private and public uses to support regional industrial and economic development. Excess land within the 1100 area will be targeted for transition to non-Federal ownership.

Groundwater Endstate: Groundwater use remains restricted for a yet to be determined period; existing site plumes will continue to be monitored. Final cleanup levels will be established within individual RODs or Permit Modifications.

Central Core Area Goal: This area will remain in Federal ownership consistent with safety analysis boundaries and continued waste management operations in the 200 Area. These areas will be available for other Federal programs or leased for non-Federal uses, consistent with appropriate recognition of cultural and ecosystem values.

Groundwater Endstate: Monitor existing groundwater site plumes; intercept or contain as necessary to protect the Columbia River. Groundwater use remains restricted for a yet to be determined period.

The full list of science research awards that have the potential to address projects such as this one, which deals with Remedial Action problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "Remedial Action".

The following awards were identified through systems engineering to have the potential to address the specific needs of this Project. Those research awards that may have the strongest link to this project are designated by the symbol "§".

Award ID	Page #	Award Title
§ 55164-AL	B-3	Advanced Experimental Analysis of Controls on Microbial Fe(III) Oxide Reduction
§ 54898-AZ	B-5	Molecular Dissection of the Cellular Mechanisms Involved in Nickel Hyperaccumulation in Plants
§ 55097-CA	B-15	Heavy Metal Pumps in Plants
§ 55278-CA	B-17	Molecular Genetics of Metal Detoxification: Prospects for Phytoremediation
§ 54698-CA	B-19	Rapid Mass Spectrometric DNA Diagnostics for Assessing Microbial Community Activity During Bioremediation
§ 55264-CA	B-21	Subsurface High Resolution Definition of Subsurface Heterogeneity for Understanding the Biodynamics of Natural Field Systems: Advancing the Ability for Scaling to Field Conditions
§ 55343-CA	B-25	Enzyme Engineering for Biodegradation of Chlorinated Organic Pollutants
§ 55396-CA	B-33	Sorption of Colloids, Organics, and Metals onto Gas-Water Interfaces: Transport Mechanisms and Potential Remediation Technology
§ 60328-CA	B-37	High Frequency Electromagnetic Impedance Measurements for Characterization, Monitoring and Verification Efforts
§ 55011-CA	B-43	Surface and Borehole Electromagnetic Imaging of Conducting Contaminant Plumes
§ 54666-CA	B-57	Mechanisms, Chemistry, and Kinectics of Anaerobic Biodegradation of Cis-Dichloroethylene and Vinyl Chloride
§ 54681-CA	B-67	Dynamics of Coupled Contaminant and Microbial Transport in Heterogeneous Porous Media
§ 55118-CA	B-71	Plant Rhizosphere Effects on Metal Mobilization and Transport
§ 55061-CA	B-77	Fundamental Studies of the Removal of Contaminants from Ground and Waste Waters via Reduction by Zero-Valent Metals
§ 55041-CA	B-79	Molecular Characterization of a Novel Heavy Metal Uptake Transporter from Higher Plants & its Potential for Use in Phytoremediation
§ 54661-DE	B-91	Electrochemical Processes for In-Situ Treatment of Contaminated Soils

Awards Related to RL-ER08 Continued

Award ID	Page #	Award Title
§ 54893-FL	B-99	Research Program to Determine Redox Properties and Their Effects on Speciation and Mobility of Pu in DOE Wastes
§ 55218-GA	B-107	Seismic Surface-Wave Tomography of Waste Sites
§ 55416-ID	B-111	Control of Biologically Active Degradation Zones by Vertical Heterogeneity: Applications in Fractured Media
§ 55374-IL	B-125	Use of Sonication for In-Well Softening of Semivolatile Organic Compounds
§ 55388-IL	B-131	Stable Isotopic Investigations of in situ Bioremediation of Chlorinated Organic Solvents
§ 60199-KS	B-159	Seismic-Reflection and Ground Penetrating Radar for Environmental Site Characterization
§ 59786-MD	B-167	Design and Construction of Deinococcus radiodurans for Biodegradation of Organic Toxins at Radioactive DOE Waste Sites
§ 55152-MD	B-171	Molecular Profiling of Microbial Communities from Contaminated Sources: Use of Subtractive Cloning Methods and rDNA Spacer Sequences
§ 54683-MA	B-173	Speciation and Structural Characterization of Plutonium and Actinide-organic Complexes in Surface and Groundwaters
§ 54888-MA	B-175	Manipulating Subsurface Colloids to Enhance Cleanups of DOE Waste Sites
§ 55300-MA	B-179	3-D Spectral IP Imaging: Non-Invasive Characterization of Contaminant Plumes
§ 55105-MI	B-183	Complete Detoxification of Short Chain Chlorinated Aliphatics: Isolation of Halorespiring Organisms and Biochemical Studies of the Dehalogenating Enzyme Systems
§ 54680-MI	B-187	The Migration and Entrapment of DNAPLs in Physically and Chemically Heterogeneous Porous Media
§ 60271-NH	B-199	Characterization of a New Family of Metal Transport Proteins
§ 55395-NM	B-239	Physics of DNAPL Migration and Remediation in the Presence of Heterogeneities
§ 54857-NM	B-245	Surface Nuclear Magnetic Resonance Imaging of Water Content Distribution in the Subsurface
§ 54639-NM	B-251	Development of an In-Situ Microsensor for the Measurements of Chromium and Uranium in Groundwater at DOE Sites
§ 54585-OH	B-269	Permanganate Treatment of DNAPLs in Reactive Barriers and Source Zone Flooding Schemes
§ 55196-OR	B-277	In Situ, Field Scale Evaluation of Surfactant Enhanced DNAPL Recovery Using a Single-Well, Push-Pull Test
§ 54122-PA	B-281	A Broad Spectrum Catalytic System for Removal of Toxic Organics from Water By Deep Oxidation
§ 55205-SC	B-299	A Fundamental Study of Laser-Induced Breakdown Spectroscopy Using Fiber Optics for Remote Measurements of Trace Metals
§ 55013-TN	B-303	Biofiltration of Volatile Pollutants: Engineering Mechanisms for Improved Design, Long-term Operation, Prediction and Implementation
§ 55033-TN	B-305	Characterization of Chemically Modified Hyperthermophilic Enzymes for Chemical Syntheses and Bioremediation Reactions
§ 55108-TN	B-313	Monitoring Genetic & Metabolic Potential for In Situ Bioremediation: Mass Spectrometry
§ 55119-TN	B-315	Phase Equilibria Modification by Electric Fields
§ 55267-TN	B-317	Containment of Toxic Metals and Radionuclides in Porous and Fractured Media: Optimizing Biogeochemical Reduction versus Geochemical Oxidation
§ 60197-TN	B-329	Microsensors for In-situ Chemical, Physical, and Radiological Characterization of Mixed Waste
§ 55185-TX	B-349	New Strategies for Designing Inexpensive but Selective Bioadsorbants for Environmental Pollutants: Selection of Specific Ligands & Their Cell Surface Expression

Awards Related to RL-ER08 Continued

Award ID	Page #	Award Title
§ 60069-VT	B-355	Least-Cost Groundwater Remediation Design Using Uncertain Hydrogeological Information
§ 55031-WA	B-373	Genetic Analysis of Stress Responses in Soil Bacteria for Enhanced Bioremediation of Mixed Contaminants
§ 54889-WA	B-389	Using Trees to Remediate Groundwaters Contaminated with Chlorinated Hydrocarbons
§ 54790-CAN-ON	B-407	Microbial Mineral Transformations at the Fe(II)/Fe(III) Redox Boundary for Solid Phase Capture of Strontium and Other Metal/Radionuclide Contaminants
55318-CA	B-23	Improved Analytical Characterization of Solid Waste-Forms by Fundamental Development of Laser Ablation Technology
54546-CA	B-61	Engineered Antibodies for Monitoring of Polynuclear Aromatic Hydrocarbons
54847-CO	B-87	Photocatalytic and Chemical Oxidation of Organic Compounds in Supercritical Carbon Dioxide
55012-CO	B-89	Extraction and Recovery of Mercury and Lead from Aqueous Waste Streams Using Redox-active Layered Metal Chalcogenides
60141-DC	B-95	Gamma Ray Imaging for Environmental Remediation
55247-IL	B-119	Sensors Using Molecular Recognition in Luminescent, Conductive Polymers
55294-IL	B-121	Superconducting Open-Gradient Magnetic Separation for the Pretreatment of Radioactive or Mixed Waste Vitrification Feeds
55380-IL	B-127	In-Situ Spectro-Electrochemical Studies of Radionuclide Contaminated Surface Films on Metals and the Mechanism of their Formation and Dissolution
55211-IL	B-141	Cavitational Hydrothermal Oxidation: A New Remediation Process
54791-KS	B-153	Managing Tight-binding Receptors for New Separations Technologies
60231-MD	B-165	Novel Miniature Spectrometer for Remote Chemical Detection
59977-MD	B-169	Synthesis and Characterization of Templated Ion Exchange Resins for the Selective Complexation of Actinide Ions
54571-MA	B-181	Removal of Heavy Metals and Organic Contaminants from Aqueous Streams by Novel Filtration Methods
54724-NM	B-205	Synthesis of New Water-Soluble Metal-Binding Polymers: Combinatorial Chemistry Approach
54751-NM	B-209	High Fluence Neutron Source for Nondestructive Characterization of Nuclear Waste
55387-NM	B-237	Photooxidation of Organic Wastes Using Semiconductor Nanoclusters
60363-NM	B-241	Optimization of Thermochemical, Kinetic, and Electrochemical Factors Governing Partitioning of Radionuclides during Melt Decontamination of Radioactively Contaminated Stainless Steel
60474-OH	B-273	Develop and Demonstrate Novel Ultrahigh Sensitivity Heavy Noble Gas Detectors for Long-Term Monitoring of Spent Fuel and TRU Waste
60041-OK	B-275	Removal of Radioactive Cations and Anions from Polluted Water Using Ligand-Modified Colloid-Enhanced Ultrafiltration
60017-PA	B-285	Removal of Technetium, Carbon Tetrachloride, and Metals from DOE Properties
54856-PA	B-289	Structural Biology of the Sequestration & Transport of Heavy Metal Toxins: NMR Structure Determination of Proteins Containing the -Cys-X-Y-Cys-metal Binding Motifs
54973-TN	B-301	A Novel Energy-Efficient Plasma Chemical Process for the Destruction of Volatile Toxic Compounds
55103-TN	B-311	Utilization of Kinetic Isotope Effects for the Concentration of Tritium
54735-TX	B-343	Development of Inorganic Ion Exchangers for Nuclear Waste Remediation
55115-TX	B-345	The Adsorption and Reaction of Halogenated Volatile Organic Compounds (VOC's) on Metal Oxides
54897-WA	B-391	The Sonophysics and Sonochemistry of Liquid Waste Quantification and Remediation

Awards Related to RL-ER08 Continued

Award ID	Page #	Award Title
60050-WA	B-395	Chemical Speciation of Inorganic Compounds under Hydrothermal Conditions
59925-WV	B-403	Modeling of Diffusion of Plutonium in Other Metals and of Gaseous Species in Plutonium-Based Systems

Richland Operations Office

Hanford Site - Richland Operations Office

RL-TP02 - Waste Encapsulation and Storage Facility (WESF) Sub-Project

Problem Area:	Nuclear Materials
Life-Cycle Cost in 2007+:	$98,000,000
DOE Project Manager:	James E. Mecca, 509-376-7471, james_e_mecca@rl.gov
Contractor Manager:	Larry J. Olguin, 509-372-8233, l_j_larry_olguin@rl.gov
For More Information:	http://www.doe.gov/em52/pbs/rl-tp02.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: High **Worker:** Low **Environment:** Urgent

Technical Approach Provided by Project Manager:

a. Operations, surveillance and maintenance will be performed commensurate with the requirements provided in the authorization/safety basis, DOE conduct of maintenance and operations requirements.
b. Hot cell cleanout will be performed using commercially available shipping and disposal system as necessary to comply with Hanford waste acceptance criteria. Cell decontamination will employ existing technologies unless considerable cost benefit is realized from advanced technological methods.
c. Technologies for ensuring capsule integrity will be identified based on technical assessment provided in the capsule integrity program plan and will include but not be limited to radiography, leak detection, ultrasonic inspection, ion exchange, eddy current, on-line process control, engineering failsafe control development.
d. Life cycle based equipment replacement strategies has been performed based on engineering standard equipment life and has been validated through the ABC process.
e. Disposition planning will integral with HLW program planning, existing data on WESF capsule makeup and system capabilities.

Post 2006 Project Scope Provided by Project Manager:

Transfer capsules to Vitrification plant starting in 2013 for blend into feed. Continue transfer for four years to 2017 then deactivated facility 2018-2019. Transfer facility to ER.

Project End State Provided by Project Manager:

The WESF project will be stabilized and turned over to the ER Project after the capsules are removed and the facility has been deactivated and will subsequently be maintained in a safe and compliant state pending final disposition.

The full list of science research awards that have the potential to address projects such as this one, which deals with Nuclear Materials problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "Nuclear Materials".

Richland Operations Office

Hanford Site - Richland Operations Office

RL-TP05 - Plutonium Finishing Plant Deactivation

Problem Area:	Decontamination and Decommissioning
Life-Cycle Cost in 2007+:	$84,000,000
DOE Project Manager:	James E. Mecca, 509-376-7471, james_e_mecca@rl.gov
Contractor Manager:	Larry J. Olguin, 509-372-8233, l_j_larry_olguin@rl.gov
For More Information:	http://www.doe.gov/em52/pbs/rl-tp05.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Low **Worker:** High **Environment:** Medium

Technical Approach Provided by Project Manager:

The detailed plan for deactivation of the PFP facilities has not been developed to the extent that breakthrough thinking can be applied in order to realize savings and decrease the scheduled time estimated to complete the project. As the Deactivation Plan for each facility is developed, methods to improve efficiency will be explored and utilized as warranted. The technical functions to be accomplished to support the PFP Deactivation Project include:

1) General technical requirements define the PFP Deactivation Project's overall approach to fulfilling the end point condition required for the transfer of the PFP Complex deactivated facilities to the ERC. Applicable requirements set forth in DOE/EM-0318, Facility Deactivation Guide--Methods and Practices Handbook, DOE/EM-0246, Environmental Restoration Program Decommissioning Resource Manual, and DOE Order 430.1, Life-Cycle Asset Management are being used as guidance. These documents apply to the development of end point criteria for facility turnover to EM-40.

2) Applicable "Lessons Learned" from PUREX/UO3, FFTF, B Plant, 308/309 Facilities, and the FERMCO site in the USA and Sellafield experience from the United Kingdom will be incorporated into the planning and execution of the PFP Projects.

3) Plant configuration will be modified and controlled sufficiently to enable safety and regulatory compliance during Project performance and post-project Surveillance and Maintenance activities. Changes to the process or infrastructure that controls configuration will be changed only in specific cases approved by Project Management.

4) Records will be established and archived for reactivating D&D essential systems and providing meaningful D&D characterization. As a minimum, the following records will be established and maintained:

Location, identification, and qualification of hazardous materials that are attached/contained and cannot be removed without D&D.

Final radiological status surveys.

Certified vendor information files, equipment operating procedures, records, drawings, photographs, etc., that reflect as-left configuration.

Information required to reactivate elevator systems.

Zero energy check records for electrical circuits that were de-energized.

Records for installed piping system and equipment blanks.

Documentation showing that locations where source and special materials were handled and/or stored were examined and material accounted for.

Radiological posting in compliance with applicable requirements set forth in WHC-CM-1-6, Radiological Control Manual.

Pending radiation occurrence reports, event fact sheets, unusual occurrence reports and any other out-of-standard condition reports finalized and closed out.

The PFP Plant Safety Basis revised for the post-deactivation surveillance and maintenance period.

Documentation demonstrating compliance with worker safety and health prepared in accordance with the Project-specific requirements.

Any required permits relating to the facility's current or anticipated use will be obtained. Activities will not preclude subsequent closure options until permitting dictates final closure.
End point criteria completed and approved by the responsible personnel performing the actual work, the overview organizations, and plant management.
End Point Matrix documents will be used to document the plant condition for turnover to EM-40.

5) The development of a Surveillance and Maintenance Plan is required by the TPA, Section 8.0, and DOE/EM-0246,"Decommissioning Resource Manual".

6) Facility deactivation and decontamination options will be presented and will include technologies used at PUREX and those available at other DOE and commercial sites (wet chemistry, hydro lasers, wipes, mechanical means, etc.). Preliminary assessments of NEPA and/or other required documentation (hazard analyses, FSAR, Orders, etc.) will be performed relative to the proposed options to identify applicability and adequacy of existing PFP environmental documentation.

7) Materials will be removed and/or stabilized sufficiently to ensure that the plant complies with WHC-CM-7-5, Environmental Compliance, and WHC-CM-1-6, Radiological Control Manual, as applicable to a unoccupied facility after completion of deactivation. As a general guide, as-left contamination and radiation levels in plant areas should be no more than the levels encountered during normal operation and occupancy of the plants. End point matrix documents will be used to document SSC condition for turnover to ERC/EM-40.

8) To ensure long-term safety and regulatory compliance, the following requirements apply:

Permanent radiation zones to be entered for surveillance will be decontaminated and released or the surface contamination levels reduced or stabilized to minimize re-suspension and/or migration of loose contamination.
Packaged radioactive and mixed waste with identified final disposition will be removed and disposed of in accordance with WAC 173-303. Wastes that are not removed will be identified, characterized, and documented.
Accessible interior glove box surfaces will be decontaminated or the surface contamination stabilized. Openings to glove boxes will be sealed in a manner that ensures confinement of remaining contamination.
Loose or damaged (friable) asbestos in areas expected to be entered during surveillance will be removed or stabilized.
Fissile materials will be removed sufficiently to eliminate the potential for a nuclear criticality excursion and the need for a criticality alarm system.
Tanks, vessels, and drums will be drained using installed equipment and features. Heels will not contain material classified as hazardous waste.
Hazardous materials used for deactivation and cleanup work will be collected and disposed of in accordance with WAC 173-303.
Emergency lighting will be deactivated and associated batteries will be removed from the facility.

9) Breakthrough technology has been factored into the planning to the extent possible. The removal of all PFP gloveboxes, versus the in place terminal cleanout and contamination fixation coatings, has been incorporated into the Program Baseline Summary. Innovative breakthrough technologies associated with glove box removal will be factored into the baseline as they are developed.

10) The method developed to ensure completion and documentation of facility transition to an identified set of End Point Criteria is called End Points, or the End Point Process. The combination of End Point Criteria and End Points ensure the facility at completion of transition will be in a condition acceptable for transfer from the Office of Facility Transition and Management (EM-60) to the Office of Environmental Restoration (EM-40) for interim Surveillance and Maintenance (S&M), pending final decommissioning. The End Point Criteria and End Points are negotiated for each facility, and for areas, spaces, systems, and components within each facility. The parties involved in the negotiations are the Hanford ERC, the Hanford Integration Contractor, the PFP operating contractor, DOE-RL, and DOE-HQ.

Post 2006 Project Scope Provided by Project Manager:

Deactivation work is delayed two years (FY 1998 and FY 1999) due to funding constraints with funding priority being given to DNFSB Recommendation 94-1 stabilization (Refer to PBS#:RL-TP06, PFP Stabilization). Deactivation work is again delayed in FY 2001 and FY 2002 in order to fund activities to meet DNFSB 94-1 commitments. Completion of the non-vault related facilities deactivation is planned for FY 2014. The PFP Deactivation Project scope will remain the same as the end of FY 2014 (See Section A:1.4 above) until FY 2025. Commencing in FY 2025, the stored Plutonium will be transported to the onsite High-Level Waste Immobilization Facility. During that time, deactivation activities will commence on the two (2) major facilities and nine (9) support facilities that comprise the PFP Vault Management Project (refer PBS#:RL-TP07) with deactivation completing in approximately FY2028.

Project End State Provided by Project Manager:

After the plutonium bearing materials have been removed from the PFP vaults the remaining facilities will be deactivated as part of the PFP Deactivation Project in the Fiscal Years 2025 through FY 2028. The remaining facilities will be maintained in a safe and compliant state pending final disposition.

The full list of science research awards that have the potential to address projects such as this one, which deals with Decontamination and Decommissioning problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "Decontamination and Decommissioning".

The following awards were identified through systems engineering to have the potential to address the specific needs of this Project. Those research awards that may have the strongest link to this project are designated by the symbol "§".

Award ID	Page #	Award Title
§ 54914-CA	B-73	Atmospheric-Pressure Plasma Cleaning of Contaminated Surfaces
§ 55380-IL	B-127	In-Situ Spectro-Electrochemical Studies of Radionuclide Contaminated Surface Films on Metals and the Mechanism of their Formation and Dissolution
§ 60283-IL	B-133	Waste Volume Reduction Using Surface Characterization and Decontamination by Laser Ablation
§ 54724-NM	B-205	Synthesis of New Water-Soluble Metal-Binding Polymers: Combinatorial Chemistry Approach
§ 60363-NM	B-241	Optimization of Thermochemical, Kinetic, and Electrochemical Factors Governing Partitioning of Radionuclides during Melt Decontamination of Radioactively Contaminated Stainless Steel
§ 60040-NY	B-257	Development of Monitoring and Diagnostic Methods for Robots Used in Remediation of Waste Sites
§ 60041-OK	B-275	Removal of Radioactive Cations and Anions from Polluted Water Using Ligand-Modified Colloid-Enhanced Ultrafiltration
§ 55052-SC	B-295	Advanced Sensing and Control Techniques to Facilitate Semi-Autonomous Decommissioning
55318-CA	B-23	Improved Analytical Characterization of Solid Waste-Forms by Fundamental Development of Laser Ablation Technology
55356-CA	B-29	Environmentally-induced Malignancies: An In Vivo Model to Evaluate the Health Impact of Chemicals in Mixed Waste
60328-CA	B-37	High Frequency Electromagnetic Impedance Measurements for Characterization, Monitoring and Verification Efforts
60370-CA	B-39	Rational Design of Metal Ion Sequestering Agents
60319-CA	B-51	Thermodynamics of the Volatilization of Actinide Metals in the High-Temperature Treatment of Radioactive Wastes
54546-CA	B-61	Engineered Antibodies for Monitoring of Polynuclear Aromatic Hydrocarbons
54926-CA	B-75	Novel Ceramic-Polymer Composite Membranes for the Separation of Hazardous Liquid Waste

Awards Related to RL-TP05 Continued

Award ID	Page #	Award Title
60162-CO	B-85	Enhancements to and Characterization of the Very Early Time Electromagnetic (VETEM) Prototype Instrument and Applications to Shallow Subsurface Imaging at Sites in the DOE Complex
54847-CO	B-87	Photocatalytic and Chemical Oxidation of Organic Compounds in Supercritical Carbon Dioxide
55012-CO	B-89	Extraction and Recovery of Mercury and Lead from Aqueous Waste Streams Using Redox-active Layered Metal Chalcogenides
60141-DC	B-95	Gamma Ray Imaging for Environmental Remediation
54893-FL	B-99	Research Program to Determine Redox Properties and Their Effects on Speciation and Mobility of Pu in DOE Wastes
55218-GA	B-107	Seismic Surface-Wave Tomography of Waste Sites
55247-IL	B-119	Sensors Using Molecular Recognition in Luminescent, Conductive Polymers
55211-IL	B-141	Cavitational Hydrothermal Oxidation: A New Remediation Process
54834-IN	B-143	An Investigation of Homogeneous and Heterogeneous Sonochemistry for Destruction of Hazardous Waste
54942-IN	B-147	Spectroscopy, Modeling and Computation of Metal Chelate Solubility in Supercritical CO_2
54791-KS	B-153	Managing Tight-binding Receptors for New Separations Technologies
54864-KS	B-157	Supramolecular Chemistry of Selective Anion Recognition for Anions of Environmental Relevance
60199-KS	B-159	Seismic-Reflection and Ground Penetrating Radar for Environmental Site Characterization
60231-MD	B-165	Novel Miniature Spectrometer for Remote Chemical Detection
59977-MD	B-169	Synthesis and Characterization of Templated Ion Exchange Resins for the Selective Complexation of Actinide Ions
55300-MA	B-179	3-D Spectral IP Imaging: Non-Invasive Characterization of Contaminant Plumes
54571-MA	B-181	Removal of Heavy Metals and Organic Contaminants from Aqueous Streams by Novel Filtration Methods
55223-MO	B-197	De Novo Design of Ligands for Metal Separation
60271-NH	B-199	Characterization of a New Family of Metal Transport Proteins
54770-NM	B-213	New Anion-Exchange Resins for Improved Separations of Nuclear Materials
59967-NM	B-217	Aqueous Electrochemical Mechanisms in Actinide Residue Processing
59981-NM	B-219	Real-Time Broad Spectrum Characterization of Hazardous Waste by Membrane Introduction Mass Spectrometry
55387-NM	B-237	Photooxidation of Organic Wastes Using Semiconductor Nanoclusters
60403-NM	B-243	Phase Chemistry of Tank Sludge Residual Components
54639-NM	B-251	Development of an In-Situ Microsensor for the Measurements of Chromium and Uranium in Groundwater at DOE Sites
54595-NM	B-255	f-Element Ion Chelation in Highly Basic Media
55100-NY	B-261	Human Genetic Marker for Resistance to Radiations and Chemicals
60474-OH	B-273	Develop and Demonstrate Novel Ultrahigh Sensitivity Heavy Noble Gas Detectors for Long-Term Monitoring of Spent Fuel and TRU Waste
54122-PA	B-281	A Broad Spectrum Catalytic System for Removal of Toxic Organics from Water By Deep Oxidation
54856-PA	B-289	Structural Biology of the Sequestration & Transport of Heavy Metal Toxins: NMR Structure Determination of Proteins Containing the -Cys-X-Y-Cys-metal Binding Motifs
55205-SC	B-299	A Fundamental Study of Laser-Induced Breakdown Spectroscopy Using Fiber Optics for Remote Measurements of Trace Metals
55033-TN	B-305	Characterization of Chemically Modified Hyperthermophilic Enzymes for Chemical Syntheses and Bioremediation Reactions

Awards Related to RL-TP05 Continued

Award ID	Page #	Award Title
55276-TN	B-319	Fundamental Chemistry and Thermodynamics of Hydrothermal Oxidation Processes
60197-TN	B-329	Microsensors for In-situ Chemical, Physical, and Radiological Characterization of Mixed Waste
60218-TN	B-333	Novel Mass Spectrometry Mutation Screening for Contaminant Impact Analysis
55185-TX	B-349	New Strategies for Designing Inexpensive but Selective Bioadsorbants for Environmental Pollutants: Selection of Specific Ligands & Their Cell Surface Expression
54679-WA	B-367	Architectural Design Criteria for F-Block Metal Ion Sequestering Agents
54897-WA	B-391	The Sonophysics and Sonochemistry of Liquid Waste Quantification and Remediation
55146-WA	B-393	Adsorption/Membrane Filtration as a Contaminant Concentration and Separation Process for Mixed Wastes and Tank Wastes
60050-WA	B-395	Chemical Speciation of Inorganic Compounds under Hydrothermal Conditions

Richland Operations Office

Hanford Site - Richland Operations Office

RL-TP07 - Plutonium Finishing Plant (PFP) Vault Management

Problem Area: Nuclear Materials
Life-Cycle Cost in 2007+: $661,000,000
DOE Project Manager: James E. Mecca, 509-376-7471, james_e_mecca@mail.rl.gov
Contractor Manager: Larry J. Olguin, 509-372-8233, l_j_larry_olguin@rl.gov
For More Information: http://www.doe.gov/em52/pbs/rl-tp07.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Urgent **Worker:** Urgent **Environment:** Urgent

Technical Approach Provided by Project Manager:

The technical functions to be accomplished to support the PFP Vault Management Project include:

1. Operate and maintain PFP in a formal, safe and secure manner in compliance with applicable regulations. Comply with DOE Orders 5630.11A, 5633.2A, 5480.1B, 5480.7A, 5480.10, 5480.11, 5480.19, 5480.21, 5480.22, 5480.24, 5480.26

2. Storage activities to include surveillance, occasional container handling required for stabilization of materials to the specifications in the DOE Standard - Criteria for Safe Storage of Plutonium Metals and Oxides (DOE-STD-3013-96), and shipping and receiving of SNM as directed by the DOE.

3. Operate and maintain the following buildings to support the material management, material stabilization, material dispositioning, or deactivation activities: Major former operations buildings currently being utilized to support the material management and material dispositioning activity are the 234-5Z, 232-Z, 236-Z, 241-Z, 242-Z, 243-Z, 291-Z, 2736-Z, and 2736-ZB buildings. Also included is the current operated 243-Z Low Level Wastewater Treatment Facility, which discharges drinking standard liquid effluents from PFP to the 200 East Area TEDF.

4. Technical training support is included which consists of development of training certification packages and performance of training and testing, as required by DOE Order 5480.18A and 5480.20.

5. Perform engineering studies, prepare functional design criteria, manage conceptual design, and provide expense support for plant capital and expense projects necessary to correct identified deficiencies, as required by RCRA and WAC 173-303.

6. Perform evaluations and engineering studies utilizing Best Available Technology/All Known, Available, and Reasonable Treatment (BAT/AKART) for air and liquid effluents.

7. Conduct air emission inventories, update FEMPs, assess compliance with NESHAPs (40 CFR 61) monitoring requirements, and support preparation of annual Hanford Site air emissions reports.

8. As a material management responsibility PFP will continue to store most of the remaining SNM at the Hanford Site in safe, secure vaults within the PFP protected area per DOE Orders 5630.11A, 5633.2A and 5480.1B. Operation of storage vaults, shipping/receiving capability and associated security and support requirements will continue indefinitely until the SNM is dispositioned for disposal or transferred to another onsite or offsite facility.

9. Upgrades to the existing facility infrastructure to enable the facility to support plutonium handling in a cost-effective manner. These upgrades are not fully defined but include replacement of the steam system with electric service, replacement of old ventilation control equipment with more reliable and maintainable systems, and modification of facilities as required to support the general stabilization and deactivation of the PFP complex. Also included is a major upgrade to the PFP Vaults, as part of the life cycle costs, in the five year period 2015 through 2020.

10. Modernization of the existing SAS systems to provide maintainable remote inventory and surveillance capabilities, part of the material management responsibility.

11 Maintain facility Safety Analysis Report (SAR) and safety documentation per DOE Orders, particularly 5480.23.

12. Support for all general plant and small plant projects as well as support for two line-item-funded projects envisioned as part of DNFSB 94-1: one for the new packaging system and associated vault modifications, and one for the facility upgrades. The SAS system modernization is expected to be expense-funded replacement-in-kind. The laboratory upgrades are expected to be within the constraints of a general plant project.

13. Vault #3 will remain under the custody of the IAEA and once vault modifications for the new DOE packaging standard are effected other vaults will be turned over to IAEA custodianship.

Post 2006 Project Scope Provided by Project Manager:

The Project scope will remain the same as the end of the year 2006 (See Section A.1.4 above) until the year 2025. At that time stored Plutonium is assumed to be transported to the onsite High-Level Waste Immobilization Facility during fiscal years 2026 and 2027. Final vault deactivation concludes in FY 2028 with turnover to the EM-40 by FY 2029.

Project End State Provided by Project Manager:

After the Plutonium materials have been removed in the Fiscal Years 2025 through FY 2028 the remaining facilities will be deactivated as the PFP Deactivation Project is completed. The remaining facilities will then be turned over to the environmental restoration program for Decontamination and Decommissioning after FY 2028.

The full list of science research awards that have the potential to address projects such as this one, which deals with Nuclear Materials problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "Nuclear Materials".

The following awards were identified through systems engineering to have the potential to address the specific needs of this Project. Those research awards that may have the strongest link to this project are designated by the symbol "§".

Award ID	Page #	Award Title
§ 55382-IL	B-129	Determination of Transmutation Effects in Crystalline Waste Forms
§ 60118-NM	B-229	Fundamental Thermodynamics of Actinide-Bearing Mineral Waste Forms
§ 60077-TN	B-327	Development of Nuclear Analysis Capabilities for DOE Waste Management Activities
54893-FL	B-99	Research Program to Determine Redox Properties and Their Effects on Speciation and Mobility of Pu in DOE Wastes
60040-NY	B-257	Development of Monitoring and Diagnostic Methods for Robots Used in Remediation of Waste Sites
55052-SC	B-295	Advanced Sensing and Control Techniques to Facilitate Semi-Autonomous Decommissioning
60197-TN	B-329	Microsensors for In-situ Chemical, Physical, and Radiological Characterization of Mixed Waste
54672-WA	B-365	Radiation Effects in Nuclear Waste Materials
59925-WV	B-403	Modeling of Diffusion of Plutonium in Other Metals and of Gaseous Species in Plutonium-Based Systems

Richland Operations Office

Hanford Site - Richland Operations Office

RL-TP10 - Accelerated Deactivation

Problem Area:	Decontamination and Decommissioning
Life-Cycle Cost in 2007+:	$243,000,000
DOE Project Manager:	James E. Mecca, 509-376-7471, james_e_mecca@rl.gov
Contractor Manager:	Larry J. Olguin, 509-372-8233, l_j_larry_olguin@rl.gov
For More Information:	http://www.doe.gov/em52/pbs/rl-tp10.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Low **Worker:** Medium **Environment:** Medium

Technical Approach Provided by Project Manager:

Monitoring and minimum safe S&M will be performed on 222T, 222U, 2704C and 231-Z. As funding becomes available in FY 00, end point criteria and deactivation planning for these facilities will begin.

In FY 01, a strategic plan for receipt of remaining facilities will be developed. Facility assessments will be performed initially on those facilities that no longer have viable missions to provide information to determine the relative risk of each facility and develop a scope of work to deactivate each facility. Specific facility endpoints will be developed and a prioritization of the facilities will be performed based upon risk reduction, mortgage reduction and maximization of cleanup progress. A schedule showing the sequence of buildings and necessary funding will be developed and captured in a Project Management Plan (PMP). Regulatory documentation will be prepared as necessary. The PMP will be updated annually to include facilities as their missions are completed.

The project is anticipated to use a phased approach to perform physical work by using small specialized work groups in combination with a small number of people having specific building knowledge. Teams specialized in building evaluation, relocation of people and equipment, contamination removal and fixation, and facility deactivation will be formed. The buildings will then be put through these various stages sequentially. Facilities are anticipated to be geographically grouped as they go through this process.

Monitoring and S&M of received facilities will be performed as necessary during deactivation to ensure they are kept in a safe and compliant status. Stakeholders and Regulators will be actively involved during deactivation planning.

Post 2006 Project Scope Provided by Project Manager:

Since deactivation of facilities in this PBS will not be completed by the end of FY 2006, funding to continue Monitoring and minimum safe S&M of facilities prior to and during deactivation, funding to perform deactivation and funding for post-deactivation S&M until these facilities can be turned over to EM-40 is necessary. Deactivation of the remaining facilities is expected to complete by the end of FY 2037.

Project End State Provided by Project Manager:

This project terminates when deactivation of all these contaminated facilities is complete and they have been accepted by EM-40 for D&D. Deactivation and D&D of these facilities is necessary so Operable Unit remediation can efficiently progress. Although the end state for the Hanford Site has not yet been determined, it is expected that some Operable Unit remediation will be necessary.

The full list of science research awards that have the potential to address projects such as this one, which deals with Decontamination and Decommissioning problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "Decontamination and Decommissioning".

The following awards were identified through systems engineering to have the potential to address the specific needs of this Project. Those research awards that may have the strongest link to this project are designated by the symbol "§".

Award ID	Page #	Award Title
§ 54914-CA	B-73	Atmospheric-Pressure Plasma Cleaning of Contaminated Surfaces
§ 55380-IL	B-127	In-Situ Spectro-Electrochemical Studies of Radionuclide Contaminated Surface Films on Metals and the Mechanism of their Formation and Dissolution
§ 54724-NM	B-205	Synthesis of New Water-Soluble Metal-Binding Polymers: Combinatorial Chemistry Approach
§ 60363-NM	B-241	Optimization of Thermochemical, Kinetic, and Electrochemical Factors Governing Partitioning of Radionuclides during Melt Decontamination of Radioactively Contaminated Stainless Steel
60328-CA	B-37	High Frequency Electromagnetic Impedance Measurements for Characterization, Monitoring and Verification Efforts
60370-CA	B-39	Rational Design of Metal Ion Sequestering Agents
54926-CA	B-75	Novel Ceramic-Polymer Composite Membranes for the Separation of Hazardous Liquid Waste
54847-CO	B-87	Photocatalytic and Chemical Oxidation of Organic Compounds in Supercritical Carbon Dioxide
55012-CO	B-89	Extraction and Recovery of Mercury and Lead from Aqueous Waste Streams Using Redox-active Layered Metal Chalcogenides
60141-DC	B-95	Gamma Ray Imaging for Environmental Remediation
60424-ID	B-113	High Temperature Condensed Phase Mass Spectrometric Analysis
55247-IL	B-119	Sensors Using Molecular Recognition in Luminescent, Conductive Polymers
60247-IL	B-139	Miniature Nuclear Magnetic Resonance Spectrometer for In-Situ and In-Process Analysis and Monitoring
55211-IL	B-141	Cavitational Hydrothermal Oxidation: A New Remediation Process
54834-IN	B-143	An Investigation of Homogeneous and Heterogeneous Sonochemistry for Destruction of Hazardous Waste
54942-IN	B-147	Spectroscopy, Modeling and Computation of Metal Chelate Solubility in Supercritical CO_2
54791-KS	B-153	Managing Tight-binding Receptors for New Separations Technologies
54864-KS	B-157	Supramolecular Chemistry of Selective Anion Recognition for Anions of Environmental Relevance
60231-MD	B-165	Novel Miniature Spectrometer for Remote Chemical Detection
59977-MD	B-169	Synthesis and Characterization of Templated Ion Exchange Resins for the Selective Complexation of Actinide Ions
54571-MA	B-181	Removal of Heavy Metals and Organic Contaminants from Aqueous Streams by Novel Filtration Methods
54770-NM	B-213	New Anion-Exchange Resins for Improved Separations of Nuclear Materials
59981-NM	B-219	Real-Time Broad Spectrum Characterization of Hazardous Waste by Membrane Introduction Mass Spectrometry
55387-NM	B-237	Photooxidation of Organic Wastes Using Semiconductor Nanoclusters
60403-NM	B-243	Phase Chemistry of Tank Sludge Residual Components
60163-NM	B-249	Investigation of Techniques to Improve Continuous Air Monitors Under Conditions of High Dust Loading in Environmental Setting
54639-NM	B-251	Development of an In-Situ Microsensor for the Measurements of Chromium and Uranium in Groundwater at DOE Sites
54595-NM	B-255	f-Element Ion Chelation in Highly Basic Media

Awards Related to RL-TP10 Continued

Award ID	Page #	Award Title
54674-OH	B-271	Design and Development of a New Hybrid Spectroelectrochemical Sensor
54122-PA	B-281	A Broad Spectrum Catalytic System for Removal of Toxic Organics from Water By Deep Oxidation
54856-PA	B-289	Structural Biology of the Sequestration & Transport of Heavy Metal Toxins: NMR Structure Determination of Proteins Containing the -Cys-X-Y-Cys-metal Binding Motifs
55033-TN	B-305	Characterization of Chemically Modified Hyperthermophilic Enzymes for Chemical Syntheses and Bioremediation Reactions
55276-TN	B-319	Fundamental Chemistry and Thermodynamics of Hydrothermal Oxidation Processes
54679-WA	B-367	Architectural Design Criteria for F-Block Metal Ion Sequestering Agents
54897-WA	B-391	The Sonophysics and Sonochemistry of Liquid Waste Quantification and Remediation
55146-WA	B-393	Adsorption/Membrane Filtration as a Contaminant Concentration and Separation Process for Mixed Wastes and Tank Wastes
60050-WA	B-395	Chemical Speciation of Inorganic Compounds under Hydrothermal Conditions

Richland Operations Office

Hanford Site - Richland Operations Office

RL-TP13 - Landlord Project

Problem Area: Decontamination and Decommissioning
Life-Cycle Cost in 2007+: $270,000,000
DOE Project Manager: WA Rutherford, 509-376-7597, W_A_Bill_Rutherford@rl.gov
Contractor Manager: TJ Harper, 509-376-2755, T_J_Harper@rl.gov
For More Information: http://www.doe.gov/em52/pbs/rl-tp13.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Medium **Worker:** High **Environment:** Medium

Technical Approach Provided by Project Manager:

This section describes the technical approach for the project.
The specific Hanford Strategic Plan end point targets addressed by this project include:
• Provide sitewide Real Estate Management to assure accurate records of site conditions, status, and End State.
• Shutdown, isolate utilities, remove hazards, and disposition (excess, salvage, transfer to another entity, or demolish) clean, nonregulated infrastructure facilities.
• Transition high cost surplus infrastructure facilities and systems to a low cost, stable, and deactivated condition.
• Reuse infrastructure facilities and systems for economic diversification where feasible.
• Disposition all regulated legacy infrastructure equipment; confirming through process knowledge or sampling the levels of dangerous waste, hazardous materials, and/or radioactive materials; and decontaminate before disposal. Clean metal is dispositioned as scrap or excess equipment; equipment that cannot be documented as clean is buried or stored at Hanford, after appropriate volume reduction and packaging.
• Provide final cover/closure of the Sanitary Solid Waste Landfill that protects the ground water and has adequate monitoring to assure environmental compliance.

The objective of the Landlord Project are reflected in two specific areas: 1) Core Infrastructure Maintenance and 2) Infrastructure Mortgage Reduction. The major objectives of the Landlord Project are:
• Maintain a standard of excellence, safety, and environmental compliance; while providing efficient, affordable, and cost effective replacements, major maintenance, upgrades, and final disposition of vacated Hanford Site infrastructure systems, facilities, and services to support the Hanford Mission.
• Provide long range planning that maintains, preserves, and upgrades strategic assets, while consolidating facilities and functions to lower life cycle operational and maintenance costs.
• Establish realistic goals and strong baseline control, while complying with all applicable laws, orders, agreements, codes, standards, and best management and safety practices.

Associated objectives that apply to the Landlord Project include:
• Continuing to focus on defining and addressing core infrastructure needs. Utilizing mortgage reduction (i.e. excess, salvage, and demolition) to transition facilities and equipment to their most cost effective status; thereby optimizing the site infrastructure. Providing upgrades to the site infrastructure only where cost effective.
• Providing an infrastructure that serves the Hanford Mission; promoting diversification for valuable and viable assets; concentrating systems and service locations; disposition obsolete, aged, surplus, and under utilized facilities through excess, demolition, and transfer to other entities; promoting energy efficiency; and facilitating the operation and maintenance of vacated facilities, equipment, and systems as economically and safely as possible within environmental regulations.
• Integrating Occupational Safety and Health Act (OSHA) requirement into all project activities, ensuring compliance with applicable federal, state, and local regulations and the Tri-Party Agreement.
• Identifying future infrastructure needs, integrating Landlord Project planning with other project plans effectively using limited resources, improving project definition and cost estimating, and direct funding all appropriate costs.
• Encouraging outreach and partnership with local/private sector and Tribal Governments.
• Providing sitewide coordination and management of the Hanford Site Real Estate (land, facilities, utilities and other infrastructure systems) to ensure effective support to the site cleanup decisions and economic transition initiatives.

Post 2006 Project Scope Provided by Project Manager:

The remaining Site Infrastructure is a required function of DOE throughout the mission of the Hanford Site Landlord Project. The Landlord Project will be required to provide replacements, major maintenance, upgrade of remaining core infrastructure functions (mainly in the Central Plateau). Another main function will be final disposition of vacant facilities, systems, equipment and land transition to other entities.

Project End State Provided by Project Manager:

Once the mission is completed the Landlord Project responsibilities will be transferred to other ownership, either public or private.

The full list of science research awards that have the potential to address projects such as this one, which deals with Decontamination and Decommissioning problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "Decontamination and Decommissioning".

Richland Operations Office

Hanford Site - Richland Operations Office

RL-TW04 - Retrieval Project

Problem Area: High Level Waste
Life-Cycle Cost in 2007+: $2,986,000,000
DOE Project Manager: J.E. Kinzer, 509-376-7591, jackson_e_kinzer@rl.gov
Contractor Manager: A.M. Umek, 509-373-5983, anthony_m_tony_umek@rl.gov
For More Information: http://www.doe.gov/em52/pbs/rl-tw04.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Low **Worker:** High **Environment:** High

Technical Approach Provided by Project Manager:

The end point targets in the Hanford Strategic Plan addressed by this project include:

- Retrieve tank wastes to the extent needed for tank closure, divide into high level and low activity fractions and immobilize.
- Transition high cost surplus facilities in the central plateau and south 600 areas to a low cost, stable, deactivated condition.
- After the waste has been retrieved from the tanks, the tank farms (including the tanks) will be closed.

The technical approach and technology initiatives for the Project to accomplish the Hanford Strategic Plan end point targets are identified below.

- Technical Approach - Retrieval Project:

The baseline technical approach for the Waste Retrieval Project during Phase I contains the following key elements:
1. Select supernatants that meet the requirements of three LAW envelopes and transfer them to private contractors to demonstrate radio nuclide removal and immobilization of LAW.

2. Select tank sludges, that when washed with water or caustic in-tank, meet contractual HLW feed requirements. Transfer the washed sludges to private contractors for immobilization into a form that meets the repository waste acceptance criteria.

3. Continue to explore new and innovative methods and emerging technologies that could result in significant cost and schedule savings through a combination of technology transfer from industry; lessons learned from the operations of DWPF, WVDP, and foreign experience; and limited technology development.

4. Participate with the other TWRS projects and TWRS systems engineering on tank retrieval sequence, blending, pretreatment, and vitrification options in a continuing effort to optimize total program costs.

The Phase II technical approach is still being defined, but current planning is to perform limited laboratory-scale testing using pretreated radioactive waste to the extent required to confirm the product specifications developed for Phase II vitrification.

Proven retrieval technology will be applied as the waste retrieval baseline for SST and DST retrieval. Technology enhancements and alternatives will be implemented to improve performance and reliability and address difficult-to-retrieve and potentially environmentally impacting technology. The Retrieval Project relies on EM-50 technology development efforts to provide for improved retrieval technologies.

Hydraulic sluicing, similar to past-practice, is the reference technology for SST waste mobilization. Sluicing will be demonstrated in tank 106-C. Sluicing will also be applied to the Initial Single-Shell Tank Retrieval System (ISSTRS). Parallel to the design of the ISSTRS is the development of leak monitoring and mitigation methods to address potential environmental impacts associated with leakage during hydraulic sluicing. Improvements to SST retrieval are needed for difficult-to-retrieve waste or for tanks that may leak beyond allowable limits. Improved retrieval technologies are to be demonstrated in tank 106-C to remove the heel following sluicing. The Hanford Tank Initiative (HTI) will provide demonstration of improved technologies as well as work toward defining closure criteria to determine acceptable waste residual following retrieval activities.

Mixer pumps are the reference technology for DST waste mobilization for retrieval. A process test will be performed in tank 101-AZ to demonstrate the capability of mixer pumps to mobilize neutralized current acid waste sludge. Concurrent with this activity, advanced design mixer pumps will be procured and tested with the goal of improved reliability and reduced life-cycle costs. Performance data obtained will be applied to other equipment used by the Initial Tank Retrieval System project, which will provide mixer pump based retrieval systems for 10 DSTs.

The following technology needs have been identified and prioritized through the Hanford Site Technology Coordination Group for the Tank Focus Area:

- Establish Retrieval Performance Criteria
- SST Alternative Retrieval Technologies
- Advanced Design Mixer Pumps for Mixer Pump Enhancement
- Tank Leak Detection and Mitigation Systems for SSTs
- Alternative to Mixer Pumps for better reliability and longer life
- High Accuracy Psychometric/Flow Measurements capability to improve process control
- Identification and management of Chromium and problem constituents for Hanford HLW vitrification
- Avoidance of formation of solids in Phase I liquid tank wastes
- Prediction of gel and precipitate formation in Hanford Tank Waste
- Enhanced sludge wash data for extended operations of Phase I and for Phase II RFP preparation
- Bench-scale radioactive demonstration of Phase I sludge washing.

Post 2006 Project Scope Provided by Project Manager:

Single Shell Tank (SST) System

- Waste retrieval from SSTs and MUSTs will continue; scheduled for completion by September 2018.

- Storage of wastes within the SST system and transfer of wastes to the DST system will continue until FY2018

- Closure of the SSTs is scheduled for completion by September 2024.

- Closure of the SSTs is scheduled for completion by September 2024.

- Closure of the SSTs is scheduled for completion by September 2024. Post-closure monitoring will begin in 2034 and continue through the end of the EM mission in 2050. Further post-closure monitoring will be conducted by other programs if required.

Double Shell Tank (DST) System

- Waste retrieval from DSTs will continue; scheduled for completion in 2028.

- Waste will be staged in DSTs and transferred to the private immobilization contractors to support Phase I extended operations.

- Closure of the DSTs may begin as early as 2024 and is scheduled for completion by 2034.

- Removal of DST waste will continue until all waste is retrieved from DSTs; scheduled for completion in FY2028

- Maintaining DSTs in safe and compliant manner will continue until all waste is retrieved from DSTs; scheduled for completion in FY2028

• Waste will be staged in DSTs and transferred to the private immobilization contractors to support Phase I extended operations.

• Waste will be staged in DSTs and transferred to the private immobilization contractors to support Phase I extended operations.

• Closure of the DSTs may begin as early as 2024 and is scheduled for completion by 2034. Post-closure monitoring will begin in 2034 and continue through the end of the EM mission in 2050. Further post-closure monitoring will be conducted by other programs if required.

Project End State Provided by Project Manager:

All waste has been retrieved from the SSTs, DSTs, and MUSTs. All tanks have been closed in accordance with regulatory requirements.

Specific work activities to close the facilities under this Project to be performed by others at the end of this Project's mission are identified below.

The full list of science research awards that have the potential to address projects such as this one, which deals with High Level Waste problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "High Level Waste".

The following awards were identified through systems engineering to have the potential to address the specific needs of this Project. Those research awards that may have the strongest link to this project are designated by the symbol "§".

Award ID	Page #	Award Title
§ 55318-CA	B-23	Improved Analytical Characterization of Solid Waste-Forms by Fundamental Development of Laser Ablation Technology
§ 54656-CA	B-65	Mixing Processes in High-Level Waste Tanks
§ 54890-CA	B-69	On-Line Slurry Viscosity and Concentration Measurement as a Real-Time Waste Stream Characterization Tool
§ 54807-GA	B-103	Studies Related to Chemical Mechanisms of Gas Formation in Hanford High-Level Nuclear Wastes
§ 60424-ID	B-113	High Temperature Condensed Phase Mass Spectrometric Analysis
§ 55229-IL	B-117	The NOx System in Nuclear Waste
§ 59977-MD	B-169	Synthesis and Characterization of Templated Ion Exchange Resins for the Selective Complexation of Actinide Ions
§ 55141-MA	B-177	Imaging and Characterizing the Waste Materials Inside an Underground Storage Tank Using Seismic Normal Modes
§ 54773-NM	B-215	Microstructural Properties of High Level Waste Concentrates and Gels with Raman And Infrared Spectroscopies
§ 59990-NM	B-221	Fundamental Chemistry, Characterization, and Separation of Technetium Complexes in Hanford Waste
§ 59993-NM	B-223	Dynamic Effects of Tank Waste Aging on Radionuclide-Complexant Interactions
§ 54595-NM	B-255	f-Element Ion Chelation in Highly Basic Media
§ 59982-NY	B-259	Reactivity of Peroxynitrite: Implications for Hanford Waste Management and Remediation
§ 55179-NY	B-267	Acoustic Probe for Solid-Gas-Liquid Suspensions
§ 54674-OH	B-271	Design and Development of a New Hybrid Spectroelectrochemical Sensor
§ 60219-PA	B-287	Development of Advanced Electrochemical Emission Spectroscopy for Monitoring Corrosion in Simulated DOE Liquid Waste
§ 55087-TN	B-309	Design and Synthesis of the Next Generation of Crown Ethers for Waste Separations: An Inter-Laboratory Comprehensive Proposal
§ 59978-TN	B-321	Thermospray Mass Spectrometry Ionization Processes Fundamental Mechanisms for Speciation, Separation and Characterization of Organic Complexants in DOE Wastes

Awards Related to RL-TW04 Continued

Award ID	Page #	Award Title
§ 60217-TN	B-331	Optically-Based Array Sensors for Selective In Situ Analysis of Tank Waste
§ 54735-TX	B-343	Development of Inorganic Ion Exchangers for Nuclear Waste Remediation
§ 54621-WA	B-357	Chemical Speciation of Strontium, Americium, and Curium in High Level Waste: Predictive Modeling of Phase Partitioning During Tank Processing
§ 54628-WA	B-359	Colloidal Agglomerates in Tank Sludge: Impact on Waste Processing
§ 54646-WA	B-363	Interfacial Radiolysis Effects in Tank Waste Speciation
§ 54672-WA	B-365	Radiation Effects in Nuclear Waste Materials
§ 60362-WA	B-379	Ion-Exchange Processes and Mechanisms in Glasses
§ 60075-WA	B-401	Particle Generation by Laser Ablation in Support of Chemical Analysis of High Level Mixed Waste from Plutonium Production Operations
60328-CA	B-37	High Frequency Electromagnetic Impedance Measurements for Characterization, Monitoring and Verification Efforts
60370-CA	B-39	Rational Design of Metal Ion Sequestering Agents
55411-CA	B-49	Joint Inversion of Geophysical Data for Site Characterization and Restoration Monitoring
60319-CA	B-51	Thermodynamics of the Volatilization of Actinide Metals in the High-Temperature Treatment of Radioactive Wastes
54926-CA	B-75	Novel Ceramic-Polymer Composite Membranes for the Separation of Hazardous Liquid Waste
60141-DC	B-95	Gamma Ray Imaging for Environmental Remediation
55218-GA	B-107	Seismic Surface-Wave Tomography of Waste Sites
55247-IL	B-119	Sensors Using Molecular Recognition in Luminescent, Conductive Polymers
55382-IL	B-129	Determination of Transmutation Effects in Crystalline Waste Forms
60247-IL	B-139	Miniature Nuclear Magnetic Resonance Spectrometer for In-Situ and In-Process Analysis and Monitoring
60231-MD	B-165	Novel Miniature Spectrometer for Remote Chemical Detection
60070-MS	B-193	The Development of Cavity Ringdown Spectroscopy as a Sensitive Continuous Emission Monitor for Metals
55223-MO	B-197	De Novo Design of Ligands for Metal Separation
54770-NM	B-213	New Anion-Exchange Resins for Improved Separations of Nuclear Materials
59996-NM	B-225	Plutonium Speciation, Solubilization, and Migration in Soils
55171-PA	B-283	Development of Advanced In-Situ Techniques for Chemistry Monitoring and Corrosion Mitigation in SCWO Environments
54828-SC	B-297	Processing of High Level Waste: Spectroscopic Characterization of Redox Reactions in Supercritical Water
55205-SC	B-299	A Fundamental Study of Laser-Induced Breakdown Spectroscopy Using Fiber Optics for Remote Measurements of Trace Metals
55036-TN	B-307	Colloid Transport and Retention in Fractured Deposits
55119-TN	B-315	Phase Equilibria Modification by Electric Fields
60197-TN	B-329	Microsensors for In-situ Chemical, Physical, and Radiological Characterization of Mixed Waste
60096-TN	B-339	Rational Synthesis of Imprinted Organofunctional Sol-Gel Materials for Toxic Metal Separation
60355-WA	B-377	Mineral Surface Processes Responsible for the Decreased Retardation (or Enhanced Mobilization) of 137Cs from HLW Tank Discharges
54897-WA	B-391	The Sonophysics and Sonochemistry of Liquid Waste Quantification and Remediation
55146-WA	B-393	Adsorption/Membrane Filtration as a Contaminant Concentration and Separation Process for Mixed Wastes and Tank Wastes

Award ID	Page #	Award Title

Richland Operations Office

Hanford Site - Richland Operations Office

RL-TW05 - Process Waste Support

Problem Area: High Level Waste
Life-Cycle Cost in 2007+: $660,000,000
DOE Project Manager: J.E. Kinzer, 509-376-7591, jackson_e_kinzer@rl.gov
Contractor Manager: A.M. Umek, 509-373-5983, anthony_m_tony_umek@rl.gov
For More Information: http://www.doe.gov/em52/pbs/rl-tw05.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Medium **Worker:** Medium **Environment:** High

Technical Approach Provided by Project Manager:

The baseline technical approach for the Process Waste Support Project during Phase I is to define the interfaces with the private contractors, prepare ICDs between the PHMC and the private contractors and to assist DOE in the evaluation of private contractor products.

The Phase II technical approach will:

1. Rely on private contractors to retrieve and transfer the remaining tank waste to private processing plants
2. Require the LLW contractor to perform in-plant treatment and separation of the waste into low and high activity fractions which will then be immobilized.
3. Require the HLW contractor to process the Cs/Sr capsules along with the HLW fraction of the tank waste.

This technical approach will require the following EM-50 funded technology development/ demonstration efforts:
1. Advanced methods for achieving LLW volume minimization
2. ILAW product acceptance inspection and test methods
3. IHLW product acceptance inspection and test methods

Post 2006 Project Scope Provided by Project Manager:

The Phase I LLW and LLW/HLW facilities will complete processing of minimum order waste quantities and extended operations. The private contractors will deactivate and transfer the Phase I facilities to the PHMC for Decontamination and Decommissioning under the Privatization Phase I Project.

Provide contract administration and integration on the construction, start-up and operations (2011-2028) of the Phase II full scale production facilities (waste retrieval, pretreatment, and immobilization).

Assume the integration and TWRS management functions from the TWRS Management Support Project in 2006.

Project End State Provided by Project Manager:

The final end state of this project will be:

1. By 2028 all retrievable waste in the 177 underground waste storage tanks (99% of the tank waste) will have been removed, transferred to processing facilities and separated into low and high activity fractions leaving the waste tanks ready for closure.

2. The LLW fraction will be processed into 442,000 MT of immobilized LAW suitable for permanent near-surface disposal on the Hanford site.

3. The HLW fraction will be processed into approximately 14000 cubic meters of immobilized HLW suitable for interim storage on the Hanford site and eventual permanent disposal in a geologic repository.

4. The Cs/Sr capsules, currently in storage at WESF, will have been processed into a form suitable for permanent disposal at a geologic repository.

5. All waste processing facilities will be decontaminated and decommissioned and turned over to the Environmental Restoration program for final disposition.

Specific work activities to close the facilities under this Project to be performed by others at the end of this Project's mission are identified below.

LAW Treatment Facility, Phase II
Work associated with facility performed by Privatization Phase II:
 Treat & Immobilize LAW, Phase II
 Maintain Safe & Compliant LAW Treatment Facility, Phase II in CP Areas
 Transition LAW Treatment Facility, Phase II
 Decontaminate and Decommission (D&D) LAW Treatment Facility, Phase II

HLW Treatment Facility, Phase II
Work associated with facility performed by Privatization Phase II:
 Treat & Immobilize HLW, Phase II
 Maintain Safe & Compliant HLW Treatment Facility, Phase II in CP Areas
 Transition HLW Treatment Facility, Phase II
 Decontaminate and Decommission (D&D) HLW Treatment Facility, Phase II

The full list of science research awards that have the potential to address projects such as this one, which deals with High Level Waste problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "High Level Waste".

The following awards were identified through systems engineering to have the potential to address the specific needs of this Project. Those research awards that may have the strongest link to this project are designated by the symbol "§".

Award ID	Page #	Award Title
§ 59827-AZ	B-9	The Influence of Radiation and Multivalent Cation Additions on Phase Separation and Crystallization of Glass
§ 55318-CA	B-23	Improved Analytical Characterization of Solid Waste-Forms by Fundamental Development of Laser Ablation Technology
§ 55137-CA	B-53	Investigation of Novel Electrode Materials for Electrochemically-Based Remediation of High- and Low-Level Mixed Wastes in the DOE Complex
§ 54656-CA	B-65	Mixing Processes in High-Level Waste Tanks
§ 54890-CA	B-69	On-Line Slurry Viscosity and Concentration Measurement as a Real-Time Waste Stream Characterization Tool
§ 55188-DC	B-93	Chemical Decomposition of High-Level Nuclear Waste Storage/Disposal Glasses Under Irradiation
§ 54716-DC	B-97	Polyoxometalates for Radioactive Waste Treatment
§ 54982-FL	B-101	Analysis of Surface Leaching Processes in Vitrified High-Level Nuclear Wastes Using In-Situ Raman Imaging and Atomistic Modeling
§ 54807-GA	B-103	Studies Related to Chemical Mechanisms of Gas Formation in Hanford High-Level Nuclear Wastes
§ 55042-GA	B-105	Quantifying Silica Reactivity in Subsurface Environments: Controls of Reaction Affinity and Solute Matrix on Quartz and SiO2 Glass Dissolution Kinetics

Awards Related to RL-TW05 Continued

Award ID	Page #	Award Title
§ 60424-ID	B-113	High Temperature Condensed Phase Mass Spectrometric Analysis
§ 55294-IL	B-121	Superconducting Open-Gradient Magnetic Separation for the Pretreatment of Radioactive or Mixed Waste Vitrification Feeds
§ 55367-IL	B-123	Investigation of Microscopic Radiation Damage in Waste Forms Using ODNMR and AEM Techniques
§ 60313-IL	B-135	Radiation Effects on Transport and Bubble Formation in Silicate Glasses
§ 59977-MD	B-169	Synthesis and Characterization of Templated Ion Exchange Resins for the Selective Complexation of Actinide Ions
§ 54691-MI	B-189	Radiation Effects on Materials in the Near-Field of Nuclear Waste Repository
§ 59990-NM	B-221	Fundamental Chemistry, Characterization, and Separation of Technetium Complexes in Hanford Waste
§ 59993-NM	B-223	Dynamic Effects of Tank Waste Aging on Radionuclide-Complexant Interactions
§ 60403-NM	B-243	Phase Chemistry of Tank Sludge Residual Components
§ 54595-NM	B-255	f-Element Ion Chelation in Highly Basic Media
§ 55179-NY	B-267	Acoustic Probe for Solid-Gas-Liquid Suspensions
§ 54674-OH	B-271	Design and Development of a New Hybrid Spectroelectrochemical Sensor
§ 55087-TN	B-309	Design and Synthesis of the Next Generation of Crown Ethers for Waste Separations: An Inter-Laboratory Comprehensive Proposal
§ 60020-TN	B-323	Stability of High-Level Waste Forms
§ 60217-TN	B-331	Optically-Based Array Sensors for Selective In Situ Analysis of Tank Waste
§ 54735-TX	B-343	Development of Inorganic Ion Exchangers for Nuclear Waste Remediation
§ 54621-WA	B-357	Chemical Speciation of Strontium, Americium, and Curium in High Level Waste: Predictive Modeling of Phase Partitioning During Tank Processing
§ 54628-WA	B-359	Colloidal Agglomerates in Tank Sludge: Impact on Waste Processing
§ 54646-WA	B-363	Interfacial Radiolysis Effects in Tank Waste Speciation
§ 54672-WA	B-365	Radiation Effects in Nuclear Waste Materials
§ 60345-WA	B-375	New Silicotitanate Waste Forms: Development and Characterization
§ 60362-WA	B-379	Ion-Exchange Processes and Mechanisms in Glasses
§ 60050-WA	B-395	Chemical Speciation of Inorganic Compounds under Hydrothermal Conditions
§ 60123-WA	B-397	Potential-Modulated Intercalation of Alkali Cations into Metal Hexacyanoferrate Coated Electrodes
§ 60075-WA	B-401	Particle Generation by Laser Ablation in Support of Chemical Analysis of High Level Mixed Waste from Plutonium Production Operations
55094-CA	B-13	Chemical and Ceramic Methods Toward Safe Storage of Actinides Using Monazite
60370-CA	B-39	Rational Design of Metal Ion Sequestering Agents
54655-CA	B-63	Collaborative Research: Hydrogeological-Geophysical Methods for Subsurface Site Characterization
54926-CA	B-75	Novel Ceramic-Polymer Composite Membranes for the Separation of Hazardous Liquid Waste
54893-FL	B-99	Research Program to Determine Redox Properties and Their Effects on Speciation and Mobility of Pu in DOE Wastes
55382-IL	B-129	Determination of Transmutation Effects in Crystalline Waste Forms
60247-IL	B-139	Miniature Nuclear Magnetic Resonance Spectrometer for In-Situ and In-Process Analysis and Monitoring
54791-KS	B-153	Managing Tight-binding Receptors for New Separations Technologies
60231-MD	B-165	Novel Miniature Spectrometer for Remote Chemical Detection
54571-MA	B-181	Removal of Heavy Metals and Organic Contaminants from Aqueous Streams by Novel Filtration Methods
55110-MO	B-195	An Alternative Host Matrix Based on Iron Phosphate Glasses for the Vitrification of Specialized Nuclear Waste Forms
55223-MO	B-197	De Novo Design of Ligands for Metal Separation

Awards Related to RL-TW05 Continued

Award ID	Page #	Award Title
54724-NM	B-205	Synthesis of New Water-Soluble Metal-Binding Polymers: Combinatorial Chemistry Approach
54751-NM	B-209	High Fluence Neutron Source for Nondestructive Characterization of Nuclear Waste
54770-NM	B-213	New Anion-Exchange Resins for Improved Separations of Nuclear Materials
60015-NM	B-227	Long-term Risk from Actinides in the Environment: Modes of Mobility
60118-NM	B-229	Fundamental Thermodynamics of Actinide-Bearing Mineral Waste Forms
54639-NM	B-251	Development of an In-Situ Microsensor for the Measurements of Chromium and Uranium in Groundwater at DOE Sites
54122-PA	B-281	A Broad Spectrum Catalytic System for Removal of Toxic Organics from Water By Deep Oxidation
55205-SC	B-299	A Fundamental Study of Laser-Induced Breakdown Spectroscopy Using Fiber Optics for Remote Measurements of Trace Metals
55036-TN	B-307	Colloid Transport and Retention in Fractured Deposits
55119-TN	B-315	Phase Equilibria Modification by Electric Fields
60197-TN	B-329	Microsensors for In-situ Chemical, Physical, and Radiological Characterization of Mixed Waste
60096-TN	B-339	Rational Synthesis of Imprinted Organofunctional Sol-Gel Materials for Toxic Metal Separation
54679-WA	B-367	Architectural Design Criteria for F-Block Metal Ion Sequestering Agents
55146-WA	B-393	Adsorption/Membrane Filtration as a Contaminant Concentration and Separation Process for Mixed Wastes and Tank Wastes

Richland Operations Office

Hanford Site - Richland Operations Office

RL-TW06 - Process Waste Privatization Phase I

Problem Area: High Level Waste
Life-Cycle Cost in 2007+: $1,786,000,000
DOE Project Manager: J.E. Kinzer, 509-376-7591, jackson_e_kinzer@rl.gov
Contractor Manager: A.M. Umek, 509-373-5983, anthony_m_tony_umek@rl.gov
For More Information: http://www.doe.gov/em52/pbs/rl-tw06.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Medium **Worker:** Medium **Environment:** High

Technical Approach Provided by Project Manager:

The end point targets in the Hanford Strategic Plan addressed by this project include:

- Transition high cost surplus facilities in the central plateau and south 600 areas to a low cost, stable, deactivated condition.

- Retrieve tank wastes to the extent needed for tank closure, divide into high level and low activity fractions and immobilize.

The technical approach and technology initiatives for the Project to accomplish the Hanford Strategic Plan end point targets are identified below.

- Technical Approach - Privatization Phase I: The Project Hanford Management Contractor is responsible for providing the waste feed envelopes, feed tanks, infrastructure, and utilities at the time, place, and quantity required for the private contractors, who will process the waste using their unique processing techniques. The technology employed by the private contractors will not be mandated by the Department. The PHMC will also receive the immobilized waste from the private contractors and will store or dispose of the waste, as appropriate.

Post 2006 Project Scope Provided by Project Manager:

During the final years of Phase I (through 2011), private contractors will continue to process LAW and HLW and will deactivate their plants. Lessons learned from the proof-of-concept Phase I will be incorporated into the planning for Phase II.

Project End State Provided by Project Manager:

Immobilized low-activity waste will be stored at Hanford, pending disposal. The immobilized high-level waste, including cesium and strontium capsules, will be stored temporarily at Hanford, pending final disposal in the Federal Geologic Repository. Contractor facilities will be deactivated after waste processing operations are completed. Deactivation takes one year, after which the facilities will be turned over to the DOE for decontamination and decommissioning

The full list of science research awards that have the potential to address projects such as this one, which deals with High Level Waste problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "High Level Waste".

The following awards were identified through systems engineering to have the potential to address the specific needs of this Project. Those research awards that may have the strongest link to this project are designated by the symbol "§".

Award ID	Page #	Award Title
§ 59827-AZ	B-9	The Influence of Radiation and Multivalent Cation Additions on Phase Separation and Crystallization of Glass
§ 55137-CA	B-53	Investigation of Novel Electrode Materials for Electrochemically-Based Remediation of High- and Low-Level Mixed Wastes in the DOE Complex
§ 55188-DC	B-93	Chemical Decomposition of High-Level Nuclear Waste Storage/Disposal Glasses Under Irradiation
§ 54982-FL	B-101	Analysis of Surface Leaching Processes in Vitrified High-Level Nuclear Wastes Using In-Situ Raman Imaging and Atomistic Modeling
§ 54807-GA	B-103	Studies Related to Chemical Mechanisms of Gas Formation in Hanford High-Level Nuclear Wastes
§ 55042-GA	B-105	Quantifying Silica Reactivity in Subsurface Environments: Controls of Reaction Affinity and Solute Matrix on Quartz and SiO_2 Glass Dissolution Kinetics
§ 55294-IL	B-121	Superconducting Open-Gradient Magnetic Separation for the Pretreatment of Radioactive or Mixed Waste Vitrification Feeds
§ 55367-IL	B-123	Investigation of Microscopic Radiation Damage in Waste Forms Using ODNMR and AEM Techniques
§ 60313-IL	B-135	Radiation Effects on Transport and Bubble Formation in Silicate Glasses
§ 60143-IL	B-137	Foaming in Radioactive Waste Treatment and Immobilization Processes
§ 59977-MD	B-169	Synthesis and Characterization of Templated Ion Exchange Resins for the Selective Complexation of Actinide Ions
§ 54691-MI	B-189	Radiation Effects on Materials in the Near-Field of Nuclear Waste Repository
§ 60403-NM	B-243	Phase Chemistry of Tank Sludge Residual Components
§ 54595-NM	B-255	f-Element Ion Chelation in Highly Basic Media
§ 60017-PA	B-285	Removal of Technetium, Carbon Tetrachloride, and Metals from DOE Properties
§ 55087-TN	B-309	Design and Synthesis of the Next Generation of Crown Ethers for Waste Separations: An Inter-Laboratory Comprehensive Proposal
§ 60020-TN	B-323	Stability of High-Level Waste Forms
§ 54735-TX	B-343	Development of Inorganic Ion Exchangers for Nuclear Waste Remediation
§ 54672-WA	B-365	Radiation Effects in Nuclear Waste Materials
§ 54996-WA	B-371	Ionizing Radiation Induced Catalysis on Metal Oxide Particles
§ 60345-WA	B-375	New Silicotitanate Waste Forms: Development and Characterization
§ 60362-WA	B-379	Ion-Exchange Processes and Mechanisms in Glasses
§ 60050-WA	B-395	Chemical Speciation of Inorganic Compounds under Hydrothermal Conditions
§ 60075-WA	B-401	Particle Generation by Laser Ablation in Support of Chemical Analysis of High Level Mixed Waste from Plutonium Production Operations
55094-CA	B-13	Chemical and Ceramic Methods Toward Safe Storage of Actinides Using Monazite
60370-CA	B-39	Rational Design of Metal Ion Sequestering Agents
60319-CA	B-51	Thermodynamics of the Volatilization of Actinide Metals in the High-Temperature Treatment of Radioactive Wastes
54926-CA	B-75	Novel Ceramic-Polymer Composite Membranes for the Separation of Hazardous Liquid Waste
60155-CO	B-83	Measurements and Models for Hazardous Chemical and Mixed Wastes
54847-CO	B-87	Photocatalytic and Chemical Oxidation of Organic Compounds in Supercritical Carbon Dioxide
55012-CO	B-89	Extraction and Recovery of Mercury and Lead from Aqueous Waste Streams Using Redox-active Layered Metal Chalcogenides

Awards Related to RL-TW06 Continued

Award ID	Page #	Award Title
54893-FL	B-99	Research Program to Determine Redox Properties and Their Effects on Speciation and Mobility of Pu in DOE Wastes
55380-IL	B-127	In-Situ Spectro-Electrochemical Studies of Radionuclide Contaminated Surface Films on Metals and the Mechanism of their Formation and Dissolution
55382-IL	B-129	Determination of Transmutation Effects in Crystalline Waste Forms
55211-IL	B-141	Cavitational Hydrothermal Oxidation: A New Remediation Process
54834-IN	B-143	An Investigation of Homogeneous and Heterogeneous Sonochemistry for Destruction of Hazardous Waste
54942-IN	B-147	Spectroscopy, Modeling and Computation of Metal Chelate Solubility in Supercritical CO_2
54791-KS	B-153	Managing Tight-binding Receptors for New Separations Technologies
54864-KS	B-157	Supramolecular Chemistry of Selective Anion Recognition for Anions of Environmental Relevance
54571-MA	B-181	Removal of Heavy Metals and Organic Contaminants from Aqueous Streams by Novel Filtration Methods
55110-MO	B-195	An Alternative Host Matrix Based on Iron Phosphate Glasses for the Vitrification of Specialized Nuclear Waste Forms
55223-MO	B-197	De Novo Design of Ligands for Metal Separation
54724-NM	B-205	Synthesis of New Water-Soluble Metal-Binding Polymers: Combinatorial Chemistry Approach
54751-NM	B-209	High Fluence Neutron Source for Nondestructive Characterization of Nuclear Waste
54770-NM	B-213	New Anion-Exchange Resins for Improved Separations of Nuclear Materials
60015-NM	B-227	Long-term Risk from Actinides in the Environment: Modes of Mobility
60118-NM	B-229	Fundamental Thermodynamics of Actinide-Bearing Mineral Waste Forms
55387-NM	B-237	Photooxidation of Organic Wastes Using Semiconductor Nanoclusters
60363-NM	B-241	Optimization of Thermochemical, Kinetic, and Electrochemical Factors Governing Partitioning of Radionuclides during Melt Decontamination of Radioactively Contaminated Stainless Steel
54122-PA	B-281	A Broad Spectrum Catalytic System for Removal of Toxic Organics from Water By Deep Oxidation
55171-PA	B-283	Development of Advanced In-Situ Techniques for Chemistry Monitoring and Corrosion Mitigation in SCWO Environments
54856-PA	B-289	Structural Biology of the Sequestration & Transport of Heavy Metal Toxins: NMR Structure Determination of Proteins Containing the -Cys-X-Y-Cys-metal Binding Motifs
55205-SC	B-299	A Fundamental Study of Laser-Induced Breakdown Spectroscopy Using Fiber Optics for Remote Measurements of Trace Metals
54973-TN	B-301	A Novel Energy-Efficient Plasma Chemical Process for the Destruction of Volatile Toxic Compounds
55033-TN	B-305	Characterization of Chemically Modified Hyperthermophilic Enzymes for Chemical Syntheses and Bioremediation Reactions
55103-TN	B-311	Utilization of Kinetic Isotope Effects for the Concentration of Tritium
55119-TN	B-315	Phase Equilibria Modification by Electric Fields
55276-TN	B-319	Fundamental Chemistry and Thermodynamics of Hydrothermal Oxidation Processes
60096-TN	B-339	Rational Synthesis of Imprinted Organofunctional Sol-Gel Materials for Toxic Metal Separation
54679-WA	B-367	Architectural Design Criteria for F-Block Metal Ion Sequestering Agents
54897-WA	B-391	The Sonophysics and Sonochemistry of Liquid Waste Quantification and Remediation
55146-WA	B-393	Adsorption/Membrane Filtration as a Contaminant Concentration and Separation Process for Mixed Wastes and Tank Wastes

Awards Related to RL-TW06 Continued

Award ID	Page #	Award Title
60150-WA	B-399	Genetic Engineering of a Radiation-Resistant Bacterium for Biodegradation of Mixed Wastes
59925-WV	B-403	Modeling of Diffusion of Plutonium in Other Metals and of Gaseous Species in Plutonium-Based Systems

Richland Operations Office

Hanford Site - Richland Operations Office

RL-TW07 - Process Waste Privatization Phase II

Problem Area:	High Level Waste
Life-Cycle Cost in 2007+:	$10,358,000,000
DOE Project Manager:	J.E. Kinzer, 509-376-7591, jackson_e_kinzer@rl.gov
Contractor Manager:	A.M. Umek, 509-373-5983, anthony_m_tony_umek@rl.gov
For More Information:	http://www.doe.gov/em52/pbs/rl-tw07.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Medium **Worker:** Medium **Environment:** High

Technical Approach Provided by Project Manager:

The LAW immobilization during Phase II will be performed by two or more vitrification contractors. Retrieval operations will be performed by an (assumed) different private contractor. Out-of-tank sludge washing will be used and enhance-sludge-washed HLW solids will be provided to the single HLW Plant. LAW plants will operate through the completion of SST closure in 2024. The HLW plant will operate from 2012 to 2028. Separated products from the LAW plants will be transferred to the HLW contractor for immobilization. (Note a LAW plant could be combined with the HLW plant into a single facility). The vitrification and retrieval technologies to be used during Phase II will reflect the lessons from Phase I and the Hanford Tank Initiative. The DOE will probably not specify the technologies to be used but will specify the performance and products required.

The capsules will either be overpacked (the current plan) or treated as HLW (the proposed plan). In either case, they will be disposed in the National Geologic Repository.

The end point targets in the Hanford Strategic Plan addressed by this project include:

- Retrieve tank wastes to the extent needed for tank closure, divide into high level and low activity fractions and immobilize.

- Transition high cost surplus facilities in the central plateau and south 600 areas to a low cost, stable, deactivated condition.

- For Cs/Sr capsules declared waste, send to Yucca Mountain for HLW repository disposal.

The technical approach and technology initiatives for the Project to accomplish the Hanford Strategic Plan end point targets are identified below.

Post 2006 Project Scope Provided by Project Manager:

Phase II retrieval and processing begin when Phase I ends in 2011; they continue until the completion of Phase II in 2028.

Project End State Provided by Project Manager:

All readily retrievable tank waste (and Cs/Sr capsules) will have been retrieved and immobilized at the end of Phase II. Immobilized LAW will be disposed on site, while immobilized HLW will be stored at Hanford pending shipment to the National Geologic Repository for disposal. Residual waste remaining in the tanks after retrieval operations are completed, in-tank equipment, tank structures, and any underlying or adjacent contaminated soils will be disposed of in place after suitable treatment. Tanks will then be closed in a RCRA-compliant manner.

The full list of science research awards that have the potential to address projects such as this one, which deals with High Level Waste problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "High Level Waste".

The following awards were identified through systems engineering to have the potential to address the specific needs of this Project. Those research awards that may have the strongest link to this project are designated by the symbol "§".

Award ID	Page #	Award Title
§ 55137-CA	B-53	Investigation of Novel Electrode Materials for Electrochemically-Based Remediation of High- and Low-Level Mixed Wastes in the DOE Complex
§ 54890-CA	B-69	On-Line Slurry Viscosity and Concentration Measurement as a Real-Time Waste Stream Characterization Tool
§ 55188-DC	B-93	Chemical Decomposition of High-Level Nuclear Waste Storage/Disposal Glasses Under Irradiation
§ 54807-GA	B-103	Studies Related to Chemical Mechanisms of Gas Formation in Hanford High-Level Nuclear Wastes
§ 60424-ID	B-113	High Temperature Condensed Phase Mass Spectrometric Analysis
§ 60313-IL	B-135	Radiation Effects on Transport and Bubble Formation in Silicate Glasses
§ 59977-MD	B-169	Synthesis and Characterization of Templated Ion Exchange Resins for the Selective Complexation of Actinide Ions
§ 59993-NM	B-223	Dynamic Effects of Tank Waste Aging on Radionuclide-Complexant Interactions
§ 60403-NM	B-243	Phase Chemistry of Tank Sludge Residual Components
§ 54595-NM	B-255	f-Element Ion Chelation in Highly Basic Media
§ 55179-NY	B-267	Acoustic Probe for Solid-Gas-Liquid Suspensions
§ 54674-OH	B-271	Design and Development of a New Hybrid Spectroelectrochemical Sensor
§ 55087-TN	B-309	Design and Synthesis of the Next Generation of Crown Ethers for Waste Separations: An Inter-Laboratory Comprehensive Proposal
§ 60020-TN	B-323	Stability of High-Level Waste Forms
§ 54735-TX	B-343	Development of Inorganic Ion Exchangers for Nuclear Waste Remediation
§ 54621-WA	B-357	Chemical Speciation of Strontium, Americium, and Curium in High Level Waste: Predictive Modeling of Phase Partitioning During Tank Processing
§ 54628-WA	B-359	Colloidal Agglomerates in Tank Sludge: Impact on Waste Processing
§ 54646-WA	B-363	Interfacial Radiolysis Effects in Tank Waste Speciation
§ 54672-WA	B-365	Radiation Effects in Nuclear Waste Materials
§ 54996-WA	B-371	Ionizing Radiation Induced Catalysis on Metal Oxide Particles
§ 60345-WA	B-375	New Silicotitanate Waste Forms: Development and Characterization
§ 60050-WA	B-395	Chemical Speciation of Inorganic Compounds under Hydrothermal Conditions
§ 60123-WA	B-397	Potential-Modulated Intercalation of Alkali Cations into Metal Hexacyanoferrate Coated Electrodes
§ 60075-WA	B-401	Particle Generation by Laser Ablation in Support of Chemical Analysis of High Level Mixed Waste from Plutonium Production Operations
55094-CA	B-13	Chemical and Ceramic Methods Toward Safe Storage of Actinides Using Monazite
60370-CA	B-39	Rational Design of Metal Ion Sequestering Agents
60319-CA	B-51	Thermodynamics of the Volatilization of Actinide Metals in the High-Temperature Treatment of Radioactive Wastes
54655-CA	B-63	Collaborative Research: Hydrogeological-Geophysical Methods for Subsurface Site Characterization
54926-CA	B-75	Novel Ceramic-Polymer Composite Membranes for the Separation of Hazardous Liquid Waste
54847-CO	B-87	Photocatalytic and Chemical Oxidation of Organic Compounds in Supercritical Carbon Dioxide
55012-CO	B-89	Extraction and Recovery of Mercury and Lead from Aqueous Waste Streams Using Redox-active Layered Metal Chalcogenides
54893-FL	B-99	Research Program to Determine Redox Properties and Their Effects on Speciation and Mobility of Pu in DOE Wastes

Awards Related to RL-TW07 Continued

Award ID	Page #	Award Title
55380-IL	B-127	In-Situ Spectro-Electrochemical Studies of Radionuclide Contaminated Surface Films on Metals and the Mechanism of their Formation and Dissolution
55382-IL	B-129	Determination of Transmutation Effects in Crystalline Waste Forms
60247-IL	B-139	Miniature Nuclear Magnetic Resonance Spectrometer for In-Situ and In-Process Analysis and Monitoring
55211-IL	B-141	Cavitational Hydrothermal Oxidation: A New Remediation Process
54834-IN	B-143	An Investigation of Homogeneous and Heterogeneous Sonochemistry for Destruction of Hazardous Waste
54942-IN	B-147	Spectroscopy, Modeling and Computation of Metal Chelate Solubility in Supercritical CO_2
54791-KS	B-153	Managing Tight-binding Receptors for New Separations Technologies
54864-KS	B-157	Supramolecular Chemistry of Selective Anion Recognition for Anions of Environmental Relevance
54571-MA	B-181	Removal of Heavy Metals and Organic Contaminants from Aqueous Streams by Novel Filtration Methods
55110-MO	B-195	An Alternative Host Matrix Based on Iron Phosphate Glasses for the Vitrification of Specialized Nuclear Waste Forms
55223-MO	B-197	De Novo Design of Ligands for Metal Separation
54724-NM	B-205	Synthesis of New Water-Soluble Metal-Binding Polymers: Combinatorial Chemistry Approach
54770-NM	B-213	New Anion-Exchange Resins for Improved Separations of Nuclear Materials
55387-NM	B-237	Photooxidation of Organic Wastes Using Semiconductor Nanoclusters
60363-NM	B-241	Optimization of Thermochemical, Kinetic, and Electrochemical Factors Governing Partitioning of Radionuclides during Melt Decontamination of Radioactively Contaminated Stainless Steel
54639-NM	B-251	Development of an In-Situ Microsensor for the Measurements of Chromium and Uranium in Groundwater at DOE Sites
54122-PA	B-281	A Broad Spectrum Catalytic System for Removal of Toxic Organics from Water By Deep Oxidation
55171-PA	B-283	Development of Advanced In-Situ Techniques for Chemistry Monitoring and Corrosion Mitigation in SCWO Environments
54856-PA	B-289	Structural Biology of the Sequestration & Transport of Heavy Metal Toxins: NMR Structure Determination of Proteins Containing the -Cys-X-Y-Cys-metal Binding Motifs
55205-SC	B-299	A Fundamental Study of Laser-Induced Breakdown Spectroscopy Using Fiber Optics for Remote Measurements of Trace Metals
54973-TN	B-301	A Novel Energy-Efficient Plasma Chemical Process for the Destruction of Volatile Toxic Compounds
55033-TN	B-305	Characterization of Chemically Modified Hyperthermophilic Enzymes for Chemical Syntheses and Bioremediation Reactions
55103-TN	B-311	Utilization of Kinetic Isotope Effects for the Concentration of Tritium
55276-TN	B-319	Fundamental Chemistry and Thermodynamics of Hydrothermal Oxidation Processes
60197-TN	B-329	Microsensors for In-situ Chemical, Physical, and Radiological Characterization of Mixed Waste
60096-TN	B-339	Rational Synthesis of Imprinted Organofunctional Sol-Gel Materials for Toxic Metal Separation
54679-WA	B-367	Architectural Design Criteria for F-Block Metal Ion Sequestering Agents
54897-WA	B-391	The Sonophysics and Sonochemistry of Liquid Waste Quantification and Remediation
55146-WA	B-393	Adsorption/Membrane Filtration as a Contaminant Concentration and Separation Process for Mixed Wastes and Tank Wastes

Awards Related to RL-TW07 Continued

Award ID	Page #	Award Title
60150-WA	B-399	Genetic Engineering of a Radiation-Resistant Bacterium for Biodegradation of Mixed Wastes

Richland Operations Office

Hanford Site - Richland Operations Office

RL-TW08 - Process Waste Privatization Infrastructure

Problem Area: High Level Waste
Life-Cycle Cost in 2007+: $1,487,000,000
DOE Project Manager: J.E. Kinzer, 509-376-7591, jackson_e_kinzer@rl.gov
Contractor Manager: A.M. Umek, 509-373-5983, anthony_m_tony_umek@rl.gov
For More Information: http://www.doe.gov/em52/pbs/rl-tw08.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Medium **Worker:** Medium **Environment:** High

Technical Approach Provided by Project Manager:

Contracting agreements associated with soliciting private contractors to provide the treatment service have been made. Using these contract documents as a basis and subsequent interaction with private contractors, infrastructure and interface requirements will be finalized. Parallel to this time line, a systems definition step was undertaken using initial contract requirements as a baseline. Through engineering studies covering each utility/service to be provided, an optimal approach using proven technologies was selected. Based upon the study findings, Conceptual Designs have been completed in FY 97. These provide sufficient technical details for developing defensible cost estimates and project schedules. In addition, the Conceptual Designs media developed will be used for preparing specifications in support of acquisition contracting strategies.

The turnover or custody transfer of feed tanks AP-106/8 to the privatization contractors entails providing essential data and information to the contractors for the safe and efficient operation of the tanks while in their custody. Contracting agreements will define the final nature of the data and information needs, extent of tank modifications to be performed by the contractors, obligations related to the return of the tanks. In response to these agreements, turnover plans will be developed and will include a tank inspection task to baseline tank integrity prior to transfer.

The Process Waste Privatization Infrastructure Project will provide the following:
(1) Project Management - Activities include management, control and reporting for all related infrastructure project activities.
(2) Acquisition of Phase I Utilities and Services for -
a. Electricity
b. Raw and Sanitary Water
c. Site Development and Roads
d. Liquid Effluent Transfer
e. Turnover of Feed Tanks AP-106/8
f. Radioactive Solid Waste
(3) Acquisition of Phase II Utilities and Services
a. Electricity
b. Site/Water/Roads
c. Liquid Effluent
d. Sewage Treatment
e. Radioactive Solid Waste
f. Telecommunications
(4) Project Operations - Activities encompass funding and resources for the operation and maintenance of acquired infrastructure including funding for Hanford operational staff training and government furnished services.
(5) D&D/Closure - Activities encompass D&D and removal of infrastructure systems after privatization contractors' facilities have gone through D&D.

Post 2006 Project Scope Provided by Project Manager:

Phase I Project Operations support will continue through completion. Following Phase I facilities deactivation, these facilities, along with added infrastructure will be D&D'd and the site closed. Phase II Facilities/Systems and Services Acquisition will continue to turnkey status. Phase II operations support will be initiated and continue throughout the life of Phase II operations. Following Phase II completion, added infrastructure will be D&D'd and with D&D'd privatization contractor facilities the site will be closed.

Project End State Provided by Project Manager:

No follow-on projects will be necessary to meet site closure requirements. However, post-closure institutional controls may be necessary consistent with overall Hanford Site closure strategies.

The full list of science research awards that have the potential to address projects such as this one, which deals with High Level Waste problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "High Level Waste".

The following awards were identified through systems engineering to have the potential to address the specific needs of this Project. Those research awards that may have the strongest link to this project are designated by the symbol "§".

Award ID	Page #	Award Title
§ 59827-AZ	B-9	The Influence of Radiation and Multivalent Cation Additions on Phase Separation and Crystallization of Glass
§ 55188-DC	B-93	Chemical Decomposition of High-Level Nuclear Waste Storage/Disposal Glasses Under Irradiation
§ 54982-FL	B-101	Analysis of Surface Leaching Processes in Vitrified High-Level Nuclear Wastes Using In-Situ Raman Imaging and Atomistic Modeling
§ 54807-GA	B-103	Studies Related to Chemical Mechanisms of Gas Formation in Hanford High-Level Nuclear Wastes
§ 55042-GA	B-105	Quantifying Silica Reactivity in Subsurface Environments: Controls of Reaction Affinity and Solute Matrix on Quartz and SiO2 Glass Dissolution Kinetics
§ 55294-IL	B-121	Superconducting Open-Gradient Magnetic Separation for the Pretreatment of Radioactive or Mixed Waste Vitrification Feeds
§ 55367-IL	B-123	Investigation of Microscopic Radiation Damage in Waste Forms Using ODNMR and AEM Techniques
§ 60313-IL	B-135	Radiation Effects on Transport and Bubble Formation in Silicate Glasses
§ 54691-MI	B-189	Radiation Effects on Materials in the Near-Field of Nuclear Waste Repository
§ 60403-NM	B-243	Phase Chemistry of Tank Sludge Residual Components
§ 60020-TN	B-323	Stability of High-Level Waste Forms
§ 54672-WA	B-365	Radiation Effects in Nuclear Waste Materials
§ 60345-WA	B-375	New Silicotitanate Waste Forms: Development and Characterization
§ 60362-WA	B-379	Ion-Exchange Processes and Mechanisms in Glasses
§ 60075-WA	B-401	Particle Generation by Laser Ablation in Support of Chemical Analysis of High Level Mixed Waste from Plutonium Production Operations
55094-CA	B-13	Chemical and Ceramic Methods Toward Safe Storage of Actinides Using Monazite
60319-CA	B-51	Thermodynamics of the Volatilization of Actinide Metals in the High-Temperature Treatment of Radioactive Wastes
54893-FL	B-99	Research Program to Determine Redox Properties and Their Effects on Speciation and Mobility of Pu in DOE Wastes
55382-IL	B-129	Determination of Transmutation Effects in Crystalline Waste Forms
55110-MO	B-195	An Alternative Host Matrix Based on Iron Phosphate Glasses for the Vitrification of Specialized Nuclear Waste Forms
54751-NM	B-209	High Fluence Neutron Source for Nondestructive Characterization of Nuclear Waste
60015-NM	B-227	Long-term Risk from Actinides in the Environment: Modes of Mobility
60118-NM	B-229	Fundamental Thermodynamics of Actinide-Bearing Mineral Waste Forms
55205-SC	B-299	A Fundamental Study of Laser-Induced Breakdown Spectroscopy Using Fiber Optics for Remote Measurements of Trace Metals
55119-TN	B-315	Phase Equilibria Modification by Electric Fields

Richland Operations Office

Hanford Site - Richland Operations Office

RL-TW09 - Immobilized Tank Waste Storage & Disposal Project

Problem Area:	High Level Waste
Life-Cycle Cost in 2007+:	$6,832,000,000
DOE Project Manager:	J.E. Kinzer, 509-376-7591, jackson_e_kinzer@rl.gov
Contractor Manager:	A.M. Umek, 509-373-5983, anthony_m_tony_umek@rl.gov
For More Information:	http://www.doe.gov/em52/pbs/rl-tw09.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Low **Worker:** Low **Environment:** Medium

Technical Approach Provided by Project Manager:

The end point targets in the Hanford Strategic Plan addressed by this project include:

• The high level immobilized fraction will be interim stored until it can be shipped offsite for disposal (planned for the Yucca Mountain geologic repository).

• Transition high cost surplus facilities in the central plateau and south 600 areas to a low cost, stable, deactivated condition.

• The immobilized low activity fraction will be disposed onsite in a 200 Area disposal system.

The technical approach and technology initiatives for the Project to accomplish the Hanford Strategic Plan end point targets are identified below.

• Technical Approach - Immobilized Tank Waste Storage & Disposal: The ILAW project shall design, construct, operate, monitor and close storage and disposal facilities for immobilized low activity tank waste. The project shall use systems engineering principles to identify functions, requirements, and alternatives for this mission.
The ILAW Project has made a decision to utilize the existing Grout vaults for storage. Additional Below Grade Disposal Facilities will be constructed to accommodate the remaining ILAW.

In order to support the LAW project certain technology support is necessary to ensure, via a comprehensive performance assessment, that the disposal action can be accomplished in a safe and compliant manner. The technologies are identified, but not limited to, in the following list:

Standard method for determining waste form release rate
Glass Monolith Surface Area
Long term testing of Surface Barrier
Field measurements of Vadose zone Hydraulic Properties
Distribution of Recharge Rates
Multi-Phase Moisture Flow in Arid condition
Testing of Sand-Gravel Capillary Barrier
Moisture Dependence of kd
Getter Materials
In-Situ Testing of Glass Release

These science and technology needs have been submitted to the Tank Focus Area (EM-50) for consideration.

The high level immobilized fraction of the tank waste will be interim stored until it can be shipped offsite for disposal. The IHLW project will use systems engineering to evaluate functions, requirements, and alternatives. The canisters of IHLW will be stored in vertical tubes in the building. The storage will be dry with natural convection cooling to maintain repository temperature requirements. The production and storage records will be managed in accordance with geologic repository requirements. The canisters are contaminant free sealed sources when received and minimal contamination is anticipated for D&D. Ability to recover in case of an upset condition will involve capability to overpack canisters.

The Cs/Sr Capsule Disposition Project will recommend to RL the preferred method for processing the capsules for their disposal as high-level waste in the geologic repository. Based on RL acceptance of the recommendation, trade studies will be performed prior to the issuance of the Phase II privatization RFP. These studies and demonstrations will be designed to provide DOE with sufficient technical definition to write the RFP and to provide potential bidders with sufficient confidence needed to respond to the RFP in a timely and cost effective manner. Additionally, the appropriate NEPA documentation supporting the recommended processing approach for the capsules will be generated and a Record of Decision issued.

The duration of the Cs/Sr project is anticipated to last until the contract for Phase II (full-scale) HLW vitrification is successfully placed. The Cs/Sr project Hanford Capsule Initiative (HCI) is recommended to provide the technical basis for capsule disposition.

Post 2006 Project Scope Provided by Project Manager:

Construction and operations of ILAW storage/disposal facilities will continue to approximately 2024. Storage/disposal facilities will be constructed on a just in time schedule to accommodate waste packages from the privatization LAW vendors. Closure and monitoring of the disposal facility will begin.

Both vaults of CSB will be full from Phase 1 production ending in FY2011. Additional vaults will be designed, constructed, monitored until IHLW is sent to Geologic Repository starting in 2034. Cesium product will be returned to Phase II Vendor. Receipt and monitoring of the IHLW storage facilities will continue until IHLW is shipped to a Geologic Repository.

Project End State Provided by Project Manager:

The ILAW project is complete when all tank waste has been processed into low activity and high activity fractions, and the all of the low activity fraction transported to the low activity waste disposal facilities. The disposal facility will be closed with surface barriers and monitoring will have been performed.

IHLW project is complete when the storage facilities are empty, canisters shipped to repository, equipment and super structure decontaminated, and disassembled, the vaults backfilled and a surface cap installed over the site of building.

A technical specification in the Phase II RFP for processing the capsules and a Record of Decision is the end state for storage and disposal of Cs/Sr Capsules.

Specific work activities to close the facilities under this Project to be performed by others at the end of this Project's mission are identified below.

The full list of science research awards that have the potential to address projects such as this one, which deals with High Level Waste problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "High Level Waste".

The following awards were identified through systems engineering to have the potential to address the specific needs of this Project. Those research awards that may have the strongest link to this project are designated by the symbol "§".

Award ID	Page #	Award Title
§ 59827-AZ	B-9	The Influence of Radiation and Multivalent Cation Additions on Phase Separation and Crystallization of Glass
§ 54656-CA	B-65	Mixing Processes in High-Level Waste Tanks
§ 54890-CA	B-69	On-Line Slurry Viscosity and Concentration Measurement as a Real-Time Waste Stream Characterization Tool
§ 55188-DC	B-93	Chemical Decomposition of High-Level Nuclear Waste Storage/Disposal Glasses Under Irradiation
§ 54982-FL	B-101	Analysis of Surface Leaching Processes in Vitrified High-Level Nuclear Wastes Using In-Situ Raman Imaging and Atomistic Modeling
§ 54807-GA	B-103	Studies Related to Chemical Mechanisms of Gas Formation in Hanford High-Level Nuclear Wastes
§ 55042-GA	B-105	Quantifying Silica Reactivity in Subsurface Environments: Controls of Reaction Affinity and Solute Matrix on Quartz and SiO2 Glass Dissolution Kinetics
§ 60424-ID	B-113	High Temperature Condensed Phase Mass Spectrometric Analysis
§ 55229-IL	B-117	The NOx System in Nuclear Waste
§ 55294-IL	B-121	Superconducting Open-Gradient Magnetic Separation for the Pretreatment of Radioactive or Mixed Waste Vitrification Feeds
§ 55367-IL	B-123	Investigation of Microscopic Radiation Damage in Waste Forms Using ODNMR and AEM Techniques
§ 60313-IL	B-135	Radiation Effects on Transport and Bubble Formation in Silicate Glasses
§ 55141-MA	B-177	Imaging and Characterizing the Waste Materials Inside an Underground Storage Tank Using Seismic Normal Modes
§ 54691-MI	B-189	Radiation Effects on Materials in the Near-Field of Nuclear Waste Repository
§ 54773-NM	B-215	Microstructural Properties of High Level Waste Concentrates and Gels with Raman And Infrared Spectroscopies
§ 59993-NM	B-223	Dynamic Effects of Tank Waste Aging on Radionuclide-Complexant Interactions
§ 60403-NM	B-243	Phase Chemistry of Tank Sludge Residual Components
§ 54595-NM	B-255	f-Element Ion Chelation in Highly Basic Media
§ 59982-NY	B-259	Reactivity of Peroxynitrite: Implications for Hanford Waste Management and Remediation
§ 55179-NY	B-267	Acoustic Probe for Solid-Gas-Liquid Suspensions
§ 54674-OH	B-271	Design and Development of a New Hybrid Spectroelectrochemical Sensor
§ 59978-TN	B-321	Thermospray Mass Spectrometry Ionization Processes Fundamental Mechanisms for Speciation, Separation and Characterization of Organic Complexants in DOE Wastes
§ 60020-TN	B-323	Stability of High-Level Waste Forms
§ 60217-TN	B-331	Optically-Based Array Sensors for Selective In Situ Analysis of Tank Waste
§ 54735-TX	B-343	Development of Inorganic Ion Exchangers for Nuclear Waste Remediation
§ 54621-WA	B-357	Chemical Speciation of Strontium, Americium, and Curium in High Level Waste: Predictive Modeling of Phase Partitioning During Tank Processing
§ 54628-WA	B-359	Colloidal Agglomerates in Tank Sludge: Impact on Waste Processing
§ 54672-WA	B-365	Radiation Effects in Nuclear Waste Materials
§ 60345-WA	B-375	New Silicotitanate Waste Forms: Development and Characterization
§ 60362-WA	B-379	Ion-Exchange Processes and Mechanisms in Glasses
§ 60123-WA	B-397	Potential-Modulated Intercalation of Alkali Cations into Metal Hexacyanoferrate Coated Electrodes
§ 60075-WA	B-401	Particle Generation by Laser Ablation in Support of Chemical Analysis of High Level Mixed Waste from Plutonium Production Operations

Awards Related to RL-TW09 Continued

Award ID	Page #	Award Title
55094-CA	B-13	Chemical and Ceramic Methods Toward Safe Storage of Actinides Using Monazite
60328-CA	B-37	High Frequency Electromagnetic Impedance Measurements for Characterization, Monitoring and Verification Efforts
55411-CA	B-49	Joint Inversion of Geophysical Data for Site Characterization and Restoration Monitoring
60319-CA	B-51	Thermodynamics of the Volatilization of Actinide Metals in the High-Temperature Treatment of Radioactive Wastes
60162-CO	B-85	Enhancements to and Characterization of the Very Early Time Electromagnetic (VETEM) Prototype Instrument and Applications to Shallow Subsurface Imaging at Sites in the DOE Complex
60141-DC	B-95	Gamma Ray Imaging for Environmental Remediation
54893-FL	B-99	Research Program to Determine Redox Properties and Their Effects on Speciation and Mobility of Pu in DOE Wastes
55218-GA	B-107	Seismic Surface-Wave Tomography of Waste Sites
55382-IL	B-129	Determination of Transmutation Effects in Crystalline Waste Forms
60247-IL	B-139	Miniature Nuclear Magnetic Resonance Spectrometer for In-Situ and In-Process Analysis and Monitoring
60199-KS	B-159	Seismic-Reflection and Ground Penetrating Radar for Environmental Site Characterization
60231-MD	B-165	Novel Miniature Spectrometer for Remote Chemical Detection
54571-MA	B-181	Removal of Heavy Metals and Organic Contaminants from Aqueous Streams by Novel Filtration Methods
55110-MO	B-195	An Alternative Host Matrix Based on Iron Phosphate Glasses for the Vitrification of Specialized Nuclear Waste Forms
54724-NM	B-205	Synthesis of New Water-Soluble Metal-Binding Polymers: Combinatorial Chemistry Approach
54741-NM	B-207	Characterization of Contaminant Transport Using Naturally-Occurring U-Series Disequilibria
54751-NM	B-209	High Fluence Neutron Source for Nondestructive Characterization of Nuclear Waste
59996-NM	B-225	Plutonium Speciation, Solubilization, and Migration in Soils
60015-NM	B-227	Long-term Risk from Actinides in the Environment: Modes of Mobility
60118-NM	B-229	Fundamental Thermodynamics of Actinide-Bearing Mineral Waste Forms
60363-NM	B-241	Optimization of Thermochemical, Kinetic, and Electrochemical Factors Governing Partitioning of Radionuclides during Melt Decontamination of Radioactively Contaminated Stainless Steel
54828-SC	B-297	Processing of High Level Waste: Spectroscopic Characterization of Redox Reactions in Supercritical Water
55205-SC	B-299	A Fundamental Study of Laser-Induced Breakdown Spectroscopy Using Fiber Optics for Remote Measurements of Trace Metals
54973-TN	B-301	A Novel Energy-Efficient Plasma Chemical Process for the Destruction of Volatile Toxic Compounds
55119-TN	B-315	Phase Equilibria Modification by Electric Fields
60355-WA	B-377	Mineral Surface Processes Responsible for the Decreased Retardation (or Enhanced Mobilization) of 137Cs from HLW Tank Discharges
55146-WA	B-393	Adsorption/Membrane Filtration as a Contaminant Concentration and Separation Process for Mixed Wastes and Tank Wastes
59925-WV	B-403	Modeling of Diffusion of Plutonium in Other Metals and of Gaseous Species in Plutonium-Based Systems

Richland Operations Office

Hanford Site - Richland Operations Office

RL-WM02 - Canister Storage Building Operations

Problem Area:	Spent Nuclear Fuel
Life-Cycle Cost in 2007+:	$412,000,000
DOE Project Manager:	Elizabeth D Sellers, 509-376-7465, Elizabeth_D_Sellers@RL.GOV
Contractor Manager:	Nancy H Williams, 509-373-6307, Nancy_H_Williams@RL.GOV
For More Information:	http://www.doe.gov/em52/pbs/rl-wm02.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Low **Worker:** Medium **Environment:** Medium

Technical Approach Provided by Project Manager:

The CSB is a reinforced concrete vault structure with three vaults for storage of SNF and IHLW. Vault 1 will be used for storage of K Basins SNF and Shippingport PWR Core 2 SNF. Vaults 2 and 3 will be used for storage of IHLW from TWRS facilities. Functions performed within the CSB include storage and dispositioning of SNF; and receipt, storage, and dispositioning of IHLW.

The 200 Area Interim Storage Area (ISA) is constructed adjacent to the CSB for interim storage of sitewide SNF. Functions performed within the 200 Area ISA include storage and disposition of sitewide SNF.

Post 2006 Project Scope Provided by Project Manager:

Receipt of IHLW and non-routine wastes from LAW/HLW, Phase I and Phase II plants and the LAW Plant, if necessary, will continue until FY 2015. Non-routine wastes received from the LAW Plant will be returned to the LAW/HLW Plant, Phase II for incorporation into IHLW stream in 2013-2015, if necessary. Transfer of SNF from the CSB complex to the federal geologic repository will be initiated in FY 2015 and will continue until FY2040. Transfer of IHLW from the CSB complex to the repository will be initiated in FY 2036 and will continue until FY2044. Deactivation or redeployment of the CSB complex will follow removal of all SNF and IHLW.

Project End State Provided by Project Manager:

SNF and IHLW will be removed from the CSB complex and transferred to the federal geologic repository for disposal. The complex will be deactivated or redeployed.

The full list of science research awards that have the potential to address projects such as this one, which deals with Spent Nuclear Fuel problems, are listed in the <u>Index of Research Awards by Environmental Management Problem Area</u>, in the back of this appendix, under the heading "Spent Nuclear Fuel".

Richland Operations Office

Hanford Site - Richland Operations Office

RL-WM03 - Solid Waste Storage and Disposal

Problem Area: Mixed Waste
Life-Cycle Cost in 2007+: $733,000,000
DOE Project Manager: R.F. Guercia, 509-376-5494, rudolph_f_rudy_guercia@rl.gov
Contractor Manager: C.G. Mattsson, 509-372-8381, carl_g_gus_mattsson@rl.gov
For More Information: http://www.doe.gov/em52/pbs/rl-wm03.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Low **Worker:** Medium **Environment:** Medium

Technical Approach Provided by Project Manager:

The end point targets in the Hanford Strategic Plan addressed by this project include:

- Complete final disposition of remaining unirradiated uranium inventories in the south 600 area facilities by disposition offsite or disposal as LLW in 200 Area.

- Low level and low level mixed waste from onsite and offsite sources (including PNNL special case wastes) will continue to be disposed of in the 200 Area.

- Contaminated media from soil sites in the south 600 area will be consolidated and moved to the 200 Area for disposal.

- Transition high cost surplus facilities in the central plateau and south 600 areas to a low cost, stable, deactivated condition.

The technical approach and technology initiatives for the Project to accomplish the Hanford Strategic Plan end point targets are identified below.

- Technical Objective - Solid Waste Storage and Disposal: Solid Waste Storage and Disposal will provide RCRA compliant interim storage for Low Level Mixed and TRU radioactive wastes, shallow land disposal for LLW, shallow land disposal of radioactive Mixed Waste in the lined Mixed Waste Disposal Trenches, and direct offsite shipment services for non-radioactive dangerous wastes. Solid Waste will strive to accelerate schedules, minimize costs, and support pollution prevention. Solid Waste interfaces with project RL-WM-04 for retrieval of Post 1970 contact handled TRU, certification of TRU waste for shipment to WIPP, disposal of treated mixed waste, and waste verification activities. Solid Waste utilizes real-time radiography (X-ray) and passive, active neutron assay technology for waste verification activities.

Post 2006 Project Scope Provided by Project Manager:

Post FY 2006 status of work scope for each facility identified in section A.2.2 is given below, as appropriate.

Central Waste Complex

- Solid Waste operations will continue until all presently stored and newly generated waste is disposed, then the facilities will be D&D'd and the burial grounds closed. It is assumed that life cycle operations will continue until approximately 2046.

Nonradioactive Dangerous Waste Storage Facility

- Transition of the Nonradioactive Dangerous Waste Storage Facility completed in FY 2001.

Transuranic Storage and Assay Facility

• Transition of the Transuranic Storage and Assay Facility completed in FY 2000.

Low-Level Waste Burial Grounds

• Disposition of Greater Than Waste Category 3 low level waste is pending decision for disposal path.

• Solid Waste operations will continue until all presently stored and newly generated waste is disposed, then the facilities will be D&D`d, the burial grounds closed, and transitioned to long term S&M. It is assumed that life cycle operations will continue until approximately 2046.

Mixed Waste Disposal Trenches

• Low level mixed waste disposal operations will continue thru FY 2035 and then be closed and transitioned to Long Term Surveillance and Maintenance (S&M) thru 2046.

Project End State Provided by Project Manager:

DOE non-defense generators will all discontinue operations. The LLBG will be stabilized. The RCRA storage facilities will be RCRA clean closed.

Specific work activities to close the facilities under this Project to be performed by others at the end of this Project`s mission are identified below.

Central Waste Complex
Work associated with facility performed by Decontamination & Decommissioning:
Decontaminate and Decommission (D&D) Central Waste Complex Facility

Nonradioactive Dangerous Waste Storage Facility
Work associated with facility performed by Decontamination & Decommissioning:
Decontaminate and Decommission (D&D) Non-Radioactive Dangerous Waste Storage Facility

Transuranic Storage and Assay Facility
Work associated with facility performed by Decontamination & Decommissioning:
Decontaminate and Decommission (D&D) Transuranic Storage and Assay Facility

The full list of science research awards that have the potential to address projects such as this one, which deals with Mixed Waste problems, are listed in the <u>Index of Research Awards by Environmental Management Problem Area</u>, in the back of this appendix, under the heading "Mixed Waste".

The following awards were identified through systems engineering to have the potential to address the specific needs of this Project. Those research awards that may have the strongest link to this project are designated by the symbol "§".

Award ID	Page #	Award Title
§ 60326-AZ	B-11	Isolation of Metals from Liquid Wastes: Reactive Scavenging in Turbulent Thermal Reactors
§ 55012-CO	B-89	Extraction and Recovery of Mercury and Lead from Aqueous Waste Streams Using Redox-active Layered Metal Chalcogenides
§ 55247-IL	B-119	Sensors Using Molecular Recognition in Luminescent, Conductive Polymers
§ 59934-IN	B-149	Hazardous Gas Production by Alpha Particles in Solid Organic Transuranic Waste Matrices
§ 60231-MD	B-165	Novel Miniature Spectrometer for Remote Chemical Detection
§ 60070-MS	B-193	The Development of Cavity Ringdown Spectroscopy as a Sensitive Continuous Emission Monitor for Metals
§ 54751-NM	B-209	High Fluence Neutron Source for Nondestructive Characterization of Nuclear Waste
§ 59981-NM	B-219	Real-Time Broad Spectrum Characterization of Hazardous Waste by Membrane Introduction Mass Spectrometry
55318-CA	B-23	Improved Analytical Characterization of Solid Waste-Forms by Fundamental Development of Laser Ablation Technology
60247-IL	B-139	Miniature Nuclear Magnetic Resonance Spectrometer for In-Situ and In-Process Analysis and Monitoring
59978-TN	B-321	Thermospray Mass Spectrometry Ionization Processes Fundamental Mechanisms for Speciation, Separation and Characterization of Organic Complexants in DOE Wastes
60197-TN	B-329	Microsensors for In-situ Chemical, Physical, and Radiological Characterization of Mixed Waste

Richland Operations Office

Hanford Site - Richland Operations Office

RL-WM04 - Solid Waste Treatment

Problem Area: Mixed Waste
Life-Cycle Cost in 2007+: $978,000,000
DOE Project Manager: R. F. Guercia, 509-376-5494, rudolph_f_rudy_guercia@rl.gov
Contractor Manager: C.G. Mattsson, 509-372-8381, carl_g_gus_mattsson@rl.gov
For More Information: http://www.doe.gov/em52/pbs/rl-wm04.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Low **Worker:** Medium **Environment:** Low

Technical Approach Provided by Project Manager:

The end point targets in the Hanford Strategic Plan addressed by this project include:

• Spent fuels consolidated in the 200 Area in safe, stable, cost-effective interim storage pending national decisions on their ultimate disposition.

• Transition high cost surplus facilities in the central plateau and south 600 areas to a low cost, stable, deactivated condition.

• Retrievably stored TRU waste retrieved, processed, shipped offsite to WIPP.

• Low level and low level mixed waste from onsite and offsite sources will continue to be disposed of in the 200 Area.

• Provide safe, stable, interim storage for nuclear materials in the 200 Area pending decisions on their ultimate disposition.

The technical approach and technology initiatives for the Project to accomplish the Hanford Strategic Plan end point targets are identified below.

• Technical Objective - Capital Project W-113: This project will provide a complete system to retrieve suspect TRU containers that are covered with dirt, free from levels of contamination which would require special features for containment. Equipment will be provided to x-ray and assay the waste containers through non-destructive techniques for proper identification of the contents to the extent necessary to meet site requirements at an on-site RCRA permitted facility.

• Technical Objective - Capital Project W-156: The 218-W-4B Alpha Caisson retrieval facility will require remote handling (RH) capability for recovering and repackaging waste from degraded containers. The facility will also be required to provide contamination confinement during all retrieval operations. Waste containers in one caisson have dose rates up to 8,000 R/hr.

• Technical Objective - Capital Project W-221: The Phase II Retrieval facility will require RH capability for recovering and repackaging waste from degraded containers and the packaging of contaminated dirt. The facility will also be required to provide contamination confinement during all retrieval operations. Of the remaining Phase II drums and boxes (approximately 19,000 and 630 respectively) it is estimated that 8,000 drums and 530 boxes will be retrieved by facilities identical or similar to the Phase I Retrieval facility. The remainder of the waste contains about 10,000 drums and 100 boxes that have a storage configuration similar to the retrieved in Phase I but will have been in storage significantly longer, are stored on dirt floors, or include a significant number of RH containers.

• Technical Objective - Capital Project W-259: Capital project number W-259 is a line-item project that adds a new liquid waste collection system to the T-Plant Complex. The new waste collection system will be fully compliant with state and federal waste storage requirements. The current waste collection system is not compliant with these requirements. The project includes installing double contained waste piping and tanks and their associated monitoring systems along side of the 2706-T complex. The system will be operational by 9/99.

• Technical Objective - Future Capital Project: Construct facility or provide for a contract to treat RH-TRU waste in support of TPA Milestone M-91

• Technical Objective - Mixed Waste Treatment:
1. Procurement of a outside vendor to complete treatment either on the Hanford Site or at the Vendors` facilities depending on the project.
2. Characterization of waste (RTR and sampling) to insure that the Vendors waste acceptance criteria is met.
3. Shipment of waste to the treatment site.
4. Treatment of Waste
5. Return of treated waste for burial at the RMW trenches.

• Management, Training, Administrative and ESQ Support: Standard training, certification, and administrative support to operate a RCRA permitted, category 2 nuclear waste treatment facility.

• Plant and Equipment Upgrades: Upgrades to failed plant equipment, new decontamination processes and equipment, and compliance upgrades such as Fire Hazards Upgrades and relocation of the chemical bath decontamination process out of the canyon.

T-Plant Facility

• Mixed Waste Treatment: Most mixed waste treatment activities are performed at the 2706-T complex. Specific treatments planned include macroencapsulation of long-length contaminated equipment, stabilization, solidification, and neutralization of mixed waste sludges, soils, and particulates. Wastes are treated to specific federal and state treatment criteria.

• Performance of High-Dose Alpha/Beta/Gamma Decontamination: Physical and chemical decontamination processes will be used to perform this operation. Materials that are to be recovered are either bathed in chemical baths and wiped down or some combination or the two. Various chemical baths are utilized and new processes are continually being evaluated for waste minimization and greater efficiency purposes. Items are also prepared for disposal by painting or grouting for contamination control and packaging for disposal. This work is performed in the 221-T Canyon where shielding and contamination control are maintained.

• Storage of Contaminated Equipment and SNF: Large contaminated equipment items are stored in the canyon from other programs pending decisions on final disposal or reuse needs. Spent Nuclear Fuel from the Shippingport decommissioned pressurized water reactor is also stored in the canyon. Cell 2R was converted into a storage pool in the late 1970`s to accept storage of the fuel. The fuel was to be reprocessed in PUREX. The reprocessing mission of PUREX was terminated and the fuel remains in storage in the T-Plant canyon. It is currently monitored for physical condition and safe storage parameters until it is removed and stored and part of the Hanford Spent Nuclear Fuels Management Program.

• Canyon Mission Transition Activities: These activities include removal of large contaminated equipment for the T-Plant canyon such as pump racks, tanks and waste boxes. These items are prepared for disposal or storage as necessary. Also included in this area is radiation area reduction in the canyon, compliance upgrades, and future mission upgrades. Potential future missions included expanded mixed waste treatment and treatment of remote-handled TRU packages for ultimate disposal at the WIPP site.

• Performance of Low-dose Beta/Gamma Decontamination: This operation is performed in the 2706-T facility. Various physical decontamination methods are employed such as high-pressure spray washing, ice blasting, grinding, painting, and wiping. Materials and equipment are decontaminated for both re-use and recycling. A prime example is the recovery of bulk lead items which are decontaminated and recycled instead of being sent to mixed waste storage. Materials are either free-released from radiological controls or are released to a regulated site use status.

• Waste Verification: Waste drums and boxes are opened or X-rayed to verify that the contents meet applicable storage or disposal criteria. Non-compliant items are removed and packaged for storage and original containers are repackaged for final disposition, either storage or disposal.

WRAP

• Technical Objective - Waste Receiving and Processing Facility (WRAP): Single shift operations are capable of viewing and assaying the contents of 6825 waste drums/yr and 70 standard boxes/yr using x-ray Non-Destructive Examination (NDE) and Non-Destructive Assay (NDA). NDE/NDA and visual inspection/repacking will be performed on LLW, TRU, and LLMW/TRUM waste in four separate process glove boxes. LLW is verified/repackaged and sent to Burial Grounds for disposal. LLMW/TRUM waste is segregated, treated, repackaged, and sent to storage, treatment, or disposal. TRU waste is verified/certified/repackaged for shipment to the WIPP for disposal.

Post 2006 Project Scope Provided by Project Manager:

Post FY 2006 status of work scope for each facility identified in section A.2.2 is given below, as appropriate.

T-Plant Facility

• T-Plant Canyon Facility transition completed by FY 2004.

2706-T

• Continue low-dose alpha/beta/gamma decontamination, waste verification, and mixed waste treatment activities. Operations will continue thru FY 2035.

M-91 Facility

• Process of newly generated waste through thermal treatment, stabilization, and other treatment methods. M-91 TPA Milestone activities and projects will be treating RH and CH-TRU and RH-LLW waste. Operations will continue thru FY 2028.

• Continue to process waste in accordance with TPA M-91 milestones.

WRAP

• Waste will be processed at design throughput (6825 drum/yr and 70 standard boxes/yr) from the following anticipated waste streams:
- newly generated on-site
- retrieved suspect TRU
- off-site TRU waste requiring WIPP certification

• Process of newly generated waste through thermal treatment, stabilization, and other treatment methods. M-91 TPA Milestone activities and projects will be treating RH and CH-TRU and RH-LLW waste. Operations will continue thru FY 2028.

• Continue WRAP mission thru 2031. Final waste shipments to WIPP are made in 2031.

Thermal Treatment Contract

• Process of newly generated waste through thermal treatment, stabilization, and other treatment methods. M-91 TPA Milestone activities and projects will be treating RH and CH-TRU and RH-LLW waste. Operations will continue thru FY 2028.

Low-Level Mixed Waste Stabilization Contract

Status not yet defined.

Project End State Provided by Project Manager:

Specific work activities to close the facilities under this Project to be performed by others at the end of this Project's mission are identified below.

T-Plant Canyon Facility
- Work associated with facility performed by Accelerated Deactivation Project: Deactivate T-Plant Facility (FY 2004)
- Work associated with facility performed by Decontamination & Decommissioning: Decontaminate and Decommission (D&D) T-Plant Facility

2706-T
- Work associated with facility performed by Accelerated Deactivation Project: Deactivate 2706-T Facility (FY 2035)
- Work associated with facility performed by Decontamination & Decommissioning: Decontaminate and Decommission (D&D) 2706-T Facility

The full list of science research awards that have the potential to address projects such as this one, which deals with Mixed Waste problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "Mixed Waste".

The following awards were identified through systems engineering to have the potential to address the specific needs of this Project. Those research awards that may have the strongest link to this project are designated by the symbol "§".

Award ID	Page #	Award Title
§ 55247-IL	B-119	Sensors Using Molecular Recognition in Luminescent, Conductive Polymers
§ 59934-IN	B-149	Hazardous Gas Production by Alpha Particles in Solid Organic Transuranic Waste Matrices
§ 60231-MD	B-165	Novel Miniature Spectrometer for Remote Chemical Detection
§ 60070-MS	B-193	The Development of Cavity Ringdown Spectroscopy as a Sensitive Continuous Emission Monitor for Metals
§ 54751-NM	B-209	High Fluence Neutron Source for Nondestructive Characterization of Nuclear Waste
§ 59981-NM	B-219	Real-Time Broad Spectrum Characterization of Hazardous Waste by Membrane Introduction Mass Spectrometry
55318-CA	B-23	Improved Analytical Characterization of Solid Waste-Forms by Fundamental Development of Laser Ablation Technology
60247-IL	B-139	Miniature Nuclear Magnetic Resonance Spectrometer for In-Situ and In-Process Analysis and Monitoring
59978-TN	B-321	Thermospray Mass Spectrometry Ionization Processes Fundamental Mechanisms for Speciation, Separation and Characterization of Organic Complexants in DOE Wastes
60197-TN	B-329	Microsensors for In-situ Chemical, Physical, and Radiological Characterization of Mixed Waste

Richland Operations Office

Hanford Site - Richland Operations Office

RL-WM05 - Liquid Effluents Project

Problem Area: High Level Waste
Life-Cycle Cost in 2007+: $586,000,000
DOE Project Manager: E. M. Bowers, 509-373-9276, elizabeth_m_liz_bowers@rl.gov
Contractor Manager: C. G. Mattsson, 509-372-8381, carl_g_gus_mattsson@rl.gov
For More Information: http://www.doe.gov/em52/pbs/rl-wm05.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Medium **Worker:** Medium **Environment:** High

Technical Approach Provided by Project Manager:

The end point targets in the Hanford Strategic Plan addressed by this project include:

- Reuse facilities in the south 600 area for economic diversification where feasible.

- Retrieve tank wastes to the extent needed for tank closure, divide into high level and low activity fractions and immobilize.

- Groundwater use remains restricted for a yet to be determined period, groundwater intercepted or contained to within designated boundaries.

- For Cs/Sr capsules declared waste, send to Yucca Mountain for HLW repository disposal.

- Low level and low level mixed waste from onsite and offsite sources (including PNNL special case wastes) will continue to be disposed of in the 200 Area.

- Transition the 324/327 Buildings to a low cost, stable, deactivated condition and disposition their nuclear materials (including 324 Building radioactive tank wastes).

- Operate the ERDF to accept waste from remediation of CERCLA units across the Hanford Site.

- Complete transition of the 300 Area Fuels Supply.

- Drain, decontaminate, and stabilize K-Basins Facility.

- Transition high cost surplus facilities in the central plateau and south 600 areas to a low cost, stable, deactivated condition.

- Complete stabilization of plutonium in PFP (DNFSB 94-1 implementation).

- Continue to provide safe storage for Cs/Sr capsules in the WESF indefinitely.
  (1) WESF decoupled and a standalone facility.

- Spent fuel removed and K-Basins cleaned sufficient to transition to D&D.

- Transition the PUREX facility and B-Plant to low cost, stable, deactivated condition.

The technical approach and technology initiatives for the Project to accomplish the Hanford Strategic Plan end point targets are identified below.

242-A Evaporator

• Technical Objective - 242-A Evaporator: The 242-A Evaporator concentrates dilute liquid tank wastes by evaporation. The volume of tank wastes is reduced to eliminate the need to construct additional storage tanks.

Liquid Effluent Retention Facility

• Technical Objective - LERF: The LERF consists of three RCRA-compliant surface impoundments for temporarily storing process condensate from the 242-A Evaporator and other waste water.

200 Area Effluent Treatment Facility

• Technical Objective - 200 Area ETF: The waste water from LERF is treated in the ETF to remove toxic metals, radionuclides, ammonia and to destroy organics. The ETF treatment process constitutes Best Available Technology (BAT) and includes pH adjustment, filtration, ultraviolet/peroxide (UV/OX) destruction of organics, reverse osmosis, and ion exchange. The treated effluent has been delisted from RCRA and is discharged to a state-approved land disposal site under a WAC 173-216 discharge permit. A truck unloading station enables liquid effluents to be received from other projects and transferred to either the LERF for storage or directly to the ETF for treatment.

200 Area Treated Effluent Disposal Facility

• Technical Objective - 200 Area TEDF: The 200 Area TEDF is a collection and disposal system for other liquid effluents which have already had BAT/AKART applied by the generators. These liquid effluents are routed to another state-approved land disposal site and discharged under a separate WAC 173-216 discharge permit.

300 Area Treated Effluent Disposal Facility

• Technical Objective - 300 Area TEDF: Waste water in the 300 Area which is nonradioactive and nonhazardous is received via the process sewer and treated in the 300 Area TEDF. Liquid effluents from other projects which meet acceptance criteria can also be received and treated in the 300 area TEDF. The waste water is treated to remove heavy metals and cyanide and to destroy organics. The 300 Area TEDF treatment process constitutes BAT and includes pH adjustment, iron co-precipitation, filtration, UV/OX, and ion exchange. The treated effluent is discharged to the Columbia River under an NPDES permit.

307 Retention Basins

• Technical Objective - 307 Retention Basins: Potentially contaminated waste water in the 300 Area is collected in the 307 Retention Basins, monitored for radioactive contamination, and transferred to the 300 Area TEDF.

340 Waste Handling Facility

• Technical Objective - 340 Facility: Radioactive and mixed liquid waste in the 300 Area is collected at the 340 Waste Handling Facility and transferred by rail car to double-shell tanks in the 200 East Area.

Miscellaneous Streams System

• Technical Objective - Miscellaneous Streams: Miscellaneous Streams include liquid effluents generated from hydrotest, maintenance, and construction activities; cooling water and condensate discharges; and storm water runoff. Commitments established in the Plan and Schedule include registration of injection wells, submitting applications for categorical discharge permits, annual update of the Miscellaneous Stream inventory, and implementation of Best Management Practices.

Post 2006 Project Scope Provided by Project Manager:

The 242-A Evaporator will operate until FY 2011, and the LERF and ETF will operate until FY 2030. The 242-A Evaporator, LERF, and ETF will then be shut down and cleaned out, and transferred to the Facility Stabilization Project for deactivation. The 200 Area TEDF will operate until FY 2030, and then be shut down and transferred to the Infrastructure Project (Landlord Program). The 307 Retention Basins and 300 Area TEDF will operate for as long as the process sewer and retention process sewer waste water streams continue (estimated to be FY 2025). The 307 Retention Basins will then be shut down and cleaned out, and transferred to the Environmental Restoration

Project for decontamination and decommissioning. The 300 Area TEDF will be privatized and transferred to commercial operation. Categorical discharge permits for Miscellaneous Streams will be maintained until the waste water streams covered by the permits no longer exist.

Post FY 2006 status of work scope for each facility identified in section A.2.2 is given below, as appropriate.

242-A Evaporator

• The 242-A Evaporator will operate until FY 2011, then be shut down and cleaned out, and transferred to the Facility Stabilization Project.

Liquid Effluent Retention Facility

• The LERF will operate until FY 2030, then be shut down and cleaned out, and transferred to the Facility Stabilization Project.

200 Area Effluent Treatment Facility

• The ETF will operate until FY 2030, then be shut down and cleaned out, and transferred to the Facility Stabilization Project.

200 Area Treated Effluent Disposal Facility

• The 200 Area TEDF will operate until FY 2030, then be shut down and transferred to the Infrastructure Project (Landlord Program).

300 Area Treated Effluent Disposal Facility

• The 300 Area TEDF will operate for as long as the 300 Area process sewer waste water streams continue (estimated to be FY 2025). The 300 Area TEDF will then be privatized and transferred to commercial operation.

307 Retention Basins

• The 307 Retention Basins will operate for as long as the 300 Area retention process sewer waste water streams continue (estimated to be FY 2025). The 307 Retention Basins will then be shut down and cleaned out, and transferred to the Environmental Restoration Project.

340 Waste Handling Facility

• The 340 Facility has been shut down and cleaned out, and transferred to the Environmental Restoration Project for decontamination and decommissioning. The radioactive liquid waste system no longer operates.

Miscellaneous Streams System

• Categorical discharge permits for Miscellaneous Streams are being maintained until the waste water streams covered by the permits no longer exist.

Project End State Provided by Project Manager:

Contaminated facilities such as the 242-A Evaporator, LERF, and ETF are generally cleaned out at the end of their useful lives and turned over to the Facility Stabilization Project for deactivation. Each facility being transitioned must meet certain acceptance criteria, which can vary by facility. A Memorandum of Understanding will be developed with Facility Stabilization. A Facility Turnover Agreement will be developed to document the condition of each facility at the time of turnover. A Facility Assessment will be performed as part of the turnover agreement. The Liquid Effluents Project will perform clean out and stabilization of the 340 Facility. The 340 Facility will then be transferred to the Environmental Restoration Project for decontamination and decommissioning. Uncontaminated facilities like the 200 Area TEDF are generally turned over to the Infrastructure Project (Landlord Program) for redeployment or demolition. The 307 Retention Basins will be shut down and cleaned out, and transferred to the

Environmental Restoration project for decontamination and decommissioning. The 300 Area TEDF will be privatized and transferred to commercial operation in support of re-vitalization of the 300 Area.

Specific work activities to close the facilities under this Project to be performed by others at the end of this Project's mission are identified below.

242-A Evaporator
Work associated with facility performed by Accelerated Deactivation Project:
Maintain Safe & Compliant 242-A Evaporator Facility in CP Areas
Transition 242-A Evaporator Facility
Work associated with facility performed by Decontamination & Decommissioning:
Decontaminate and Decommission (D&D) 242-A Evaporator Facility

Liquid Effluent Retention Facility
Work associated with facility performed by Accelerated Deactivation Project:
Maintain Safe & Compliant Liquid Effluent Retention Facility in CP Areas
Transition Liquid Effluent Retention Facility
Work associated with facility performed by Decontamination & Decommissioning:
Decontaminate and Decommission (D&D) Liquid Effluent Retention Facility

200 Area Effluent Treatment Facility
Work associated with facility performed by Accelerated Deactivation Project:
Maintain Safe & Compliant 200 Area Effluent Treatment Facility in CP Areas
Transition 200 Area Effluent Treatment Facility
Work associated with facility performed by Decontamination & Decommissioning:
Decontaminate and Decommission (D&D) 200 Area Effluent Treatment Facility

200 Area Treated Effluent Disposal Facility
Work associated with facility performed by Landlord:
Transition 200 Area Treated Effluent Disposal Facility

307 Retention Basins
Work associated with facility performed by Decontamination & Decommissioning:
Maintain Safe & Compliant 307 Retention Basins in South 600 Areas
Transition 307 Retention Basins
Decontaminate and Decommission (D&D) 307 Retention Basins

340 Waste Handling Facility
Work associated with facility performed by Decontamination & Decommissioning:
Decontaminate and Decommission (D&D) 340 Waste Handling Facility

The full list of science research awards that have the potential to address projects such as this one, which deals with High Level Waste problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "High Level Waste".

Richland Operations Office

RL-ST01 - PNNL WASTE MANAGEMENT

Problem Area: Mixed Waste
Life-Cycle Cost in 2007+: $628,000,000
DOE Project Manager: Roger F. Christensen, 509-372-4900, Roger_F_Christensen@rl.gov
Contractor Manager: James T. Fulton, 509-375-2557, jt_fulton@pnl.gov
For More Information: http://www.doe.gov/em52/pbs/rl-st01.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: High **Worker:** High **Environment:** High

Technical Approach Provided by Project Manager:

Some wastes are generated during normal laboratory operations and facility maintenance activities. Legacy wastes in buildings and in the soil require disposition. These wastes are generally transferred to the Central Waste Complex for storage prior to treatment and/or disposal. Hazardous wastes are shipped to commercial TSD facilities for disposal. There are no emerging technologies applicable to this activity.

Time proven treatment technologies such as neutralization will be used in the Hazardous Waste Treatment Unit (HWTU) when permits allow the relatively small-scale operations to start. The 325 Building Hazardous Waste Treatment Units (HWTUs) receive, store and treat mixed and dangerous waste generated by PNNL programs. The 325 HWTUs consist of two units: the Shielded Analytical Laboratory (SAL) and the Hazardous Waste Treatment Unit (HWTU). The SAL is a hot cell facility that has a dual role as an analytical laboratory and a treatment, storage, and disposal facility (TSDF). The SAL performs tank treatment and bench scale treatment of high dose rate lab waste (2,000 rem/hr capability). The HWTU is a treatment and storage unit that contains fume hoods and gloveboxes for mixed waste treatment. The HWTU performs bench scale treatment of mixed and dangerous waste from various PNNL programs and also treats transuranic and transuranic-mixed waste by neutralization and stabilization. The 325 HWTUs are currently operating under interim status. Final status is anticipated in December 1997.

The stretch goals associated with this program include the following activities:
- Evaluate operating routines within the 325 Facility to reduce the overall cost of surveillance and maintenance.
- Eliminate 300 Area dependency on the 340 Facility and the Radioactive Liquid Waste System by FY 1999. Stretch to complete by FY 1998.

Unfunded breakthrough goals include:
- Reduce the number of active 300 Area facilities. Manage excess facilities in accordance with the Hanford Excess Facilities Management Plan.
- Support DOE in the development and implementation of a Waste Generator Cost Recovery System which penalizes the proliferation of waste, provides incentives for waste minimization and reduces the dependency on the Hanford Site EM budget to pay for the management of newly generated waste.

Post 2006 Project Scope Provided by Project Manager:

The status of this activity after FY 2006 will be continuing minimum safe, compliant EM laboratory facilities and waste management operations to support the completion of the Hanford cleanup mission. Remaining legacy wastes and contamination in DOE facilities and sites assigned to PNNL will be dispositioned. The 325 Building will continue to support other missions in the DOE complex.

Project End State Provided by Project Manager:

This activity is on-going and will continue to provide minimum safe, compliant research and technology development laboratory facilities and waste management operations. As these facilities come to the end of their useful life, interface with Transition Projects will be required for stabilization and eventual D&D.

The Waste Management & Operational Compliance Program Management activities provide support for the following Hanford Strategic Plan (HSP) endpoint targets for the South 600 Area geographical area:

FACILITY TRANSITION
Interim Endpoint Target: 300 Area Revitalization
Description: Transition high-cost surplus facilities to a low-cost, stable deactivated condition.

ENVIRONMENTAL CONTAMINATED SOIL SITES
Final End-State Targets: 300 Area Source Remedial Action
Description: - Soil sites remediated consistent with ROD cleanup standards.
- Contaminated media will be consolidated and moved to the 200 Area for disposal.
- Final cleanup levels will be established within individual RODs or Permit Modifications.

DECONTAMINATION AND DECOMMISSIONING (D&D)
Final End-State Target: D&D
Description: - Reuse facilities for economic diversification where feasible.
- Remove non-essential, surplus buildings and facilities that don't have identified post-cleanup uses.

The following goal from the Science & Technology Mission section of the HSP is also applicable to program activities:
Demonstrate Excellence in Laboratory Management: Be the model for management of National Laboratories.
Strategies:
- Protect the environment, the health and safety of our staff and the public through effective conduct of operations
- Become our customers most productive and cost effective science and technology provider
- Develop the diverse leadership necessary to meet the scientific and technical challenges of the next century.
- Enhance the value of our human and physical assets, and intellectual properties.

Success Indicators:
- Conduct safe, compliant and environmentally benign operations.
- Pacific Northwest National Laboratory is recognized by both government and private customers as the benchmark case for value and cost effectiveness.
- Pacific Northwest National Laboratory attracts and retains highly competent technical staff and the diverse, highly qualified leadership necessary to manage the laboratory.

The full list of science research awards that have the potential to address projects such as this one, which deals with Mixed Waste problems, are listed in the <u>Index of Research Awards by Environmental Management Problem Area</u>, in the back of this appendix, under the heading "Mixed Waste".

Rocky Flats Field Office

Science Needs as Reported in the March 1998 *Accelerating Cleanup: Focus on 2006*, Table O.9.2

RF-DD14 - Determination of Appropriate Free Release Level for Property and Salvageable Equipment Contaminated with Beryllium

Research Identified Through the Complex-Wide Needs Survey, June 1996

CS-056 - Environmental remediation of tanks and piping adjacent to dismantled buildings.
CS-057 - Characterize site UBCs and PACs to determine type and extent of contamination.
CS-058 - In-situ method for surface decontamination for uranium process equipment.
CS-060 - Systems/procedures for assuring that all radioactive material has been removed from tanks and pipes prior to dismantlement is necessary to avoid budget/schedule impact.
CS-062 - Cleanup, decommissioning, dismantling, and construction activities will require containment technologies to prevent the spread of contamination offsite or to uncontaminated areas on-site.
CS-063 - Cost effective and safe systems and procedures are required to size reduce and remove excess equipment.
CS-070 - Improve techniques for volume reduction of decommissioning waste such as sheet metal, piping, conduit and furniture.
CS-071 - In-situ capping of dismantled buildings to prevent contaminant migration into groundwater or release to air or surface water.
CS-075 - Best available technologies for safe removal of friable asbestos.
CS-078 - Contain airborne contamination during disassembly and demolition activities.
CS-108 - Chromium contamination in soils and groundwater.
CS-109 - Acid mine drainage (AMD).
CS-126 - Remove OU 5 landfill contents.

Technology Development and Science Needs related to the Decontamination and Decommissioning Technology Focus Area

D&D06 - More durable, economical, and comfortable worker protection equipment, clothing, and breathing apparatus for both radioactive and non-radioactive environments are required to reduce the risk of exposure.
Science Need: Fundamental chemical and materials studies concerned with understanding the mechanism of penetration and diffusion of liquid materials through polymeric materials are needed to develop new personnel protection equipment.
D&D08 - Methods are needed to discern the type and depth of radioactive contamination in concrete. Current methods typically volatilize contaminants or create problems of cross contamination.
Science Need: Fundamental instrumentation studies concerned with development of non-intrusive, spatially resolved measurement of radioactive species inside structure bodies are needed to develop more sensitive characterization methods and technology.
D&D10 - Current processes are not effective in cleaning non-metal complex configurations to free-release conditions and in reducing secondary waste associated with cleaning porous materials.
Science Need: A basic understanding of the chemistry and surface science of porous surfaces is needed to develop improved decontamination methods for wood, concrete, and asbestos.
D&D16 - Fixatives are used to fix dispersible contaminants in place where decontamination operations are not feasible or during periods prior to decontamination. Improved fixatives are required which are more easily applied & removed and have longer life.
Science Need: Fundamental chemistry and interfacial science of polymer fixatives are required for development of new materials which are more easily applied, long lived, and easily removed.

Rocky Flats Field Office

Rocky Flats Environmental Technology Site

RF002 - Waste Management Project

Problem Area: Mixed Waste
Life-Cycle Cost in 2007+: $161,000,000
DOE Project Manager: Jessie Roberson, 303-966-2263, ten.year.plan@rfets.gov
Contractor Manager: Not Identified
For More Information: http://www.doe.gov/em52/pbs/rf002.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Medium **Worker:** Medium **Environment:** Medium

Technical Approach Provided by Project Manager:

By the end of the project, over 300,000 m3 of waste will have been dispositioned including 26,000 m3 of current inventory and approximately 275,000 m3 of newly generated waste. Approximately 51% of this will be sanitary/uncontaminated waste, 46% will be low level and low level mixed, 3% will be transuranic and transuranic mixed waste, with <1% being hazardous waste. The waste volumes that will be managed over the life of the RFETS closure corresponding to the scope of the waste types and subprojects are summarized in section A.4 (Performance Measure Metrics) below. Specific approaches for overall management of the individual waste types is as follows:

Sanitary/Uncontaminated Waste generated from routine activities and operations and from deactivation, decontamination and decommissioning will be landfilled onsite (until the end of FY98); used as fill onsite; or will be collected, staged and disposed offsite at a commercial landfill. Sanitary Liquids will continue to be generated from routine Site activities and will continue to be treated in the existing sewage treatment plant. Hazardous Wastes will continue to be collected and staged in onsite storage facilities for shipment to offsite commercial facilities for treatment, recycle, reclamation and/or disposal. Low Level and Low Level Mixed Process Wastes are currently stored in containers in a variety of locations onsite. Efforts are underway to consolidate storage in Buildings 440, 664, and 906. Low Level Waste will be shipped to the Nevada Test Site until FY2009. With the exception of a small volume of classified waste and process waste water, treatment of low level waste is not anticipated. Approximately, 10,000m3 of LLM waste (pondcrete and saltcrete) will be treated and disposed at a commercial facility (Envirocare) over the next 3 years. About 50% of the remaining LLM inventory and the new LLM generation will require treatment prior to disposal. Most, if not all, will be treated offsite. In the event offsite treatment is not available, onsite treatment would occur first through the use of temporary, mobile treatment units. Failing this, fixed onsite treatment units would be required. Much of the existing inventory and future generation of LLM will require disposal at federal facilities (e.g. Hanford) because of radiological constraints at existing commercial facilities. Shipment to such a facility is planned to begin in FY 2001. Initially, LL and LLM Remediation Wastes will be collected and stored temporarily in existing facilities. These wastes will be managed in large containers (e.g. roll offs) to facilitate handling and reduce costs. Beginning in FY 2003 generation will increase dramatically as remediation efforts accelerate. Contingency storage will be required to handle newly generated remediation wastes. Accordingly, new containerized storage facilities are contemplated (see RF-003) to house wastes until they can be shipped offsite for disposal. Such interim storage will occur in a monitored and retrievable fashion to facilitate ultimate offsite treatment and disposal. Future disposal locations will be selected based on acceptance criteria for the waste forms generated. Approximately 50% of the LLM waste generated will require treatment prior to final dispositioning. TRU/TRM Waste is currently stored in containers at a variety of locations onsite while awaiting the opening of WIPP ((i.e. FY 98). Consolidation efforts are underway to store TRU/TRM in Buildings 371, 440, 664 and 991. TRU/TRM will be staged and shipped from Building 664 when WIPP opens. At expected generation rates and desired shipping rates increase, additional shipping capacities will be needed beginning in FY2000. While a new facility is preferred, retrofitting an existing facility is also being evaluated (likely Bldg. 440). Most TRU/TRM will meet WIPP acceptance criteria but approximately 5% will require offsite treatment prior to disposal. These wastes will be sent to offsite treatment location(s) or will be treated onsite as appropriate beginning in FY 2004. All wastes will be dispositioned by the last year of generation (FY 2009).

For all waste types, the storage and disposal functions can be accomplished through the use of industry accepted techniques. Thus, the use of emerging technologies is not expected to significantly alter the approaches discussed above. In the areas of characterization and treatment, however, emerging technologies could assist in reducing costs and expediting schedules for these functions. The Site will continue to monitor the progress of commercial and DOE supported waste management technology development activities that could lead to reduced Site cost and risk. Specific waste management technology development activities that could reduce costs and risks associated with Site closure include: expedited characterization and assay techniques for all waste types; size reduction, characterization, and decontamination technologies for D&D wastes; mixed waste treatment technologies for immobilization of contaminants, destruction of hazardous organic contaminants, and separation of hazardous/radioactive contaminants. Section O.9 contained in the Operations/Field Office Data Summary provides specific information on Site needs and applicable technology development activities.

Post 2006 Project Scope Provided by Project Manager:

The project will be 100% complete by the end of the last year of waste generation (FY 2009). At this point all existing inventory and new generation of all waste types will be dispositioned at offsite locations.

Project End State Provided by Project Manager:

All wastes will be treated and or disposed in approved and licensed offsite facilities. This includes: 80,000 m3 of LLM waste, 65,000 m3 of LL waste, 8,500 m3 of TRU/TRM waste, 159,000 m3 of sanitary/uncontaminated waste, and 2,400 m3 of hazardous waste. The LLM and LL waste will have been disposed at both commercial and DOE disposal facilities. The TRU/TRM waste will have been disposed at the WIPP facility. Sanitary/uncontaminated waste will have been disposed at offsite commercial solid waste landfill(s). Hazardous waste will have been treated/disposed at offsite commercial TSD facilities.

The remaining waste management facilities (Buildings 440, 569, 664, 906, and, if acquired, new TRU/TRM staging/shipping facility and CAMU) will be decommissioned and dismantled for removal from the Site. The D&D of Buildings 440, 569, 664, and 906 are currently planned for completion by the end of FY 2009. An additional follow on project will be required for the remaining TRU/TRM shipping/staging facility in FY 2009 (if it is constructed as a new facility). The costs for this follow on project have been submitted as part of the Focus 2006 baseline, but the functional location of this project must still be determined. For D&D of the CAMU see RF-003.

The full list of science research awards that have the potential to address projects such as this one, which deals with Mixed Waste problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "Mixed Waste".

Rocky Flats Field Office

Rocky Flats Environmental Technology Site

RF013 - Closure Caps Project

Problem Area: Remedial Action
Life-Cycle Cost in 2007+: $62,000,000
DOE Project Manager: Jessie Roberson, 303-966-2263, ten.year.plan@rfets.gov
Contractor Manager: Not Identified
For More Information: http://www.doe.gov/em52/pbs/rf013.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Low **Worker:** Medium **Environment:** Medium

Technical Approach Provided by Project Manager:

The caps that will be utilized for the industrial area are capillary break type caps, although, a vegetative soil cap may also be considered and are currently being used in arid climates. The typical cross section of a capillary break cap includes (from bottom to top) structural backfill, a clay layer, a HDPE geomembrane, sandy gravel (finer material) and then gravelly sand (coarser material) covered by a vegetative surface. The fine material covered by coarser material is what provides the capillary break. Prior to building the caps, initial grading would be conducted and site pavement and building foundations would be removed, if necessary. The construction of the caps will utilize traditional construction techniques and equipment. The majority of the material needed to construct the caps are available in the local area and the geomembrane is commercially available. After completion of cap construction final grading and revegetation would be conducted in the non capped areas in order to limit infiltration and direct runoff. This would include a layer of clean topsoil to establish a horizon capable of supporting an indigenous plant community. Prior to regrading and revegetation of the industrial area, the remaining pavement/parking lots would be removed. The cap would provide a cover over contaminated media that remained in place after remedial activities are completed and also limit the infiltration of water that would otherwise migrate through the media and potentially reach groundwater.

The progress of both commercial and DOE supported technology development activities that have the potential to reduce Site costs or risk will be monitored. A specific technology development activity that could benefit the closure cap project is the Advanced Closure Project at Sandia National Laboratory.

Post 2006 Project Scope Provided by Project Manager:

The caps will be emplaced in the industrial area from FY08 - FY09. This activity will also include the removal of building foundations and regrading/revegetation of the industrial area.

Project End State Provided by Project Manager:

The capping project is one of the final EM projects for the Site to reach interim closure. The only EM activities that will occur after placement of the caps is long term monitoring and maintenance.

The full list of science research awards that have the potential to address projects such as this one, which deals with Remedial Action problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "Remedial Action".

Rocky Flats Field Office

Rocky Flats Environmental Technology Site

RF014 - Industrial Zone Closure Project

Problem Area: Remedial Action
Life-Cycle Cost in 2007+: $57,000,000
DOE Project Manager: Jessie Roberson, 303-966-2263, ten.year.plan@rfets.gov
Contractor Manager: Not Identified
For More Information: http://www.doe.gov/em52/pbs/rf014.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Low **Worker:** Medium **Environment:** Medium

Technical Approach Provided by Project Manager:

There is no technical development process at the Rocky Flats Environmental Technology Site to develop new ways or methodology of operating facilities, removing hazardous materials, facility deactivation, decommissioning, or closure activities. This type of work will be monitored at other facilities across the weapons complex and in private enterprise for any new technologies that may become available. The new technologies would be evaluated for use at Rocky Flats as they may apply to upgrading or reducing the cost of the baseline. It is expected that improvements will be made through a continuing effort at Rocky Flats for improvement in the processes governing work at the plantsite that could yield cost reducing efficiencies in operations and maintenance as well as D & D activities.

For purposes of planning, all IHSSs would be excavated, thermally treated, and disposed. However, each IHSS will be evaluated on a case-by-case basis and the appropriate remedial action would be implemented. In some cases, insitu treatment, containment, or another type of remedial action might be more appropriate.

Post 2006 Project Scope Provided by Project Manager:

The scope of the Industrial Zone activity after 2006 is as follows:
1.1.05.01 - 111 Cluster; Complete in FY02.
1.1.05.02 - 125/441 Cluster; Closure activities will be taking place in FY05.
1.1.05.03 - 221/224 Cluster; All closure activities in this cluster were completed in FY96.
1.1.05.04 - 223 Cluster; All activities in this cluster will completed in FY04.
1.1.05.05 - 300/500; This cluster provides landlord functions in support of on-going plant activities until FY08. Deactivation and decommissioning will take place in FY00, with closure activities in FY01.
1.1.05.06 - 331 Cluster; This cluster continues providing landlord functions in support of on-going plant activities until FY09.
1.1.05.07 - 371T Cluster; All activities complete by FY06.
1.1.05.09 - 442/452 Cluster; D&D and closure complete in FY07.
1.1.05.11 - 460 Cluster; Landlord functions in all the facilities are completed in FY05; Deactivation, Decommissioning and Closure activities for those facilities are completed in FY07.
1.1.05.13 - 690T Cluster (662, 663, T690N); Closure complete in FY99.
1.1.05.15 - 850 Cluster; Closure complete in FY06.
1.1.05.20 - SECIZ Cluster; Closure complete during FY06.
1.1.05.21 - INELI Cluster; Closure complete during FY09.
1.1.05.22 - INFGAS Cluster; Closure complete during FY09.
1.1.05.24 - INFWTI Cluster; Closure complete during FY06
1.1.05.26 - INFRDS Cluster; Operations continue until FY09 to maintain roads and fences, etc., when all plant activities are completed. Roads, fences, etc. will be abandoned in place.
1.1.05.28; - INFSTM Cluster; Operations continue until FY06 in support of steam requirements of the plant. Decommissioning and closure activities are scheduled for completion in FY07. Facilities left on site will be on natural gas or electric heat pumps. Economic conversion facilities that are steam heated will have to be converted by the new tenants.

1.1.05.29 - INFTCM Cluster; Operations continue until FY06 in support of communications systems. Current facilities in Building 112 and others are deactivated, decommissioned and closed in FY07.
1.1.05.30 - IZ High Risk IHSSs; 40% of the effort extends past FY06, but will be completed in FY07.
1.1.05.31 - No Action/No Further Action Justification for IZ - Complete FY05.

125/441, 444, 690T Clusters Project
1.1.05.02 - 125/441 Cluster; Decommissioning activities in FY98 (B123 Only)
1.1.05.10 - 444 Cluster; Deactivation activities complete in FY06, decommissioning of facilities in the cluster takes place in FY07, and closure activities complete in FY08. The IHSS is remediated over FY08.
1.1.05.13 - 690T Cluster; Closure activities completed in FY99.
903/905, H2OGIZ Clusters Project
1.1.05.23 - H2OGIZ Cluster; Operations continue until FY06 in support of ground water monitoring. Decommissioning is scheduled for FY09.
1.1.05.17 - 903/905 Cluster; Closure activities complete in FY04.
INFSEW Cluster Project
1.1.05.27 - INFSEW; Decommissioning and closure take place in FY07 and FY08
664 Cluster Project
1.1.05.12 - 664 Cluster; This cluster remains in operation until FY07 in support of waste storage and shipping activities. Deactivation, decommissioning and closure activities are planned to be complete in FY08.
440/750 HAZ, 904/906 Clusters Project
1.1.05.08 - 440 Cluster; This cluster remains in operation until FY07 in support of waste storage activities. In FY08 deactivation, decommissioning, and closure will complete.
1.1.05.14 - 750HAZ Cluster; Cluster closure in FY99.
1.1.05.18 - 904/906 Cluster; This cluster remains in operation until FY07 in support of waste storage activities. The cluster will be decommissioned in FY08.
PWTS Cluster Project
1.1.05.25 - PWTS Cluster; Decommissioning and closure take place in FY06 and 07.

Project End State Provided by Project Manager:

All facilities and structures in the Industrial Zone will be removed to the foundations and remediated to acceptable standards.

The full list of science research awards that have the potential to address projects such as this one, which deals with Remedial Action problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "Remedial Action".

The following awards were identified through systems engineering to have the potential to address the specific needs of this Project. Those research awards that may have the strongest link to this project are designated by the symbol "§".

Award ID	Page #	Award Title
§ 55396-CA	B-33	Sorption of Colloids, Organics, and Metals onto Gas-Water Interfaces: Transport Mechanisms and Potential Remediation Technology
§ 60328-CA	B-37	High Frequency Electromagnetic Impedance Measurements for Characterization, Monitoring and Verification Efforts
§ 55249-CA	B-47	Experimental Determination of Contaminant Metal Mobility as a Function of Temperature Time and Solution Chemistry
§ 54926-CA	B-75	Novel Ceramic-Polymer Composite Membranes for the Separation of Hazardous Liquid Waste
§ 60162-CO	B-85	Enhancements to and Characterization of the Very Early Time Electromagnetic (VETEM) Prototype Instrument and Applications to Shallow Subsurface Imaging at Sites in the DOE Complex
§ 54893-FL	B-99	Research Program to Determine Redox Properties and Their Effects on Speciation and Mobility of Pu in DOE Wastes

Awards Related to RF014 Continued

Award ID	Page #	Award Title
§ 54834-IN	B-143	An Investigation of Homogeneous and Heterogeneous Sonochemistry for Destruction of Hazardous Waste
§ 60199-KS	B-159	Seismic-Reflection and Ground Penetrating Radar for Environmental Site Characterization
§ 54888-MA	B-175	Manipulating Subsurface Colloids to Enhance Cleanups of DOE Waste Sites
§ 54639-NM	B-251	Development of an In-Situ Microsensor for the Measurements of Chromium and Uranium in Groundwater at DOE Sites
§ 60158-OR	B-279	Development of Radon-222 as a Natural Tracer for Monitoring the Remediation of NAPL Contamination in the Subsurface
§ 54122-PA	B-281	A Broad Spectrum Catalytic System for Removal of Toxic Organics from Water By Deep Oxidation
§ 55033-TN	B-305	Characterization of Chemically Modified Hyperthermophilic Enzymes for Chemical Syntheses and Bioremediation Reactions
§ 55119-TN	B-315	Phase Equilibria Modification by Electric Fields
§ 60197-TN	B-329	Microsensors for In-situ Chemical, Physical, and Radiological Characterization of Mixed Waste
§ 55185-TX	B-349	New Strategies for Designing Inexpensive but Selective Bioadsorbants for Environmental Pollutants: Selection of Specific Ligands & Their Cell Surface Expression
§ 54635-WA	B-361	Molecular-Level Process Governing the Interaction of Contaminants with Iron and Manganese Oxides
60370-CA	B-39	Rational Design of Metal Ion Sequestering Agents
60319-CA	B-51	Thermodynamics of the Volatilization of Actinide Metals in the High-Temperature Treatment of Radioactive Wastes
55137-CA	B-53	Investigation of Novel Electrode Materials for Electrochemically-Based Remediation of High- and Low-Level Mixed Wastes in the DOE Complex
54890-CA	B-69	On-Line Slurry Viscosity and Concentration Measurement as a Real-Time Waste Stream Characterization Tool
54914-CA	B-73	Atmospheric-Pressure Plasma Cleaning of Contaminated Surfaces
54847-CO	B-87	Photocatalytic and Chemical Oxidation of Organic Compounds in Supercritical Carbon Dioxide
55012-CO	B-89	Extraction and Recovery of Mercury and Lead from Aqueous Waste Streams Using Redox-active Layered Metal Chalcogenides
60141-DC	B-95	Gamma Ray Imaging for Environmental Remediation
60424-ID	B-113	High Temperature Condensed Phase Mass Spectrometric Analysis
55247-IL	B-119	Sensors Using Molecular Recognition in Luminescent, Conductive Polymers
55294-IL	B-121	Superconducting Open-Gradient Magnetic Separation for the Pretreatment of Radioactive or Mixed Waste Vitrification Feeds
60283-IL	B-133	Waste Volume Reduction Using Surface Characterization and Decontamination by Laser Ablation
60247-IL	B-139	Miniature Nuclear Magnetic Resonance Spectrometer for In-Situ and In-Process Analysis and Monitoring
55211-IL	B-141	Cavitational Hydrothermal Oxidation: A New Remediation Process
54942-IN	B-147	Spectroscopy, Modeling and Computation of Metal Chelate Solubility in Supercritical CO_2
54791-KS	B-153	Managing Tight-binding Receptors for New Separations Technologies
54864-KS	B-157	Supramolecular Chemistry of Selective Anion Recognition for Anions of Environmental Relevance
60231-MD	B-165	Novel Miniature Spectrometer for Remote Chemical Detection
59977-MD	B-169	Synthesis and Characterization of Templated Ion Exchange Resins for the Selective Complexation of Actinide Ions

Awards Related to RF014 Continued

Award ID	Page #	Award Title
54571-MA	B-181	Removal of Heavy Metals and Organic Contaminants from Aqueous Streams by Novel Filtration Methods
60070-MS	B-193	The Development of Cavity Ringdown Spectroscopy as a Sensitive Continuous Emission Monitor for Metals
55223-MO	B-197	De Novo Design of Ligands for Metal Separation
54724-NM	B-205	Synthesis of New Water-Soluble Metal-Binding Polymers: Combinatorial Chemistry Approach
54770-NM	B-213	New Anion-Exchange Resins for Improved Separations of Nuclear Materials
59967-NM	B-217	Aqueous Electrochemical Mechanisms in Actinide Residue Processing
59981-NM	B-219	Real-Time Broad Spectrum Characterization of Hazardous Waste by Membrane Introduction Mass Spectrometry
55387-NM	B-237	Photooxidation of Organic Wastes Using Semiconductor Nanoclusters
60363-NM	B-241	Optimization of Thermochemical, Kinetic, and Electrochemical Factors Governing Partitioning of Radionuclides during Melt Decontamination of Radioactively Contaminated Stainless Steel
60403-NM	B-243	Phase Chemistry of Tank Sludge Residual Components
60163-NM	B-249	Investigation of Techniques to Improve Continuous Air Monitors Under Conditions of High Dust Loading in Environmental Setting
54595-NM	B-255	f-Element Ion Chelation in Highly Basic Media
55179-NY	B-267	Acoustic Probe for Solid-Gas-Liquid Suspensions
54674-OH	B-271	Design and Development of a New Hybrid Spectroelectrochemical Sensor
55171-PA	B-283	Development of Advanced In-Situ Techniques for Chemistry Monitoring and Corrosion Mitigation in SCWO Environments
60017-PA	B-285	Removal of Technetium, Carbon Tetrachloride, and Metals from DOE Properties
54856-PA	B-289	Structural Biology of the Sequestration & Transport of Heavy Metal Toxins: NMR Structure Determination of Proteins Containing the -Cys-X-Y-Cys-metal Binding Motifs
54973-TN	B-301	A Novel Energy-Efficient Plasma Chemical Process for the Destruction of Volatile Toxic Compounds
55087-TN	B-309	Design and Synthesis of the Next Generation of Crown Ethers for Waste Separations: An Inter-Laboratory Comprehensive Proposal
55103-TN	B-311	Utilization of Kinetic Isotope Effects for the Concentration of Tritium
55276-TN	B-319	Fundamental Chemistry and Thermodynamics of Hydrothermal Oxidation Processes
60218-TN	B-333	Novel Mass Spectrometry Mutation Screening for Contaminant Impact Analysis
60096-TN	B-339	Rational Synthesis of Imprinted Organofunctional Sol-Gel Materials for Toxic Metal Separation
54735-TX	B-343	Development of Inorganic Ion Exchangers for Nuclear Waste Remediation
54679-WA	B-367	Architectural Design Criteria for F-Block Metal Ion Sequestering Agents
54996-WA	B-371	Ionizing Radiation Induced Catalysis on Metal Oxide Particles
54897-WA	B-391	The Sonophysics and Sonochemistry of Liquid Waste Quantification and Remediation
55146-WA	B-393	Adsorption/Membrane Filtration as a Contaminant Concentration and Separation Process for Mixed Wastes and Tank Wastes
60050-WA	B-395	Chemical Speciation of Inorganic Compounds under Hydrothermal Conditions
60150-WA	B-399	Genetic Engineering of a Radiation-Resistant Bacterium for Biodegradation of Mixed Wastes
59925-WV	B-403	Modeling of Diffusion of Plutonium in Other Metals and of Gaseous Species in Plutonium-Based Systems

Savannah River Operations Office

Research Identified Through the Complex-Wide Needs Survey, June 1996

CS-018 - Understand partitioning of Pu-238 in high temperature melters.
CS-019 - Waste forms having long-term durability.
CS-020 - Prevent H_2 accumulation in drums resulting from radiolysis of plastic packaging or other hydrogenous materials during long term storage.
CS-033 - Develop non destructive testing (NDT) methods to verify integrity of SNM storage container closure weld.
CS-088 - Characterization techniques for determining quantity and extent of DNAPLs.
CS-089 - Rapid (Field) non Invasive, real time *in-situ* measures to reduce cost of site characterization.
CS-091 - Location and characterization of high hazard waste and verification of remedial action.
CS-092 - Characterization, containment, and remediation of DNAPL sources.
CS-098 - Replace current batch sampling of surface water with a continuous monitoring systems maximizing information value of down-sized data collection.
CS-099 - In-situ quantification of DNAPL for purpose of site characterization, waste characterization, monitoring the effectiveness of remediation plume identification.
CS-101 - Non-intrusive detection and delineation of DNAPL source terms, e.g. pools, remedial saturation zones, in the subsurface.
CS-105 - Need inexpensive approach to characterizing burial grounds. Under current approaches it costs as much to characterize a burial ground as it would to retrieve all waste. No real-time analytical system. Analytical data are too costly to support real technical decisions.
CS-106 - Burial ground characterization.
CS-108 - Chromium contamination in soils and groundwater.
CS-109 - Acid mine drainage (AMD).
CS-110 - Nitrate - contaminated groundwater.
CS-111 - Cyanide leach ponds leaking into groundwater.
CS-112 - Cost effective remediation methods for DNAPLS found in unconsolidated, deep, subsurface sediments; i.e. sandy/clayey soils.
CS-113 - Cost effective, in-situ, and ex-situ, groundwater treatment methods for radioactive, voc's, and hazardous waste constituents in unconsolidated sandy/clayey soils.
CS-115 - Cost effective method to remove low levels (pCi/mi) of tritium from large volumes of water (groundwater up).
CS-116 - Proper application of Electronic Soil remediation techniques to removal of metal ions and anions (including radionuclides) from contaminated soil.
CS-117 - Contaminated underground plumes.
CS-118 - Containment of buried tritium waste.
CS-119 - Remove or stabilize dense non-aqueous phase liquids (DNAPL's) from under Pu & U process building foundations.
CS-122 - Remove VOCs from groundwater using an in situ treatment method.
CS-126 - Remove OU 5 landfill contents.
CS-128 - Environmental remediation of soils and other media adjacent to dismantled buildings.
CS-132 - Identification and treatment of DNAPLs from groundwater.
CS-133 - Removal of ^{3}H, ^{129}I, and CCl_4 from large volumes of groundwater plumes.
CS-134 - Restoration of an aquifer. Principal contaminant is ^{90}Sr.
CS-136 - Characterization of Waste; Chemical characteristics and remediation; degradation of chlorinated hydrocarbons TRU/TRM/LL/LLM waste to be retrievable. Appropriate technology required.
CS-137 - Technical justification is necessary to establish the necessary (but not excessive) requirements for waste storage operations within an existing or new building.
CS-138 - Evaluate and determine the necessary upgrades to convert an existing building to use as a retrievable storage facility.
CS-139 - Make decision based on technical information whether to build a pre-engineered facility or a fully hardened facility for TRU/TRM Mixed Waste Storage.
CS-140 - Many organic contaminated wastes can be treated by removal of the organic chemical species.
CS-142 - Technical justification to allow waste from different waste categories to be placed within the same TRUPACT-II container. Allows for more efficient use of available volume.

CS-143 - Technology to facilitate retrieval of LL, LLM, TRU, and TRM waste from storage facility.
CS-144 - Technical justification to increase Pu gram limit above 325g/TRUPACT-II container.
CS-145 - Efficient method to eliminate hydrogen buildings in TRU containers being shipped to WIPP that contain organics.
CS-146 - Faster, better, cheaper methods are desirable for waste certification prior to shipment for disposal.
CS-147 - Technical justification is necessary to establish appropriate waste packaging requirements for drums. Without this, the number of drum storage spaces required cannot be accurately estimated.
CS-149 - Detection and quantification of RCRA and CAA regulated organic chemicals in process off gases.
CS-150 - Characterization of radionuclide constituents and concentrations deterring waste classification.
CS-151 - Real time radiography is required for waste certification for shipment to WIPP. Improved techniques would speed this process.
CS-152 - Techniques for representative sampling of heterogeneous wastes.
CS-153 - Rapid, in-situ identification and quantification Rad contaminants in process equipment and tanks.
CS-155 - Because of the different treatment requirements for LL, LLM, TRU, TRM and residue wastes, there is a technical need for accurate, fast determination of drum contents via Non-Destructive Assay (NDA) and Non-Destructive Evaluation (NDE).
CS-157 - Technology needed for improved characterization of LLM waste and ER waste.
CS-159 - Conduct headspace gas sampling and gas generations studies on residue drums destined for WIPP.
CS-160 - Technical justification is necessary to establish appropriate Pu gram limits for various choices of waste storage buildings. Without this, the number of drum storage spaces and buildings required cannot be accurately estimated.
CS-161 - TRU, TRM, and Residue wastes will require critically safe treatment and interim storage systems to minimize/eliminate the possibility of a nuclear criticality. Commercial disposal facilities have an upper acceptance limit of 10 nCi/g. Existing in-drum counter instrumentation cannot detect levels this low.
CS-163 - Characterization of RCRA metals, volatile and semi-volatile in containers by non-intrusive measurement.
CS-164 - Radiological surveys are performed to establish the integrity of waste containers. Improvements in this technology would be more accurate and provide greater confidence in the results.
CS-165 - Waste assay is required for waste certification for shipment to WIPP. Improved techniques would speed this process.
CS-167 - Non-intrusive detection, quantification, and speciation of RCRA toxic metals in drums, boxes, and debris.
CS-172 - Bioremediation of Mixed Waste.
CS-173 - Safe, reliable, clean methods to detoxify toxic materials--for example using specific catalysts.
CS-174 - Provide technical input to the design of a facility addressing the needs of specialty waste (e.g., radioactive PCB's and asbestos).
CS-176 - LL and LLM liquid wastes containing higher levels of radioactivity require precipitation. Improvements in this technology will make this operation more efficient.
CS-178 - Liquid wastes will require immobilization prior to disposal. Use of appropriate absorbents is necessary for some liquids.
CS-179 - Offsite treatment of radioactive, hazardous, and mixed wastes is a consideration under ASAP II. Such facilities must be evaluated to ensure they provide adequate treatment, safety, and are licensable for these applications.
CS-182 - Some Hazardous wastes, particularly liquid wastes, will need to be immobilized prior to packaging. Also includes liquids entrained in solid waste matrices.
CS-183 - Some hazardous wastes will require oxidative treatment to minimize the hazardous component.
CS-184 - Stabilize ion exchange resins for repack and interim storage in new SNM storage facility.
CS-189 - Liquid waste stabilization is required for all residue wastes to comply with the WIPP waste acceptance criteria.
CS-191 - Effective treatment of transuranic waste containing ^{238}Pu.
CS-192 - Continuous real time, at temperature monitors for measurements of hazardous compound concentrations in stack gas-specific metals and chemicals.
CS-193 - Selective removal and recovery of toxic metal ions and radionuclides from DOE aqueous waste solutions is an urgent problem that needs a basic science approach to be able to eventually remediate the extensive metal ion/radionuclide contamination.
CS-194 - Treatment of spent deionizers with long-lived radionuclides (carbon-14).
CS-195 - Excess water from liquid wastes requires evaporation for volume reduction. Improvements in this technology will make this operation more efficient.
CS-197 - Characterization and Treatment of tritiated oil with mercury with high activity.
CS-198 - Detection and quantification of RCRA toxic metals in process offgases.

Technology Development and Science Needs related to the MIxed Waste Technology Focus Area

MWFA3 - Removal of sodium nitrate from low level waste destined for landfill disposal is required to comply with regulations.

Science Need: Basic studies associated with methods, chemistry, and kinetics of reduction of sodium nitrate are needed to treat liquid low level waste prior to landfill disposal.

MWFA4 - Radio assay improvements in data collection and analysis time are needed to reduce assay throughput bottlenecks.

Science Need: Fundamental studies leading to development of improved (sensitivity) gamma or neutron detectors, refinement of analysis algorithms, and improved neutron sources are needed to reduce uncertainty and measurement times.

MWFA6 - Improved remote handled TRU characterization is needed to support activities associated with certification of wastes for disposal.

Science Need: Fundamental instrumentation research is required to develop methods, sensors, and techniques that are functional for isotopic and plutonium determinations in high radiation environments.

MWFA7 - Data and analysis models of dioxin/furan formation in thermal treatment processes are needed to reduce or eliminate the potential of formation and release of these compounds.

Science Need: Basic computer modeling studies resulting in supporting data, methods of data measurement, and mechanisms of gas phase dioxin/furan production by thermal treatment processes are needed for improved process design and reduced emission recovery.

MWFA8 - Chelated nickel is produced during bioremediation and must be removed from processed water to comply with regulations.

Science Need: Fundamental chemistry of biomolecule coordinated nickel is needed to understand reactions and conditions necessary for release of chelated nickel produced during bioremediation.

Technology Development and Science Needs related to the Plutonium Technology Focus Area

PFA09 - An improved understanding of plutonium phosphate chemistry in solution and solid states is needed to develop selective phosphate ligands for separation and remediation applications.

Science Need: Basic separations chemistry of plutonium and phosphate systems is needed to develop selective phosphate separations and remediation processes.

Technology Development and Science Needs related to the Radioactive Waste Tanks Technology Focus Area

TFA01 - Data for Closure. Need to develop data on parameters such as radionuclide movement through soil and water structures and effects of long-lived isotopes. Data will allow more realistic options to be developed over the use of conservative assumptions.

Science Need: Basic geochemistry studies are needed that develop fundamental transport data, such as solubilities, partition functions, and rates of migration of radionuclides in soil.

TFA02 - In-Situ Testing of LLW Glass Release. Propose a full-instrumented, in-situ, field experiment to validate computational model to calculate fluid-flow, release of contaminants from glass, and solute transport through soils.

Science Need: Basic geochemical studies are needed to support model validation of radionuclide leaching rates from fracture borosilicate glasses in unsaturated environments.

TFA03 - Waste Chemistry. Need for fundamental understanding of waste chemistry, including mineralization, aging, and unusual speciation with the objective of successful waste retrieval and processing.

Science Need: Basic materials science and geochemical studies are needed to develop an understanding of waste chemistry, mineralization, aging, and unusual speciation for improved waste retrieval and processing methods.

TFA04 - Cold Cap/Off-gas Thermodynamics Model. Need an improved immobilization or treatment process for volatile metals to lower cost and improve safety and reliability in handling the off-gas products.

Science Need: Fundamental chemical studies are needed to determine species concentration above molten glass solutions containing heavy metals, cesium, strontium, lanthanides, and actinides with and without a cold cap composed of unmelted material.

TFA05 - Waste Characterization for Technetium. Need to identify the amount of Tc in the waste and what impacts that may have upon pretreatment processing and subsequent waste form composition and disposal requirements.
Science Need: Fundamental analytical chemical studies are needed for improved separation processes, performance of waste forms, and characterization of Tc chemistry and materials science of waste forms.

TFA06 - Sludge Separations. Require sludge separations to pretreat tank sludges to meet feed acceptance criteria for the solidification system. May include sludge washing and solid/liquid separations.
Science Need: Basic engineering and separations science studies are required to support pretreatment activities, development of solid/liquid separations, and tank remediation of high solids loaded liquids.

TFA07 - Liquids/Solids Separations Studies. Need studies to support the development of advanced separations processes and equipment to minimize the volumes of TRU by separating treated liquid from fine precipitants which can be disposed of as solid waste.
Science Need: Basic engineering and separations science studies are required to support pretreatment activities, development of solid/liquid separations, and tank remediation of high solids loaded liquids.

TFA08 - Waste Characterization Strategy (physical and chemical) to Support Processing Needs. Need a strategy for obtaining characterization data to support processing, including retrieval, pretreatment, and immobilization.
Science Need: Basic analytical chemistry studies are needed to develop new methods for chemical and physical characterization of solids, liquids, and slurries and for development of advanced processing methodologies.

TFA12 - Bulk Sludge Mobilization and Slurry Transport. Slurry transport studies are needed to design pipeline systems for LLW sludges.
Science Need: Basic engineering and separations science studies are required to support pretreatment activities, development of solid/liquid separations, and tank remediation of high solids loaded liquids.

TFA13 - Sludge Waste Form Study. Need lab-scale vitrification and grouting studies with surrogates and actual waste samples to define the operational envelopes for these waste forms.
Science Need: Materials science studies of molten materials that simulate conditions anticipated during vitrification of HLW are needed to develop improved processes and formulations.

TFA14 - Field Methods for 3D Mapping of Waste Chemical and Radiological Properties. Need techniques that generate in situ characterization data to reduce cost of sample handling and analytical tasks in hot laboratories.
Science Need: Basic instrument development is needed to perform in situ radiological measurements and collect spatially resolved species and concentration data.

TFA15 - On-line Monitoring Waste Retrieval Process. Need characterization tools for on-line monitoring of the waste retrieval process and for final verification of the tank conditions following cleanup activities.
Science Need: Basic engineering and separations science studies are required to support pretreatment activities, development of solid/liquid separations, and tank remediation of high solids loaded liquids.

TFA17 - In-line Solids Monitoring. Need to demonstrate in-line solids monitors to assure accurate slurry content when transferring sludges in pipelines and to avoid pipeline plugging.
Science Need: Basic engineering and separations science studies are required to support pretreatment activities, development of solid/liquid separations, and tank remediation of high solids loaded liquids.

TFA18 - Technetium Removal. Need method to remove technetium from DSSF,CC, and other DST supernatants for Phase 1 Privatization to produce a low activity waste product with a Class A concentration for technetium.
Science Need: Fundamental analytical chemical studies are needed for improved separation processes, performance of waste forms, and characterization of Tc chemistry and materials science of waste forms.

TFA22 - Develop Method to Remove Dry/Hardened Sludge.
Science Need: Basic engineering and separations science studies are required to support pretreatment activities, development of solid/liquid separations, and tank remediation of high solids loaded liquids.

TFA24 - Develop In Situ Sensor to Identify Flammable Gas Species. Need species-specific detectors to monitor the tank environment during waste retrieval and characterization activities to ensure that unsafe conditions are not being generated.
Science Need: Basic measurement science and sensor development are required to remotely detect low concentrations of hydrogen inside tanks and containers.

TFA25 - Develop Electrochemical Treatment of Salt Solutions for Caustic Recovery and Recycle. Need technology to recover chemicals of value from salt solution and to reduce volume of waste disposed in saltstone.
Science Need: Fundamental chemical studies are needed concerning the electrochemistry of sodium nitrate/nitrite in complex brine solutions.

TFA27 - Colloidal Transport. Need definitive data on the kinetics of agglomeration of tank solid waste to develop colloidal transport models.
Science Need: Basic engineering and separations science studies are required to support pretreatment activities, development of solid/liquid separations, and tank remediation of high solids loaded liquids.

TFA30 - Decontamination of High Level Waste Salt Solutions. Evaluate alternative precipitating agents and ion exchange media for decontamination of high level waste salt solutions.

Science Need: Fundamental separations chemistry of precipitating agents and ion exchange media is needed to support development of improved methods for decontamination of HLW.

TFA31 - Alternative Salt Removal Techniques. Demonstrate alternative salt removal techniques, such as modified density gradient, steam circulate jets, water jets, agitators, etc. for salt dissolution.

Science Need: Basic engineering and separations science studies are required to support pretreatment activities, development of solid/liquid separations, and tank remediation of high solids loaded liquids.

TFA36 - Develop on-line and in situ method for measuring elemental composition and weight percent solids of HLW slurries.

Science Need: Basic engineering and separations science studies are required to support pretreatment activities, development of solid/liquid separations, and tank remediation of high solids loaded liquids.

TFA39 - Remove RCRA-listed wastes from the high- and low-activity fractions resulting from radionuclide separation processes.

Science Need: Fundamental separation science studies for separation of RCRA metals, Tc, and Ru species from HLW are needed to promote waste volume reduction.

Technology Development and Science Needs related to the Sub-Surface Contaminants Technology Focus Area

SCFA01 - Cost effective monitoring strategy. Need cost effective monitoring strategy for containment of radionuclides, metals, and organic systems.

Science Need: Fundamental biological studies are needed for collection of data related to long term monitoring using natural systems to monitor for radionuclides, metals, and organic molecules. Fundamental studies to relate ecological change to contamination level.

SCFA02 - Cs/Sr treatment in soil. Need methods to treat Cs and Sr contaminated soils; soil washing treatability study is underway.

Science Need: Basic biological and separations chemical studies are needed to understand methods and mechanisms of capture of Cs and Sr using biological or active barrier methods.

SCFA03 - Active groundwater remediation. Need for cheaper, active groundwater remediation to replace expensive pump and treat methods for radionuclides and metals in groundwater; include bioremediation and permeable reactive barriers if feasible.

Science Need: Basic biological and geochemical studies are needed to understand methods, mechanisms, and routes to actively remediate ground water in place.

SCFA04 - Long term (200-500 years) performance monitoring. Also include modeling/prediction for landfill closure cover for both arid and humid climates.

Science Need: Fundamental engineering science studies are needed to understand aging effects and structural longevity using the aging phenomena associated with natural structures.

SCFA05 - Low maintenance vegetative covers. Covers needed for landfills containing organics, low level wastes, and/or uranium mill tailings.

Science Need: Plant molecular biology, tissue culture, and genetic strain improvement of grasses and herbaceous plants are needed to develop low-maintenance vegetative covers. Ecological studies of natural environments having similar characteristics may yield data.

SCFA06 - DNAPL mass removal technologies. Techniques for DNAPL source reduction by mobilization and mass removal of DNAPLs (TCE) from lenticular pockets and as residual stringers in the soil column; Y-12 plant, K-25 site, Paducah and Portsmouth GD Plants.

Science Need: Fundamental hydrogeological studies are desired to support removal of TCE from lenticular pockets and residual stringers in soil columns by characterization of TCE binding to soil particles.

SCFA07 - In situ immobilization of radionuclides in groundwater. Need in situ methods to treat water contaminated with Cs-137, Sr-90, U, Pu, and Co-60; application in fractured basalt 200-400 feet below the surface.

Science Need: Basic biological and separations chemical studies are needed to understand methods and mechanisms of capture of Cs and Sr using biological or active barrier methods.

SCFA08 - DNAPL source characterization and delineation. Characterization and detection of residual and pooled DNAPL and VOC sources in subsurface soils to facilitate remediation technologies; OR sites: Y-12 plant, K-25 site, Paducah and Portsmouth GD Plants.

Science Need: Fundamental hydrogeological studies are desired to support removal of TCE from lenticular pockets and residual stringers in soil columns by characterization of TCE binding to soil particles.

Savannah River Operations Office

Savannah River Site

SR-ER03 - Lower Three Runs & Operations Project

Problem Area:	Remedial Action
Life-Cycle Cost in 2007+:	$366,000,000
DOE Project Manager:	Cynthia V. Anderson, 803-725-3966, cynthia-v.anderson@srs.gov
Contractor Manager:	Richard R. Harbert, 803-952-6818, richard.harbert@srs.gov
For More Information:	http://www.doe.gov/em52/pbs/sr-er03.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Low **Worker:** Medium **Environment:** Medium

Technical Approach Provided by Project Manager:

The technical approach to the preliminary evaluations and investigations will consist of sampling soil, surface water, and groundwater to determine the nature, extent, and mobility of the contaminants associated with the waste units. Once the sampling has been completed, analysis of the data will be performed to evaluate the current and future impacts to human health and the environment due to the waste unit. This information will be used to screen remediation technologies to identify the most effective remedy. The remedy will then be implemented, and post-action monitoring initiated to ensure that it is effective.

The types of remedies that are anticipated to be used or are currently in use on the Lower Three Runs and Operations Project are capping (using either natural or synthetic materials), removal and proper disposal of contaminated soil and sediments, and other actions resulting from the FFA process.

In addition to these standard technologies, the Environmental Restoration Division is aggressively pursuing innovative technologies that will either enhance the effectiveness of the remedy or minimize the cost. Innovative technologies to be deployed in this project are SCAPS logistics, CPT well installation, and well-head analyzer methods as alternate sample collection and well installation technologies that eliminate or significantly reduce aqueous or non-aqueous Investigative Derived Waste (IDW). A long term closure cover system for humid climates and additional alternate sample collection and well installation technologies that eliminate or significantly reduce aqueous or non-aqueous Investigative Derived Waste (IDW) are technology needs that have been identified for this project.

Once ER's waste sites have been closed (remediated) in accordance with regulatory requirements and are in post closure phase, the sites will require regular maintenance such as erosion control, placement of signs, fence repair etc. Periodic inspections and monitoring is also required. Also required is verification that the generated waste meets the acceptance criteria of the designated treatment, storage and disposal facility.
Activities include:
• Performing programmatic initiatives and process improvements for technical activities such as technology development, risk assessment, codes & standards, training, software research, safety documentation, and configuration management.
• Centralized coordination of waste certification / pollution prevention / waste minimization within the ER department.
• Systematic evaluation of waste areas to lead to a defensible recommendation for either conducting further response action or taking no further action through a graded, step approach.
• Conduct well monitoring and analysis through groundwater sampling, analysis, data management, well maintenance, and reporting.

Post 2006 Project Scope Provided by Project Manager:

P-Area Reactor Seepage Basins (904-061G, 062G, 063G) remedial activities will be completed by FY 2007. Stormwater Outfall P-010 will complete remedial activities by FY 2008. R-Area Burning/Rubble Pits (131-R, -1R) remediation activities will be completed by FY 2010. Par Pond Sludge Land Application Site characterization, assessment, and remediation construction activities will be completed by FY 2013. R-Area Rubble Pile (631-25G) activities will be completed by FY 2015. Post-closure activities such as maintenance and monitoring will continue.

Project End State Provided by Project Manager:

The Lower Three Runs Watershed Project will meet the EM site end state after the completion of the remediation and monitoring described in the technical approach. After remediation has been completed the sites will be subject to periodic 5-year reviews of the Records of Decision, and the portions of the project where institutional controls were implemented to continue to require oversight until the property is transferred with appropriate deed restrictions.

The full list of science research awards that have the potential to address projects such as this one, which deals with Remedial Action problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "Remedial Action".

The following awards were identified through systems engineering to have the potential to address the specific needs of this Project. Those research awards that may have the strongest link to this project are designated by the symbol "§".

Award ID	Page #	Award Title
§ 55014-AL	B-1	Kinetics and Mechanisms of Metal Retention/Release in Geochemical Processes in Soil
§ 54908-AZ	B-7	Partitioning Tracers for In Situ Detection and Quantification of Dense Nonaqueous Phase Liquids in Groundwater Systems
§ 55396-CA	B-33	Sorption of Colloids, Organics, and Metals onto Gas-Water Interfaces: Transport Mechanisms and Potential Remediation Technology
§ 60328-CA	B-37	High Frequency Electromagnetic Impedance Measurements for Characterization, Monitoring and Verification Efforts
§ 55011-CA	B-43	Surface and Borehole Electromagnetic Imaging of Conducting Contaminant Plumes
§ 55249-CA	B-47	Experimental Determination of Contaminant Metal Mobility as a Function of Temperature Time and Solution Chemistry
§ 55284-CA	B-55	Aquifer Transport of Th, U, Ra, and Rn in Solution and on Colloids
§ 54860-CA	B-59	Sorption of Heavy Metals and Radionuclides on Mineral Surfaces in the Presence of Organic Co-Contaminants
§ 54926-CA	B-75	Novel Ceramic-Polymer Composite Membranes for the Separation of Hazardous Liquid Waste
§ 55061-CA	B-77	Fundamental Studies of the Removal of Contaminants from Ground and Waste Waters via Reduction by Zero-Valent Metals
§ 54661-DE	B-91	Electrochemical Processes for In-Situ Treatment of Contaminated Soils
§ 54893-FL	B-99	Research Program to Determine Redox Properties and Their Effects on Speciation and Mobility of Pu in DOE Wastes
§ 55218-GA	B-107	Seismic Surface-Wave Tomography of Waste Sites
§ 55374-IL	B-125	Use of Sonication for In-Well Softening of Semivolatile Organic Compounds
§ 54834-IN	B-143	An Investigation of Homogeneous and Heterogeneous Sonochemistry for Destruction of Hazardous Waste
§ 60199-KS	B-159	Seismic-Reflection and Ground Penetrating Radar for Environmental Site Characterization
§ 54683-MA	B-173	Speciation and Structural Characterization of Plutonium and Actinide-organic Complexes in Surface and Groundwaters
§ 55300-MA	B-179	3-D Spectral IP Imaging: Non-Invasive Characterization of Contaminant Plumes
§ 54680-MI	B-187	The Migration and Entrapment of DNAPLs in Physically and Chemically Heterogeneous Porous Media
§ 60271-NH	B-199	Characterization of a New Family of Metal Transport Proteins
§ 54741-NM	B-207	Characterization of Contaminant Transport Using Naturally-Occurring U-Series Disequilibria
§ 55332-NM	B-235	A Hybrid Hydrologic-Geophysical Inverse Technique for the Assessment and Monitoring of Leachates in the Vadose Zone

Awards Related to SR-ER03 Continued

Award ID	Page #	Award Title
§ 55395-NM	B-239	Physics of DNAPL Migration and Remediation in the Presence of Heterogeneities
§ 54857-NM	B-245	Surface Nuclear Magnetic Resonance Imaging of Water Content Distribution in the Subsurface
§ 55109-NM	B-247	New Permeameters for in situ Characterization of Unsaturated Heterogeneous Permeability
§ 54639-NM	B-251	Development of an In-Situ Microsensor for the Measurements of Chromium and Uranium in Groundwater at DOE Sites
§ 54793-NY	B-263	Establishing a Quantitative Functional Relationship Between Capillary Pressure Saturation and Interfacial Area
§ 54585-OH	B-269	Permanganate Treatment of DNAPLs in Reactive Barriers and Source Zone Flooding Schemes
§ 55196-OR	B-277	In Situ, Field Scale Evaluation of Surfactant Enhanced DNAPL Recovery Using a Single-Well, Push-Pull Test
§ 60158-OR	B-279	Development of Radon-222 as a Natural Tracer for Monitoring the Remediation of NAPL Contamination in the Subsurface
§ 54122-PA	B-281	A Broad Spectrum Catalytic System for Removal of Toxic Organics from Water By Deep Oxidation
§ 55205-SC	B-299	A Fundamental Study of Laser-Induced Breakdown Spectroscopy Using Fiber Optics for Remote Measurements of Trace Metals
§ 55033-TN	B-305	Characterization of Chemically Modified Hyperthermophilic Enzymes for Chemical Syntheses and Bioremediation Reactions
§ 55036-TN	B-307	Colloid Transport and Retention in Fractured Deposits
§ 55119-TN	B-315	Phase Equilibria Modification by Electric Fields
§ 55267-TN	B-317	Containment of Toxic Metals and Radionuclides in Porous and Fractured Media: Optimizing Biogeochemical Reduction versus Geochemical Oxidation
§ 60197-TN	B-329	Microsensors for In-situ Chemical, Physical, and Radiological Characterization of Mixed Waste
§ 55083-TN	B-335	Behavior of Dense, Immiscible Solvents in Fractured Clay-Rich Soils
§ 55185-TX	B-349	New Strategies for Designing Inexpensive but Selective Bioadsorbants for Environmental Pollutants: Selection of Specific Ligands & Their Cell Surface Expression
§ 55216-TX	B-351	In-Situ Characterization of Dense Non-Aqueous Phase Liquids Using Partitioning Tracers
§ 60069-VT	B-355	Least-Cost Groundwater Remediation Design Using Uncertain Hydrogeological Information
§ 54635-WA	B-361	Molecular-Level Process Governing the Interaction of Contaminants with Iron and Manganese Oxides
§ 60355-WA	B-377	Mineral Surface Processes Responsible for the Decreased Retardation (or Enhanced Mobilization) of 137Cs from HLW Tank Discharges
60370-CA	B-39	Rational Design of Metal Ion Sequestering Agents
54546-CA	B-61	Engineered Antibodies for Monitoring of Polynuclear Aromatic Hydrocarbons
54847-CO	B-87	Photocatalytic and Chemical Oxidation of Organic Compounds in Supercritical Carbon Dioxide
55012-CO	B-89	Extraction and Recovery of Mercury and Lead from Aqueous Waste Streams Using Redox-active Layered Metal Chalcogenides
60141-DC	B-95	Gamma Ray Imaging for Environmental Remediation
55042-GA	B-105	Quantifying Silica Reactivity in Subsurface Environments: Controls of Reaction Affinity and Solute Matrix on Quartz and SiO2 Glass Dissolution Kinetics
55247-IL	B-119	Sensors Using Molecular Recognition in Luminescent, Conductive Polymers
55211-IL	B-141	Cavitational Hydrothermal Oxidation: A New Remediation Process
54942-IN	B-147	Spectroscopy, Modeling and Computation of Metal Chelate Solubility in Supercritical CO_2

Awards Related to SR-ER03 Continued

Award ID	Page #	Award Title
54791-KS	B-153	Managing Tight-binding Receptors for New Separations Technologies
54864-KS	B-157	Supramolecular Chemistry of Selective Anion Recognition for Anions of Environmental Relevance
60231-MD	B-165	Novel Miniature Spectrometer for Remote Chemical Detection
59977-MD	B-169	Synthesis and Characterization of Templated Ion Exchange Resins for the Selective Complexation of Actinide Ions
54571-MA	B-181	Removal of Heavy Metals and Organic Contaminants from Aqueous Streams by Novel Filtration Methods
55223-MO	B-197	De Novo Design of Ligands for Metal Separation
54724-NM	B-205	Synthesis of New Water-Soluble Metal-Binding Polymers: Combinatorial Chemistry Approach
54770-NM	B-213	New Anion-Exchange Resins for Improved Separations of Nuclear Materials
59967-NM	B-217	Aqueous Electrochemical Mechanisms in Actinide Residue Processing
55387-NM	B-237	Photooxidation of Organic Wastes Using Semiconductor Nanoclusters
60403-NM	B-243	Phase Chemistry of Tank Sludge Residual Components
60474-OH	B-273	Develop and Demonstrate Novel Ultrahigh Sensitivity Heavy Noble Gas Detectors for Long-Term Monitoring of Spent Fuel and TRU Waste
60041-OK	B-275	Removal of Radioactive Cations and Anions from Polluted Water Using Ligand-Modified Colloid-Enhanced Ultrafiltration
54856-PA	B-289	Structural Biology of the Sequestration & Transport of Heavy Metal Toxins: NMR Structure Determination of Proteins Containing the -Cys-X-Y-Cys-metal Binding Motifs
54973-TN	B-301	A Novel Energy-Efficient Plasma Chemical Process for the Destruction of Volatile Toxic Compounds
55103-TN	B-311	Utilization of Kinetic Isotope Effects for the Concentration of Tritium
55276-TN	B-319	Fundamental Chemistry and Thermodynamics of Hydrothermal Oxidation Processes
54735-TX	B-343	Development of Inorganic Ion Exchangers for Nuclear Waste Remediation
55115-TX	B-345	The Adsorption and Reaction of Halogenated Volatile Organic Compounds (VOC's) on Metal Oxides
54679-WA	B-367	Architectural Design Criteria for F-Block Metal Ion Sequestering Agents
54996-WA	B-371	Ionizing Radiation Induced Catalysis on Metal Oxide Particles
54897-WA	B-391	The Sonophysics and Sonochemistry of Liquid Waste Quantification and Remediation
60050-WA	B-395	Chemical Speciation of Inorganic Compounds under Hydrothermal Conditions

Savannah River Operations Office

Savannah River Site

SR-ER06 - Upper Three Runs Project

Problem Area:	Remedial Action
Life-Cycle Cost in 2007+:	$244,000,000
DOE Project Manager:	Cynthia V. Anderson, 803-725-3966, cynthia-v.anderson@srs.gov
Contractor Manager:	Richard R. Harbert, 803-952-6818, richard.harbert@srs.gov
For More Information:	http://www.doe.gov/em52/pbs/sr-er06.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Medium **Worker:** Medium **Environment:** High

Technical Approach Provided by Project Manager:

The technical approach to the preliminary evaluations and investigations will consist of sampling soil, surface water, and groundwater to determine the nature, extent, and mobility of the contaminants associated with the waste units. Once the sampling has been completed, analysis of the data will be performed to evaluate the current and future impacts to human health and the environment due to the waste unit. This information will be used to screen remediation technologies to identify the most effective remedy. The remedy will then be implemented, and post-action monitoring initiated to ensure that it is effective. The types of remedies that are anticipated to be used or are currently in use on the Upper Three Runs Watershed Project are:
- capping (using either natural or synthetic materials),
- removal and proper disposal of contaminated soil and sediments, and
- operation of air stripers (both in situ and ex situ) for removal or destruction of VOCs from the vadose zone and groundwater,
- employment of bioremediation for the destruction of VOCs and the removal of heavy metals
- employment of oxidation for the in situ destruction of dense non-aqueous phase liquids (DNAPL).

In addition to these standard technologies, the Environmental Restoration Division is aggressively pursuing innovative technologies that will either enhance the effectiveness of the remedy or minimize the cost. Innovative technologies to be deployed in this project are the following DNAPL characterization and remediation methods: alcohol micro injection/extraction, partitioning gas trace, laser induced fluorescence, rapid hydrophobic sampling, spectral gamma probe radon, 2-D and 3-D analysis, fenton process effect, hydrophobic membrane, fluorescence, and precision injection/extraction. Additional technologies to be deployed are phytoremediation to attenuate VOC's at shallow subsurface depths at the A/M Area groundwater plume and SCAPS logistics, CPT well installation, and well-head analyzer methods as alternate sample collection and well installation technologies that eliminate or significantly reduce aqueous or non-aqueous Investigative Derived Waste (IDW).

Technologies that are being investigated for this project are 1) innovative alternative in-situ technologies to replace pump and treat for radionuclides, metals and/or VOC contaminants, 2) long term closure cover system for a humid climate, and 3) additional alternate sample collection and well installation technologies that eliminate or significantly reduce aqueous or non-aqueous Investigative Derived Waste (IDW).

Post 2006 Project Scope Provided by Project Manager:

SRL 904-A Process Trench, Stormwater Outfall A-002 and A-024, and Outfall Drainage Ditch X-001 will complete remediation by FY 2009. Inactive Clay Process Sewers to Tims Branch (313-M & 320-M), 211-FB Pu-239 Release, A-Area and H-Area Coal Pile Runoff Basins will complete remedial actions by FY 2013. Steed Pond and Low Level Rad. Waste Disposal Facility (Cap A-D) will complete in FY 2016. Post-closure activities such as maintenance and monitoring will continue.

Project End State Provided by Project Manager:

The Upper Three Runs Watershed Project will meet the EM site end state after the completion of the remediation and monitoring described in the technical approach. After remediation has been completed the sites will be subject to periodic 5-year reviews of the Records of Decision, and the portions of the project where institutional controls were implemented to continue to require oversight until the property is transferred with appropriate deed restrictions.

The full list of science research awards that have the potential to address projects such as this one, which deals with Remedial Action problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "Remedial Action".

The following awards were identified through systems engineering to have the potential to address the specific needs of this Project. Those research awards that may have the strongest link to this project are designated by the symbol "§".

Award ID	Page #	Award Title
§ 55014-AL	B-1	Kinetics and Mechanisms of Metal Retention/Release in Geochemical Processes in Soil
§ 55164-AL	B-3	Advanced Experimental Analysis of Controls on Microbial Fe(III) Oxide Reduction
§ 54898-AZ	B-5	Molecular Dissection of the Cellular Mechanisms Involved in Nickel Hyperaccumulation in Plants
§ 54908-AZ	B-7	Partitioning Tracers for In Situ Detection and Quantification of Dense Nonaqueous Phase Liquids in Groundwater Systems
§ 55097-CA	B-15	Heavy Metal Pumps in Plants
§ 55278-CA	B-17	Molecular Genetics of Metal Detoxification: Prospects for Phytoremediation
§ 54698-CA	B-19	Rapid Mass Spectrometric DNA Diagnostics for Assessing Microbial Community Activity During Bioremediation
§ 55264-CA	B-21	Subsurface High Resolution Definition of Subsurface Heterogeneity for Understanding the Biodynamics of Natural Field Systems: Advancing the Ability for Scaling to Field Conditions
§ 55343-CA	B-25	Enzyme Engineering for Biodegradation of Chlorinated Organic Pollutants
§ 55396-CA	B-33	Sorption of Colloids, Organics, and Metals onto Gas-Water Interfaces: Transport Mechanisms and Potential Remediation Technology
§ 60328-CA	B-37	High Frequency Electromagnetic Impedance Measurements for Characterization, Monitoring and Verification Efforts
§ 55011-CA	B-43	Surface and Borehole Electromagnetic Imaging of Conducting Contaminant Plumes
§ 55249-CA	B-47	Experimental Determination of Contaminant Metal Mobility as a Function of Temperature Time and Solution Chemistry
§ 55284-CA	B-55	Aquifer Transport of Th, U, Ra, and Rn in Solution and on Colloids
§ 54666-CA	B-57	Mechanisms, Chemistry, and Kinectics of Anaerobic Biodegradation of Cis-Dichloroethylene and Vinyl Chloride
§ 54860-CA	B-59	Sorption of Heavy Metals and Radionuclides on Mineral Surfaces in the Presence of Organic Co-Contaminants
§ 54681-CA	B-67	Dynamics of Coupled Contaminant and Microbial Transport in Heterogeneous Porous Media
§ 55118-CA	B-71	Plant Rhizosphere Effects on Metal Mobilization and Transport
§ 54926-CA	B-75	Novel Ceramic-Polymer Composite Membranes for the Separation of Hazardous Liquid Waste
§ 55061-CA	B-77	Fundamental Studies of the Removal of Contaminants from Ground and Waste Waters via Reduction by Zero-Valent Metals
§ 55041-CA	B-79	Molecular Characterization of a Novel Heavy Metal Uptake Transporter from Higher Plants & its Potential for Use in Phytoremediation
§ 54661-DE	B-91	Electrochemical Processes for In-Situ Treatment of Contaminated Soils
§ 54893-FL	B-99	Research Program to Determine Redox Properties and Their Effects on Speciation and Mobility of Pu in DOE Wastes

Awards Related to SR-ER06 Continued

Award ID	Page #	Award Title
§ 55218-GA	B-107	Seismic Surface-Wave Tomography of Waste Sites
§ 55416-ID	B-111	Control of Biologically Active Degradation Zones by Vertical Heterogeneity: Applications in Fractured Media
§ 55374-IL	B-125	Use of Sonication for In-Well Softening of Semivolatile Organic Compounds
§ 55388-IL	B-131	Stable Isotopic Investigations of in situ Bioremediation of Chlorinated Organic Solvents
§ 54834-IN	B-143	An Investigation of Homogeneous and Heterogeneous Sonochemistry for Destruction of Hazardous Waste
§ 60199-KS	B-159	Seismic-Reflection and Ground Penetrating Radar for Environmental Site Characterization
§ 59786-MD	B-167	Design and Construction of Deinococcus radiodurans for Biodegradation of Organic Toxins at Radioactive DOE Waste Sites
§ 55152-MD	B-171	Molecular Profiling of Microbial Communities from Contaminated Sources: Use of Subtractive Cloning Methods and rDNA Spacer Sequences
§ 54683-MA	B-173	Speciation and Structural Characterization of Plutonium and Actinide-organic Complexes in Surface and Groundwaters
§ 54888-MA	B-175	Manipulating Subsurface Colloids to Enhance Cleanups of DOE Waste Sites
§ 55300-MA	B-179	3-D Spectral IP Imaging: Non-Invasive Characterization of Contaminant Plumes
§ 55105-MI	B-183	Complete Detoxification of Short Chain Chlorinated Aliphatics: Isolation of Halorespiring Organisms and Biochemical Studies of the Dehalogenating Enzyme Systems
§ 54680-MI	B-187	The Migration and Entrapment of DNAPLs in Physically and Chemically Heterogeneous Porous Media
§ 60271-NH	B-199	Characterization of a New Family of Metal Transport Proteins
§ 54741-NM	B-207	Characterization of Contaminant Transport Using Naturally-Occurring U-Series Disequilibria
§ 55332-NM	B-235	A Hybrid Hydrologic-Geophysical Inverse Technique for the Assessment and Monitoring of Leachates in the Vadose Zone
§ 55395-NM	B-239	Physics of DNAPL Migration and Remediation in the Presence of Heterogeneities
§ 54857-NM	B-245	Surface Nuclear Magnetic Resonance Imaging of Water Content Distribution in the Subsurface
§ 55109-NM	B-247	New Permeameters for in situ Characterization of Unsaturated Heterogeneous Permeability
§ 54639-NM	B-251	Development of an In-Situ Microsensor for the Measurements of Chromium and Uranium in Groundwater at DOE Sites
§ 54793-NY	B-263	Establishing a Quantitative Functional Relationship Between Capillary Pressure Saturation and Interfacial Area
§ 54585-OH	B-269	Permanganate Treatment of DNAPLs in Reactive Barriers and Source Zone Flooding Schemes
§ 55196-OR	B-277	In Situ, Field Scale Evaluation of Surfactant Enhanced DNAPL Recovery Using a Single-Well, Push-Pull Test
§ 60158-OR	B-279	Development of Radon-222 as a Natural Tracer for Monitoring the Remediation of NAPL Contamination in the Subsurface
§ 54122-PA	B-281	A Broad Spectrum Catalytic System for Removal of Toxic Organics from Water By Deep Oxidation
§ 55205-SC	B-299	A Fundamental Study of Laser-Induced Breakdown Spectroscopy Using Fiber Optics for Remote Measurements of Trace Metals
§ 55013-TN	B-303	Biofiltration of Volatile Pollutants: Engineering Mechanisms for Improved Design, Long-term Operation, Prediction and Implementation
§ 55033-TN	B-305	Characterization of Chemically Modified Hyperthermophilic Enzymes for Chemical Syntheses and Bioremediation Reactions

Awards Related to SR-ER06 Continued

Award ID	Page #	Award Title
§ 55036-TN	B-307	Colloid Transport and Retention in Fractured Deposits
§ 55108-TN	B-313	Monitoring Genetic & Metabolic Potential for In Situ Bioremediation: Mass Spectrometry
§ 55119-TN	B-315	Phase Equilibria Modification by Electric Fields
§ 55267-TN	B-317	Containment of Toxic Metals and Radionuclides in Porous and Fractured Media: Optimizing Biogeochemical Reduction versus Geochemical Oxidation
§ 60197-TN	B-329	Microsensors for In-situ Chemical, Physical, and Radiological Characterization of Mixed Waste
§ 55083-TN	B-335	Behavior of Dense, Immiscible Solvents in Fractured Clay-Rich Soils
§ 55185-TX	B-349	New Strategies for Designing Inexpensive but Selective Bioadsorbants for Environmental Pollutants: Selection of Specific Ligands & Their Cell Surface Expression
§ 55216-TX	B-351	In-Situ Characterization of Dense Non-Aqueous Phase Liquids Using Partitioning Tracers
§ 60069-VT	B-355	Least-Cost Groundwater Remediation Design Using Uncertain Hydrogeological Information
§ 54635-WA	B-361	Molecular-Level Process Governing the Interaction of Contaminants with Iron and Manganese Oxides
§ 55031-WA	B-373	Genetic Analysis of Stress Responses in Soil Bacteria for Enhanced Bioremediation of Mixed Contaminants
§ 60355-WA	B-377	Mineral Surface Processes Responsible for the Decreased Retardation (or Enhanced Mobilization) of 137Cs from HLW Tank Discharges
§ 54889-WA	B-389	Using Trees to Remediate Groundwaters Contaminated with Chlorinated Hydrocarbons
§ 54790-CAN-ON	B-407	Microbial Mineral Transformations at the Fe(II)/Fe(III) Redox Boundary for Solid Phase Capture of Strontium and Other Metal/Radionuclide Contaminants
60370-CA	B-39	Rational Design of Metal Ion Sequestering Agents
54546-CA	B-61	Engineered Antibodies for Monitoring of Polynuclear Aromatic Hydrocarbons
54847-CO	B-87	Photocatalytic and Chemical Oxidation of Organic Compounds in Supercritical Carbon Dioxide
55012-CO	B-89	Extraction and Recovery of Mercury and Lead from Aqueous Waste Streams Using Redox-active Layered Metal Chalcogenides
60141-DC	B-95	Gamma Ray Imaging for Environmental Remediation
55042-GA	B-105	Quantifying Silica Reactivity in Subsurface Environments: Controls of Reaction Affinity and Solute Matrix on Quartz and SiO2 Glass Dissolution Kinetics
55247-IL	B-119	Sensors Using Molecular Recognition in Luminescent, Conductive Polymers
55294-IL	B-121	Superconducting Open-Gradient Magnetic Separation for the Pretreatment of Radioactive or Mixed Waste Vitrification Feeds
55211-IL	B-141	Cavitational Hydrothermal Oxidation: A New Remediation Process
54942-IN	B-147	Spectroscopy, Modeling and Computation of Metal Chelate Solubility in Supercritical CO_2
54791-KS	B-153	Managing Tight-binding Receptors for New Separations Technologies
54864-KS	B-157	Supramolecular Chemistry of Selective Anion Recognition for Anions of Environmental Relevance
60231-MD	B-165	Novel Miniature Spectrometer for Remote Chemical Detection
59977-MD	B-169	Synthesis and Characterization of Templated Ion Exchange Resins for the Selective Complexation of Actinide Ions
54571-MA	B-181	Removal of Heavy Metals and Organic Contaminants from Aqueous Streams by Novel Filtration Methods
55223-MO	B-197	De Novo Design of Ligands for Metal Separation
54584-NJ	B-201	Comparison of the Bioavailability of Elemental Waste Laden Soils Using in vivo and in vitro Analytical Methodology, and Refinement of Exposure/Dose Models

Awards Related to SR-ER06 Continued

Award ID	Page #	Award Title
54724-NM	B-205	Synthesis of New Water-Soluble Metal-Binding Polymers: Combinatorial Chemistry Approach
54751-NM	B-209	High Fluence Neutron Source for Nondestructive Characterization of Nuclear Waste
54770-NM	B-213	New Anion-Exchange Resins for Improved Separations of Nuclear Materials
59967-NM	B-217	Aqueous Electrochemical Mechanisms in Actinide Residue Processing
55387-NM	B-237	Photooxidation of Organic Wastes Using Semiconductor Nanoclusters
60403-NM	B-243	Phase Chemistry of Tank Sludge Residual Components
60474-OH	B-273	Develop and Demonstrate Novel Ultrahigh Sensitivity Heavy Noble Gas Detectors for Long-Term Monitoring of Spent Fuel and TRU Waste
60041-OK	B-275	Removal of Radioactive Cations and Anions from Polluted Water Using Ligand-Modified Colloid-Enhanced Ultrafiltration
60017-PA	B-285	Removal of Technetium, Carbon Tetrachloride, and Metals from DOE Properties
54856-PA	B-289	Structural Biology of the Sequestration & Transport of Heavy Metal Toxins: NMR Structure Determination of Proteins Containing the -Cys-X-Y-Cys-metal Binding Motifs
54973-TN	B-301	A Novel Energy-Efficient Plasma Chemical Process for the Destruction of Volatile Toxic Compounds
55103-TN	B-311	Utilization of Kinetic Isotope Effects for the Concentration of Tritium
55276-TN	B-319	Fundamental Chemistry and Thermodynamics of Hydrothermal Oxidation Processes
54735-TX	B-343	Development of Inorganic Ion Exchangers for Nuclear Waste Remediation
55115-TX	B-345	The Adsorption and Reaction of Halogenated Volatile Organic Compounds (VOC's) on Metal Oxides
54679-WA	B-367	Architectural Design Criteria for F-Block Metal Ion Sequestering Agents
54996-WA	B-371	Ionizing Radiation Induced Catalysis on Metal Oxide Particles
54897-WA	B-391	The Sonophysics and Sonochemistry of Liquid Waste Quantification and Remediation
60050-WA	B-395	Chemical Speciation of Inorganic Compounds under Hydrothermal Conditions

Savannah River Operations Office

Savannah River Site

SR-FA02 - F Canyon Deactivation Project

Problem Area: Decontamination and Decommissioning
Life-Cycle Cost in 2007+: $69,000,000
DOE Project Manager: G. M. Nichols, Jr., 803-952-2021, gnichols@srs.gov
Contractor Manager: R. V. Carlson, 803-725-2326, r.carlson@srs.gov
For More Information: http://www.doe.gov/em52/pbs/sr-fa02.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Low **Worker:** Medium **Environment:** Medium

Technical Approach Provided by Project Manager:

The project will be managed per the DOE-EM 60 Deactivation Guidance; phase 1 Project Requirements Determination, Phase 2 Project Execution Plan Development and Phase 3 Project Execution. The characterization of existing surplus facilities and development of end state criteria is a critical to the success of the deactivation project. Application of latest technology developments in the characterization and analysis of residual radiological and industrial hazards and cost-benefit engineering evaluations are key components in developing a cost effective deactivation plan and should be developed as funding is available prior to completion of nuclear material stabilization phase for each facility.

Post 2006 Project Scope Provided by Project Manager:

Current site funding limitations would require the postponement of all F-Canyon Deactivation project activities to begin after FY06. Deactivation is expected to require 4-5 years to complete. At such time, a routine surveillances will be established to verify the structural integrity of F Canyon facilities, and verify the operational integrity of equipment required by the surveillance and maintenance plan. This routine monitoring will continue until the final disposition of the facilities.

Project End State Provided by Project Manager:

This project provides for the deactivation of F-Canyon facilities only. Additional projects will be required to meet the EM site end state. At this time, an end state for the F-Canyon facilities have not been defined. No plans have been made at this time to reuse F-Canyon facilities after deactivation.

No nuclear materials, spent fuel, or high level waste are stored in F-Canyon facilities. TRU and low level solid and liquid waste will be generated during deactivation activities.

The full list of science research awards that have the potential to address projects such as this one, which deals with Decontamination and Decommissioning problems, are listed in the <u>Index of Research Awards by Environmental Management Problem Area</u>, in the back of this appendix, under the heading "Decontamination and Decommissioning".

Savannah River Operations Office

Savannah River Site

SR-FA04 - H Canyon Deactivation Project

Problem Area: Decontamination and Decommissioning
Life-Cycle Cost in 2007+: $59,000,000
DOE Project Manager: G. M. Nichols, Jr., 803-952-2021, gnichols@srs.gov
Contractor Manager: R. V. Carlson, 803-725-2326, r.carlson@srs.gov
For More Information: http://www.doe.gov/em52/pbs/sr-fa04.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Low **Worker:** Medium **Environment:** Medium

Technical Approach Provided by Project Manager:

The project will be managed per the DOE-EM 60 Deactivation Guidance; phase 1 Project Requirements Determination, Phase 2 Project Execution Plan Development and Phase 3 Project Execution. The characterization of existing surplus facilities and development of end state criteria is a critical to the success of the deactivation project. Application of latest technology developments in the characterization and analysis of residual radiological and industrial hazards and cost-benefit engineering evaluations are key components in developing a cost effective deactivation plan and should be developed as funding is available prior to completion of nuclear material stabilization phase for each facility.

Post 2006 Project Scope Provided by Project Manager:

Current site funding limitations would require the postponement of all H-Canyon Deactivation project activities to begin after FY06. Deactivation is expected to require 4-5 years to complete. At such time, a routine surveillances will be established to verify the structural integrity of H-Canyon facilities, and verify the operational integrity of equipment required by the surveillance and maintenance plan. This routine monitoring will continue until the final disposition of the facilities.

Project End State Provided by Project Manager:

This project provides for the deactivation of H-Canyon facilities only. Additional projects will be required to meet the EM site end state. At this time, an end state for the H-Canyon facilities have not been defined. No plans have been made at this time to reuse H-Canyon facilities after deactivation.

No nuclear materials, spent fuel, or high level waste are stored in H-Canyon facilities. Some quantities of TRU, mixed and low level solid and liquid waste will be generated during deactivation activities.

The full list of science research awards that have the potential to address projects such as this one, which deals with Decontamination and Decommissioning problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "Decontamination and Decommissioning".

Savannah River Operations Office

Savannah River Site

SR-FA06 - 235-F Deactivation Project

Problem Area: Decontamination and Decommissioning
Life-Cycle Cost in 2007+: $65,000,000
DOE Project Manager: G. M. Nichols, Jr., 803-952-2021, gnichols@srs.gov
Contractor Manager: R. V. Carlson, 803-725-2326, r.carlson@srs.gov
For More Information: http://www.doe.gov/em52/pbs/sr-fa06.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Low **Worker:** Medium **Environment:** Medium

Technical Approach Provided by Project Manager:

The project will be managed per the DOE-EM 60 Deactivation Guidance; phase 1 Project Requirements Determination, Phase 2 Project Execution Plan Development and Phase 3 Project Execution. The characterization of existing surplus facilities and development of end state criteria is a critical to the success of the deactivation project. Application of latest technology developments in the characterization and analysis of residual radiological and industrial hazards and cost-benefit engineering evaluations are key components in developing a cost effective deactivation plan and should be developed as funding is available prior to completion of nuclear material stabilization phase for each facility.

Post 2006 Project Scope Provided by Project Manager:

Current site funding limitations would require the postponement of all 235-F Deactivation project activities to begin after FY06. Deactivation is expected to require 4-5 years to complete. At such time, a routine surveillances will be established to verify the structural integrity of the 235-F facility, and verify the operational integrity of equipment required by the surveillance and maintenance plan. This routine monitoring will continue until the final disposition of the facilities.

Project End State Provided by Project Manager:

This project provides for the deactivation of 235-F only. Additional projects will be required to meet the EM site end state. At this time, an end state for the 235-F have not been defined. No plans have been made at this time to reuse the 235-F facilities after deactivation.

No nuclear materials, spent fuel, or high level waste are stored in the 235-F facilities. TRU, mixed and low level solid and liquid waste will be generated during deactivation activities.

The full list of science research awards that have the potential to address projects such as this one, which deals with Decontamination and Decommissioning problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "Decontamination and Decommissioning".

Savannah River Operations Office

Savannah River Site

SR-FA16 - F-Area Monitoring

Problem Area: Decontamination and Decommissioning
Life-Cycle Cost in 2007+: $1,467,000,000
DOE Project Manager: G. M. Nichols, Jr., 803-952-2021, gnichols@srs.gov
Contractor Manager: R. V. Carlson, 803-725-2326, r.carlson@srs.gov
For More Information: http://www.doe.gov/em52/pbs/sr-fa16.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Low **Worker:** Medium **Environment:** Medium

Technical Approach Provided by Project Manager:

Surveillance and maintenance of F Area requires no new technologies or capabilities that are not already available at SRS.

Post 2006 Project Scope Provided by Project Manager:

The post-FY06 work scope is a continuation of pre-deactivation surveillance and maintenance until such time as deactivation is completed. Current funding guidance indicates that these deactivation activities will begin after FY06. Individual facilities within F Area are expected to require 4-5 years to complete deactivation. At such time, a routine of quarterly surveillances will be established. These surveillances will verify the structural integrity of the F Area facilities, and verify the operational integrity of any remote monitoring equipment, sump pumping equipment, and environmental monitoring equipment required by the surveillance and maintenance plan for F Area. This quarterly monitoring will continue until final disposition of the facilities.

Project End State Provided by Project Manager:

This project only provides for surveillance and maintenance prior to deactivation, during the deactivation, and post-deactivation phases of the F Area life cycle (i.e., this project end state). Additional projects will be required to meet the EM site end state. At this time, a final end state for the area has not been defined. F Area facilities will most likely not be reused after area deactivation .

No nuclear materials, spent fuel, or high level waste will be stored in F Area following deactivation, nor will any be generated by this project. Wastes generated by this project will be primarily job control wastes from incidental decontamination, surveillance, and maintenance activities. Such wastes would be disposed of as low level waste.

The full list of science research awards that have the potential to address projects such as this one, which deals with Decontamination and Decommissioning problems, are listed in the <u>Index of Research Awards by Environmental Management Problem Area</u>, in the back of this appendix, under the heading "Decontamination and Decommissioning".

Savannah River Operations Office

Savannah River Site

SR-FA17 - H-Area Monitoring and Minor Facility Monitoring

Problem Area:	Decontamination and Decommissioning
Life-Cycle Cost in 2007+:	$927,000,000
DOE Project Manager:	C. E. Anderson, 803-557-3828, Charles.Anderson@srs.gov
Contractor Manager:	R. V. Carlson, 803-725-2326, r.carlson@srs.gov
For More Information:	http://www.doe.gov/em52/pbs/sr-fa17.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Low **Worker:** Medium **Environment:** Medium

Technical Approach Provided by Project Manager:

Surveillance and maintenance of H Area requires no new technologies or capabilities that are not already available at SRS.

Post 2006 Project Scope Provided by Project Manager:

The post-FY06 work scope is a continuation of pre-deactivation surveillance and maintenance until such time as deactivation is completed. Current funding guidance indicates that these deactivation activities will begin after FY06. Individual facilities within H Area are expected to require 4-5 years to complete deactivation. At such time, a routine of quarterly surveillances will be established. These surveillances will verify the structural integrity of the H Area facilities, and verify the operational integrity of any remote monitoring equipment, sump pumping equipment, and environmental monitoring equipment required by the surveillance and maintenance plan for H Area. This quarterly monitoring will continue until final disposition of the facilities.

Project End State Provided by Project Manager:

This project only provides for surveillance and maintenance prior to deactivation, during the deactivation, and post-deactivation phases of the H Area life cycle (i.e., this project end state). Additional projects will be required to meet the EM site end state. At this time, a final end state for the area has not been defined. H Area facilities will most likely not be reused after area deactivation .

No nuclear materials, spent fuel, or high level waste will be stored in H Area following deactivation, nor will any be generated by this project. Wastes generated by this project will be primarily job control wastes from incidental decontamination, surveillance, and maintenance activities. Such wastes would be disposed of as low level waste.

The full list of science research awards that have the potential to address projects such as this one, which deals with Decontamination and Decommissioning problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "Decontamination and Decommissioning".

Savannah River Operations Office

Savannah River Site

SR-FA18 - M Area Monitoring Project

Problem Area: Decontamination and Decommissioning
Life-Cycle Cost in 2007+: $115,000,000
DOE Project Manager: C. E. Anderson, 803-557-3828, Charles.Anderson@srs.gov
Contractor Manager: R. V. Carlson, 803-725-2326, r.carlson@srs.gov
For More Information: http://www.doe.gov/em52/pbs/sr-fa18.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Low **Worker:** Medium **Environment:** Medium

Technical Approach Provided by Project Manager:

Surveillance and maintenance of M Area requires no new technologies or capabilities that are not already available at SRS.

Post 2006 Project Scope Provided by Project Manager:

The post-FY06 work scope is a continuation of pre-deactivation surveillance and maintenance until such time as deactivation is completed. Current funding guidance indicates that these deactivation activities will begin after FY06. Deactivation is expected to be complete by FY11. At such time, a routine of quarterly entries will be established. These entries will verify the structural integrity of the M Area facilities, and verify the operational integrity of any remote monitoring equipment, sump pumping equipment, and environmental monitoring equipment required by the surveillance and maintenance plan for M Area. This quarterly monitoring will continue until final disposition of the facilities.

Project End State Provided by Project Manager:

This project only provides for surveillance and maintenance during the pre- and post-deactivation phases of the M Area life cycle (i.e., this project end state). Additional projects will be required to meet the EM site end state. Contamination in the area is expected to be eliminated or fixed with a surface sealant. At this time, a final end state for the area has not been defined. Reuse of some M Area facilities has been considered in the past, including use as support facilities for the Accelerator Production of Tritium (APT) project. However, no plans have been made at this time to reuse any of the facilities after area deactivation (post-FY11).

No nuclear materials, spent fuel, or high level waste will be stored in M Area following deactivation, nor will any be generated by this project. Wastes generated by this project will be primarily job control wastes from incidental decontamination, surveillance, and maintenance activities. Such wastes would be disposed of as low level waste.

The full list of science research awards that have the potential to address projects such as this one, which deals with Decontamination and Decommissioning problems, are listed in the <u>Index of Research Awards by Environmental Management Problem Area</u>, in the back of this appendix, under the heading "Decontamination and Decommissioning".

Savannah River Operations Office

Savannah River Site

SR-FA20 - Reactors Monitoring Project

Problem Area: Decontamination and Decommissioning
Life-Cycle Cost in 2007+: $619,000,000
DOE Project Manager: C. E. Anderson, 803-557-3828, Charles.Anderson@srs.gov
Contractor Manager: R. V. Carlson, 803-725-2326, r.carlson@srs.gov
For More Information: http://www.doe.gov/em52/pbs/sr-fa20.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Low **Worker:** Medium **Environment:** Medium

Technical Approach Provided by Project Manager:

Surveillance and maintenance of P, C, R, K, and L Areas requires no new technologies or capabilities that are not already available at SRS.

Post 2006 Project Scope Provided by Project Manager:

The post-FY06 work scope is a continuation of pre-deactivation surveillance and maintenance until such time as deactivation is completed. Current funding guidance indicates that these deactivation activities will begin after FY06. Deactivation is expected to be complete by FY12 for P, C, R, and K Areas, and FY14 for L Area. At such time, a routine of quarterly entries will be established. These entries will verify the structural integrity of facilities, and verify the operational integrity of any remote monitoring equipment, sump pumping equipment, and environmental monitoring equipment required by the surveillance and maintenance plans for each Area. This quarterly monitoring will continue until final disposition of the facilities.

Project End State Provided by Project Manager:

This project only provides for surveillance and maintenance during the pre- and post-deactivation phases of the P, C, R, K, and L Areas life cycle (i.e., this project end state). Additional projects will be required to meet the EM site end state. Contamination in each Area is expected to be consolidated within the confines of the 105 Reactor buildings. At this time, final end states for the reactor areas have not been defined. Reuse of certain facilities has been considered in the past. However, no plans have been made at this time to reuse any of the facilities after deactivation (post-FY12/14).

No nuclear materials, spent fuel, or high level waste will be stored in P, C, R, K or L Areas following deactivation, nor will any be generated by this project. Wastes generated by this project will be primarily job control wastes from incidental decontamination, surveillance, and maintenance activities. Such wastes would be disposed of as low level waste.

The full list of science research awards that have the potential to address projects such as this one, which deals with Decontamination and Decommissioning problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "Decontamination and Decommissioning".

Savannah River Operations Office

Savannah River Site

SR-FA22 - Receiving Basin for Off-site Fuels (RBOF) Monitoring Project

Problem Area:	Decontamination and Decommissioning
Life-Cycle Cost in 2007+:	$76,000,000
DOE Project Manager:	C. E. Anderson, 803-557-3828, Charles.Anderson@srs.gov
Contractor Manager:	R. V. Carlson, 803-725-2326, r.carlson@srs.gov
For More Information:	http://www.doe.gov/em52/pbs/sr-fa22.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Low **Worker:** Medium **Environment:** Medium

Technical Approach Provided by Project Manager:

Surveillance and maintenance of RBOF requires no new technologies or capabilities that are not already available at SRS.

Post 2006 Project Scope Provided by Project Manager:

The post-FY06 work scope is a continuation of pre-deactivation surveillance and maintenance until such time as deactivation is completed. Current funding guidance indicates that these deactivation activities will begin after FY06. Deactivation is expected to be complete by FY14. At such time, a routine of quarterly facility entries will be established. These entries will verify the structural integrity of the facility, and verify the operational integrity of any remote monitoring equipment, sump pumping equipment, and environmental monitoring equipment required by the RBOF surveillance and maintenance plan. This quarterly monitoring will continue until final disposition of the facility.

Project End State Provided by Project Manager:

This project only provides for surveillance and maintenance during the deactivation and post-deactivation phases of the RBOF life cycle (i.e., this project end state). Additional projects will be required to meet the EM site end state. Contamination in the area is expected to be eliminated or fixed with a surface sealant. At this time, a final end state for the area has not been defined. RBOF has not been considered for reuse in the past, nor have plans have been made at this time to reuse any of the facilities after area deactivation (post-FY11).

No nuclear materials, spent fuel, or high level waste will be stored in RBOF following deinventory, nor will any be generated by this project. Wastes generated by this project will be primarily job control wastes from incidental decontamination, surveillance, and maintenance activities. Such wastes would be disposed of as low level waste.

The full list of science research awards that have the potential to address projects such as this one, which deals with Decontamination and Decommissioning problems, are listed in the <u>Index of Research Awards by Environmental Management Problem Area</u>, in the back of this appendix, under the heading "Decontamination and Decommissioning".

Savannah River Operations Office

Savannah River Site

SR-HL01 - H-Tank Farm

Problem Area: High Level Waste
Life-Cycle Cost in 2007+: $1,022,000,000
DOE Project Manager: H. B. Gnann, 803-208-6076, howard.gnann@srs.gov
Contractor Manager: S. S. Cathey, 803-725-3052, susan.cathey@srs.gov
For More Information: http://www.doe.gov/em52/pbs/sr-hl01.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Medium **Worker:** High **Environment:** Urgent

Technical Approach Provided by Project Manager:

The key technologies used in the safe storage and management of this liquid high level radioactive waste are:

- Evaporation (necessary for volume reduction of waste to manage current available tank space)
- Chemical Additions (required to control the pH of the waste being stored to minimize corrosion of these underground carbon steel waste tanks)
- Ventilation (to remove hydrogen gas from tank vapor space)
- Cooling (to remove radioactive decay heat from waste tanks)
- Transfer Systems (pumping, piping, and jets)
- Remote Handling (for removal and repair of highly contaminated equipment)

Post 2006 Project Scope Provided by Project Manager:

- Waste will be removed from 15 underground high level radioactive waste storage tanks and all remaining tanks (20) will be closed by the end of FY25 (i.e., services and connecting piping cut and capped, tanks filled with grout). NOTE: Tank closure is covered by Waste Removal Operations and Tank Closure, Project SR-HL03
- By the end of FY10, three groups of tanks of four tanks each with common systems (Tanks 9-12, 13-16 and 21-24) will have been closed. A limited mortgage reduction will be put in place by reducing the Surveillance & Maintenance costs by $9.5 million per year in FY10 and an additional $17.5 million in FY11. This project will be completed in FY24, including the closure of the remaining 11 waste tanks and all remaining supporting facilities and control rooms. Annual costs will be reduced by $35.7 in FY20; $22.0 in FY21; $7.0 in FY23; and $11.4 million in FY24. With the final mortgage reduction of $18.1 in FY25, the cost of the project will be reduced to zero and the facilities will be transferred to Environmental Restoration for final closure.
- The evaporator systems will have achieved 65 million gallons of space gain between FY07 and FY24. - The waste volume being stored will have been reduced from 16.0 million gallons in FY07 to zero gallons by the end of FY24.

Project End State Provided by Project Manager:

The project will end in FY24 when all waste removal activities are complete and all remaining tanks and facilities have been prepared for closure. This includes de-inventorying the existing underground high level radioactive waste storage tanks and associated facilities. Closure of remaining tanks and facilities is covered by Waste Removal Operations and Tank Closure, Project SR-HL03.

The full list of science research awards that have the potential to address projects such as this one, which deals with High Level Waste problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "High Level Waste".

The following awards were identified through systems engineering to have the potential to address the specific needs of this Project. Those research awards that may have the strongest link to this project are designated by the symbol "§".

Award ID	Page #	Award Title
§ 59827-AZ	B-9	The Influence of Radiation and Multivalent Cation Additions on Phase Separation and Crystallization of Glass
§ 55318-CA	B-23	Improved Analytical Characterization of Solid Waste-Forms by Fundamental Development of Laser Ablation Technology
§ 54890-CA	B-69	On-Line Slurry Viscosity and Concentration Measurement as a Real-Time Waste Stream Characterization Tool
§ 55188-DC	B-93	Chemical Decomposition of High-Level Nuclear Waste Storage/Disposal Glasses Under Irradiation
§ 54716-DC	B-97	Polyoxometalates for Radioactive Waste Treatment
§ 54982-FL	B-101	Analysis of Surface Leaching Processes in Vitrified High-Level Nuclear Wastes Using In-Situ Raman Imaging and Atomistic Modeling
§ 54807-GA	B-103	Studies Related to Chemical Mechanisms of Gas Formation in Hanford High-Level Nuclear Wastes
§ 55042-GA	B-105	Quantifying Silica Reactivity in Subsurface Environments: Controls of Reaction Affinity and Solute Matrix on Quartz and SiO2 Glass Dissolution Kinetics
§ 60424-ID	B-113	High Temperature Condensed Phase Mass Spectrometric Analysis
§ 55229-IL	B-117	The NOx System in Nuclear Waste
§ 55294-IL	B-121	Superconducting Open-Gradient Magnetic Separation for the Pretreatment of Radioactive or Mixed Waste Vitrification Feeds
§ 55367-IL	B-123	Investigation of Microscopic Radiation Damage in Waste Forms Using ODNMR and AEM Techniques
§ 60313-IL	B-135	Radiation Effects on Transport and Bubble Formation in Silicate Glasses
§ 59977-MD	B-169	Synthesis and Characterization of Templated Ion Exchange Resins for the Selective Complexation of Actinide Ions
§ 55141-MA	B-177	Imaging and Characterizing the Waste Materials Inside an Underground Storage Tank Using Seismic Normal Modes
§ 54691-MI	B-189	Radiation Effects on Materials in the Near-Field of Nuclear Waste Repository
§ 59990-NM	B-221	Fundamental Chemistry, Characterization, and Separation of Technetium Complexes in Hanford Waste
§ 59993-NM	B-223	Dynamic Effects of Tank Waste Aging on Radionuclide-Complexant Interactions
§ 60403-NM	B-243	Phase Chemistry of Tank Sludge Residual Components
§ 54595-NM	B-255	f-Element Ion Chelation in Highly Basic Media
§ 59982-NY	B-259	Reactivity of Peroxynitrite: Implications for Hanford Waste Management and Remediation
§ 55179-NY	B-267	Acoustic Probe for Solid-Gas-Liquid Suspensions
§ 54674-OH	B-271	Design and Development of a New Hybrid Spectroelectrochemical Sensor
§ 60219-PA	B-287	Development of Advanced Electrochemical Emission Spectroscopy for Monitoring Corrosion in Simulated DOE Liquid Waste
§ 60401-SC	B-293	Mechanism of Pitting Corrosion Prevention by Nitrite in Carbon Steel Exposed to Dilute Salt Solutions
§ 55087-TN	B-309	Design and Synthesis of the Next Generation of Crown Ethers for Waste Separations: An Inter-Laboratory Comprehensive Proposal
§ 59978-TN	B-321	Thermospray Mass Spectrometry Ionization Processes Fundamental Mechanisms for Speciation, Separation and Characterization of Organic Complexants in DOE Wastes
§ 60020-TN	B-323	Stability of High-Level Waste Forms
§ 60217-TN	B-331	Optically-Based Array Sensors for Selective In Situ Analysis of Tank Waste

Awards Related to SR-HL01 Continued

Award ID	Page #	Award Title
§ 54735-TX	B-343	Development of Inorganic Ion Exchangers for Nuclear Waste Remediation
§ 54621-WA	B-357	Chemical Speciation of Strontium, Americium, and Curium in High Level Waste: Predictive Modeling of Phase Partitioning During Tank Processing
§ 54628-WA	B-359	Colloidal Agglomerates in Tank Sludge: Impact on Waste Processing
§ 54646-WA	B-363	Interfacial Radiolysis Effects in Tank Waste Speciation
§ 54672-WA	B-365	Radiation Effects in Nuclear Waste Materials
§ 60345-WA	B-375	New Silicotitanate Waste Forms: Development and Characterization
§ 60362-WA	B-379	Ion-Exchange Processes and Mechanisms in Glasses
§ 60050-WA	B-395	Chemical Speciation of Inorganic Compounds under Hydrothermal Conditions
§ 60075-WA	B-401	Particle Generation by Laser Ablation in Support of Chemical Analysis of High Level Mixed Waste from Plutonium Production Operations
55094-CA	B-13	Chemical and Ceramic Methods Toward Safe Storage of Actinides Using Monazite
60328-CA	B-37	High Frequency Electromagnetic Impedance Measurements for Characterization, Monitoring and Verification Efforts
60370-CA	B-39	Rational Design of Metal Ion Sequestering Agents
54655-CA	B-63	Collaborative Research: Hydrogeological-Geophysical Methods for Subsurface Site Characterization
54926-CA	B-75	Novel Ceramic-Polymer Composite Membranes for the Separation of Hazardous Liquid Waste
54893-FL	B-99	Research Program to Determine Redox Properties and Their Effects on Speciation and Mobility of Pu in DOE Wastes
55247-IL	B-119	Sensors Using Molecular Recognition in Luminescent, Conductive Polymers
55382-IL	B-129	Determination of Transmutation Effects in Crystalline Waste Forms
60247-IL	B-139	Miniature Nuclear Magnetic Resonance Spectrometer for In-Situ and In-Process Analysis and Monitoring
54791-KS	B-153	Managing Tight-binding Receptors for New Separations Technologies
60231-MD	B-165	Novel Miniature Spectrometer for Remote Chemical Detection
54571-MA	B-181	Removal of Heavy Metals and Organic Contaminants from Aqueous Streams by Novel Filtration Methods
60070-MS	B-193	The Development of Cavity Ringdown Spectroscopy as a Sensitive Continuous Emission Monitor for Metals
55110-MO	B-195	An Alternative Host Matrix Based on Iron Phosphate Glasses for the Vitrification of Specialized Nuclear Waste Forms
55223-MO	B-197	De Novo Design of Ligands for Metal Separation
54724-NM	B-205	Synthesis of New Water-Soluble Metal-Binding Polymers: Combinatorial Chemistry Approach
54751-NM	B-209	High Fluence Neutron Source for Nondestructive Characterization of Nuclear Waste
54770-NM	B-213	New Anion-Exchange Resins for Improved Separations of Nuclear Materials
60015-NM	B-227	Long-term Risk from Actinides in the Environment: Modes of Mobility
60118-NM	B-229	Fundamental Thermodynamics of Actinide-Bearing Mineral Waste Forms
54639-NM	B-251	Development of an In-Situ Microsensor for the Measurements of Chromium and Uranium in Groundwater at DOE Sites
54122-PA	B-281	A Broad Spectrum Catalytic System for Removal of Toxic Organics from Water By Deep Oxidation
55205-SC	B-299	A Fundamental Study of Laser-Induced Breakdown Spectroscopy Using Fiber Optics for Remote Measurements of Trace Metals
55036-TN	B-307	Colloid Transport and Retention in Fractured Deposits
55119-TN	B-315	Phase Equilibria Modification by Electric Fields
60197-TN	B-329	Microsensors for In-situ Chemical, Physical, and Radiological Characterization of Mixed Waste
60096-TN	B-339	Rational Synthesis of Imprinted Organofunctional Sol-Gel Materials for Toxic Metal Separation

Awards Related to SR-HL01 Continued

Award ID	Page #	Award Title
54679-WA	B-367	Architectural Design Criteria for F-Block Metal Ion Sequestering Agents
54897-WA	B-391	The Sonophysics and Sonochemistry of Liquid Waste Quantification and Remediation
55146-WA	B-393	Adsorption/Membrane Filtration as a Contaminant Concentration and Separation Process for Mixed Wastes and Tank Wastes

Savannah River Operations Office

Savannah River Site

SR-HL02 - F-Tank Farm

Problem Area: High Level Waste
Life-Cycle Cost in 2007+: $657,000,000
DOE Project Manager: H. B. Gnann, 803-208-6076, howard.gnann@srs.gov
Contractor Manager: S. S. Cathey, 803-725-3052, susan.cathey@srs.gov
For More Information: http://www.doe.gov/em52/pbs/sr-hl02.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Medium **Worker:** High **Environment:** Urgent

Technical Approach Provided by Project Manager:

The key technologies used in the safe storage and management of this liquid high level radioactive waste are:

- Evaporation (necessary for volume reduction of waste to manage current available tank space)
- Chemical Additions (required to control the pH of the waste being stored to minimize that corrosion of these underground carbon steel waste tanks)
- Ventilation (to remove hydrogen gas from tank vapor space)
- Cooling (to remove radioactive decay heat from waste tanks)
- Transfer Systems (pumping, piping, and jets)

Post 2006 Project Scope Provided by Project Manager:

- Waste will be removed from the remaining 11 underground high level radioactive waste storage tanks. These remaining tanks will be closed by the end of FY25 (i.e., services and connecting piping cut and capped, tanks filled with grout). NOTE: Tank closure is covered by Waste Removal Operations and Tank Closure, Project SR-HL03.
- By FY16 a second group of tanks (tanks 1, 2, 3, 4, 5, 6, 7, and 8) with common systems plus a Control Room and related waste transfer systems will be closed. Beginning in FY15 a mortgage reduction will be put in place by reducing the Surveillance & Maintenance cost by $20.0 million.
- The evaporator systems will have achieved 13.5 million gallons of space gain.
- The waste volume being stored will have been reduced from 13.3 million gallons in FY07 to zero gallons.

Project End State Provided by Project Manager:

The project will end in FY21 when all waste removal activities are complete and all remaining tanks and facilities have been prepared for closure. This includes de-inventorying the existing underground high level radioactive waste storage tanks and associated facilities. Closure of remaining tanks and facilities is covered by Waste Removal Operations and Tank Closure, Project SR-HL03.

The full list of science research awards that have the potential to address projects such as this one, which deals with High Level Waste problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "High Level Waste".

The following awards were identified through systems engineering to have the potential to address the specific needs of this Project. Those research awards that may have the strongest link to this project are designated by the symbol "§".

Award ID	Page #	Award Title
§ 54656-CA	B-65	Mixing Processes in High-Level Waste Tanks
§ 54890-CA	B-69	On-Line Slurry Viscosity and Concentration Measurement as a Real-Time Waste Stream Characterization Tool
§ 54716-DC	B-97	Polyoxometalates for Radioactive Waste Treatment
§ 54982-FL	B-101	Analysis of Surface Leaching Processes in Vitrified High-Level Nuclear Wastes Using In-Situ Raman Imaging and Atomistic Modeling
§ 54807-GA	B-103	Studies Related to Chemical Mechanisms of Gas Formation in Hanford High-Level Nuclear Wastes
§ 60424-ID	B-113	High Temperature Condensed Phase Mass Spectrometric Analysis
§ 55229-IL	B-117	The NOx System in Nuclear Waste
§ 55141-MA	B-177	Imaging and Characterizing the Waste Materials Inside an Underground Storage Tank Using Seismic Normal Modes
§ 54691-MI	B-189	Radiation Effects on Materials in the Near-Field of Nuclear Waste Repository
§ 54773-NM	B-215	Microstructural Properties of High Level Waste Concentrates and Gels with Raman And Infrared Spectroscopies
§ 59993-NM	B-223	Dynamic Effects of Tank Waste Aging on Radionuclide-Complexant Interactions
§ 54595-NM	B-255	f-Element Ion Chelation in Highly Basic Media
§ 59982-NY	B-259	Reactivity of Peroxynitrite: Implications for Hanford Waste Management and Remediation
§ 55179-NY	B-267	Acoustic Probe for Solid-Gas-Liquid Suspensions
§ 54674-OH	B-271	Design and Development of a New Hybrid Spectroelectrochemical Sensor
§ 60219-PA	B-287	Development of Advanced Electrochemical Emission Spectroscopy for Monitoring Corrosion in Simulated DOE Liquid Waste
§ 60401-SC	B-293	Mechanism of Pitting Corrosion Prevention by Nitrite in Carbon Steel Exposed to Dilute Salt Solutions
§ 59978-TN	B-321	Thermospray Mass Spectrometry Ionization Processes Fundamental Mechanisms for Speciation, Separation and Characterization of Organic Complexants in DOE Wastes
§ 60217-TN	B-331	Optically-Based Array Sensors for Selective In Situ Analysis of Tank Waste
§ 54735-TX	B-343	Development of Inorganic Ion Exchangers for Nuclear Waste Remediation
§ 54621-WA	B-357	Chemical Speciation of Strontium, Americium, and Curium in High Level Waste: Predictive Modeling of Phase Partitioning During Tank Processing
§ 54628-WA	B-359	Colloidal Agglomerates in Tank Sludge: Impact on Waste Processing
§ 54646-WA	B-363	Interfacial Radiolysis Effects in Tank Waste Speciation
§ 54672-WA	B-365	Radiation Effects in Nuclear Waste Materials
§ 60362-WA	B-379	Ion-Exchange Processes and Mechanisms in Glasses
§ 60050-WA	B-395	Chemical Speciation of Inorganic Compounds under Hydrothermal Conditions
§ 60075-WA	B-401	Particle Generation by Laser Ablation in Support of Chemical Analysis of High Level Mixed Waste from Plutonium Production Operations
60328-CA	B-37	High Frequency Electromagnetic Impedance Measurements for Characterization, Monitoring and Verification Efforts
55411-CA	B-49	Joint Inversion of Geophysical Data for Site Characterization and Restoration Monitoring
60319-CA	B-51	Thermodynamics of the Volatilization of Actinide Metals in the High-Temperature Treatment of Radioactive Wastes
54655-CA	B-63	Collaborative Research: Hydrogeological-Geophysical Methods for Subsurface Site Characterization

Awards Related to SR-HL02 Continued

Award ID	Page #	Award Title
60141-DC	B-95	Gamma Ray Imaging for Environmental Remediation
55218-GA	B-107	Seismic Surface-Wave Tomography of Waste Sites
60247-IL	B-139	Miniature Nuclear Magnetic Resonance Spectrometer for In-Situ and In-Process Analysis and Monitoring
60231-MD	B-165	Novel Miniature Spectrometer for Remote Chemical Detection
54571-MA	B-181	Removal of Heavy Metals and Organic Contaminants from Aqueous Streams by Novel Filtration Methods
54724-NM	B-205	Synthesis of New Water-Soluble Metal-Binding Polymers: Combinatorial Chemistry Approach
59996-NM	B-225	Plutonium Speciation, Solubilization, and Migration in Soils
54639-NM	B-251	Development of an In-Situ Microsensor for the Measurements of Chromium and Uranium in Groundwater at DOE Sites
54828-SC	B-297	Processing of High Level Waste: Spectroscopic Characterization of Redox Reactions in Supercritical Water
55205-SC	B-299	A Fundamental Study of Laser-Induced Breakdown Spectroscopy Using Fiber Optics for Remote Measurements of Trace Metals
55036-TN	B-307	Colloid Transport and Retention in Fractured Deposits
60197-TN	B-329	Microsensors for In-situ Chemical, Physical, and Radiological Characterization of Mixed Waste
60355-WA	B-377	Mineral Surface Processes Responsible for the Decreased Retardation (or Enhanced Mobilization) of 137Cs from HLW Tank Discharges
54897-WA	B-391	The Sonophysics and Sonochemistry of Liquid Waste Quantification and Remediation
55146-WA	B-393	Adsorption/Membrane Filtration as a Contaminant Concentration and Separation Process for Mixed Wastes and Tank Wastes

Savannah River Operations Office

Savannah River Site

SR-HL03 - Waste Removal Operations and Tank Closure

Problem Area: High Level Waste
Life-Cycle Cost in 2007+: $684,000,000
DOE Project Manager: H. B. Gnann, 803-208-6076, howard.gnann@srs.gov
Contractor Manager: S. S. Cathey, 803-725-3052, susan.cathey@srs.gov
For More Information: http://www.doe.gov/em52/pbs/sr-hl03.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Low **Worker:** Medium **Environment:** Low

Technical Approach Provided by Project Manager:

Key HLW waste removal and tank/facility closure technologies are:
- Salt dissolution via mechanical agitation (slurry pumps),
- Sludge suspension via mechanical agitation (slurry pumps),
- Remote process sampling,
- Corrosion control of the carbon steel waste tanks,
- Heel removal techniques and specialized equipment, and
- Grout formulation to chemically bind radioactive contaminants

The key technology development needs are:
- More cost effective salt removal methods than slurry pumps such as water jetting, hydraulic mining, modified density gradient, etc.,
- Effective methods to remove tank heels (sludge heel, hardened sludge, zeolite, sand, etc.), and
- Enhanced method for retrieval of waste from annulus spaces.

Post 2006 Project Scope Provided by Project Manager:

Waste Removal - Waste will be removed from the remaining 39 tanks and the tanks water washed by FY25. Process facilities will be de-inventoried and flushed out in a similar manner by FY25.

Waste Removal Demonstrations - There are no waste removal demonstrations scheduled after FY04.

Tank/Facility Closure - The remaining 41 tanks will be closed by FY26. Process facilities will also be closed by FY26.

Area Closures - All geographical areas will be closed by FY26 and ready to transition to Environmental Restoration for characterization, remediation (if needed) and final closure activities.

Project End State Provided by Project Manager:

The project will end in FY26 when all waste removal, tank closure, and facility closure activities are complete. All HLW facilities will be transitioned to Environmental Restoration project SR-ER02.

The full list of science research awards that have the potential to address projects such as this one, which deals with High Level Waste problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "High Level Waste".

The following awards were identified through systems engineering to have the potential to address the specific needs of this Project. Those research awards that may have the strongest link to this project are designated by the symbol "§".

Award ID	Page #	Award Title
§ 55318-CA	B-23	Improved Analytical Characterization of Solid Waste-Forms by Fundamental Development of Laser Ablation Technology
§ 54656-CA	B-65	Mixing Processes in High-Level Waste Tanks
§ 54890-CA	B-69	On-Line Slurry Viscosity and Concentration Measurement as a Real-Time Waste Stream Characterization Tool
§ 54982-FL	B-101	Analysis of Surface Leaching Processes in Vitrified High-Level Nuclear Wastes Using In-Situ Raman Imaging and Atomistic Modeling
§ 54807-GA	B-103	Studies Related to Chemical Mechanisms of Gas Formation in Hanford High-Level Nuclear Wastes
§ 60424-ID	B-113	High Temperature Condensed Phase Mass Spectrometric Analysis
§ 55229-IL	B-117	The NOx System in Nuclear Waste
§ 59977-MD	B-169	Synthesis and Characterization of Templated Ion Exchange Resins for the Selective Complexation of Actinide Ions
§ 55141-MA	B-177	Imaging and Characterizing the Waste Materials Inside an Underground Storage Tank Using Seismic Normal Modes
§ 54691-MI	B-189	Radiation Effects on Materials in the Near-Field of Nuclear Waste Repository
§ 54773-NM	B-215	Microstructural Properties of High Level Waste Concentrates and Gels with Raman And Infrared Spectroscopies
§ 59990-NM	B-221	Fundamental Chemistry, Characterization, and Separation of Technetium Complexes in Hanford Waste
§ 59993-NM	B-223	Dynamic Effects of Tank Waste Aging on Radionuclide-Complexant Interactions
§ 54595-NM	B-255	f-Element Ion Chelation in Highly Basic Media
§ 59982-NY	B-259	Reactivity of Peroxynitrite: Implications for Hanford Waste Management and Remediation
§ 55179-NY	B-267	Acoustic Probe for Solid-Gas-Liquid Suspensions
§ 54674-OH	B-271	Design and Development of a New Hybrid Spectroelectrochemical Sensor
§ 60219-PA	B-287	Development of Advanced Electrochemical Emission Spectroscopy for Monitoring Corrosion in Simulated DOE Liquid Waste
§ 55087-TN	B-309	Design and Synthesis of the Next Generation of Crown Ethers for Waste Separations: An Inter-Laboratory Comprehensive Proposal
§ 59978-TN	B-321	Thermospray Mass Spectrometry Ionization Processes Fundamental Mechanisms for Speciation, Separation and Characterization of Organic Complexants in DOE Wastes
§ 60217-TN	B-331	Optically-Based Array Sensors for Selective In Situ Analysis of Tank Waste
§ 54735-TX	B-343	Development of Inorganic Ion Exchangers for Nuclear Waste Remediation
§ 54621-WA	B-357	Chemical Speciation of Strontium, Americium, and Curium in High Level Waste: Predictive Modeling of Phase Partitioning During Tank Processing
§ 54628-WA	B-359	Colloidal Agglomerates in Tank Sludge: Impact on Waste Processing
§ 54646-WA	B-363	Interfacial Radiolysis Effects in Tank Waste Speciation
§ 54672-WA	B-365	Radiation Effects in Nuclear Waste Materials
§ 60362-WA	B-379	Ion-Exchange Processes and Mechanisms in Glasses
§ 60050-WA	B-395	Chemical Speciation of Inorganic Compounds under Hydrothermal Conditions
§ 60075-WA	B-401	Particle Generation by Laser Ablation in Support of Chemical Analysis of High Level Mixed Waste from Plutonium Production Operations
55014-AL	B-1	Kinetics and Mechanisms of Metal Retention/Release in Geochemical Processes in Soil
60328-CA	B-37	High Frequency Electromagnetic Impedance Measurements for Characterization, Monitoring and Verification Efforts

Awards Related to SR-HL03 Continued

Award ID	Page #	Award Title
60370-CA	B-39	Rational Design of Metal Ion Sequestering Agents
55148-CA	B-45	Hydrologic and Geochemical Controls on the Transport of Radionuclides in Natural Undisturbed Arid Environments as Determined by Accelerator Mass Spectrometry Measurements
55411-CA	B-49	Joint Inversion of Geophysical Data for Site Characterization and Restoration Monitoring
60319-CA	B-51	Thermodynamics of the Volatilization of Actinide Metals in the High-Temperature Treatment of Radioactive Wastes
54860-CA	B-59	Sorption of Heavy Metals and Radionuclides on Mineral Surfaces in the Presence of Organic Co-Contaminants
54655-CA	B-63	Collaborative Research: Hydrogeological-Geophysical Methods for Subsurface Site Characterization
54926-CA	B-75	Novel Ceramic-Polymer Composite Membranes for the Separation of Hazardous Liquid Waste
60141-DC	B-95	Gamma Ray Imaging for Environmental Remediation
55218-GA	B-107	Seismic Surface-Wave Tomography of Waste Sites
55247-IL	B-119	Sensors Using Molecular Recognition in Luminescent, Conductive Polymers
55382-IL	B-129	Determination of Transmutation Effects in Crystalline Waste Forms
60247-IL	B-139	Miniature Nuclear Magnetic Resonance Spectrometer for In-Situ and In-Process Analysis and Monitoring
60231-MD	B-165	Novel Miniature Spectrometer for Remote Chemical Detection
54571-MA	B-181	Removal of Heavy Metals and Organic Contaminants from Aqueous Streams by Novel Filtration Methods
60070-MS	B-193	The Development of Cavity Ringdown Spectroscopy as a Sensitive Continuous Emission Monitor for Metals
55223-MO	B-197	De Novo Design of Ligands for Metal Separation
54724-NM	B-205	Synthesis of New Water-Soluble Metal-Binding Polymers: Combinatorial Chemistry Approach
54741-NM	B-207	Characterization of Contaminant Transport Using Naturally-Occurring U-Series Disequilibria
54770-NM	B-213	New Anion-Exchange Resins for Improved Separations of Nuclear Materials
59996-NM	B-225	Plutonium Speciation, Solubilization, and Migration in Soils
54639-NM	B-251	Development of an In-Situ Microsensor for the Measurements of Chromium and Uranium in Groundwater at DOE Sites
54793-NY	B-263	Establishing a Quantitative Functional Relationship Between Capillary Pressure Saturation and Interfacial Area
54828-SC	B-297	Processing of High Level Waste: Spectroscopic Characterization of Redox Reactions in Supercritical Water
55205-SC	B-299	A Fundamental Study of Laser-Induced Breakdown Spectroscopy Using Fiber Optics for Remote Measurements of Trace Metals
55036-TN	B-307	Colloid Transport and Retention in Fractured Deposits
55119-TN	B-315	Phase Equilibria Modification by Electric Fields
60197-TN	B-329	Microsensors for In-situ Chemical, Physical, and Radiological Characterization of Mixed Waste
60096-TN	B-339	Rational Synthesis of Imprinted Organofunctional Sol-Gel Materials for Toxic Metal Separation
60355-WA	B-377	Mineral Surface Processes Responsible for the Decreased Retardation (or Enhanced Mobilization) of 137Cs from HLW Tank Discharges
54897-WA	B-391	The Sonophysics and Sonochemistry of Liquid Waste Quantification and Remediation
55146-WA	B-393	Adsorption/Membrane Filtration as a Contaminant Concentration and Separation Process for Mixed Wastes and Tank Wastes

Savannah River Operations Office

Savannah River Site

SR-HL04 - In Tank Precipitation/Extended Sludge Processing/Late Wash (ITP/ESP/LW) Operations

Problem Area: High Level Waste
Life-Cycle Cost in 2007+: $1,681,000,000
DOE Project Manager: H. B. Gnann, 803-208-6076, howard.gnann@srs.gov
Contractor Manager: S. S. Cathey, 803-725-3052, susan.cathey@srs.gov
For More Information: http://www.doe.gov/em52/pbs/sr-hl04.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Medium **Worker:** High **Environment:** Urgent

Technical Approach Provided by Project Manager:

The key technologies used in the safe storage and pretreatment of this liquid high level radioactive waste are:

- Chemical precipitation
- Chemical adsorption
- Chemical dissolution
- Microfiltration
- Benzene stripping
- Tank mixing
- Solids settling

Post 2006 Project Scope Provided by Project Manager:

ITP - the facility will have processed all 13,436,000 gallons (legacy plus currently projected from ongoing operations) of concentrated supernate and 57,104,000 gallons of dissolved saltcake (21,150,000 gal saltcake) into 4,828,000 gallons of precipitate for vitrification in DWPF and 108,300,000 gallons of filtrate for disposal in Saltstone by the end of FY24. All 4,367 canisters of coupled sludge and precipitate feed will have been produced by the end of FY24.

ESP - All of the remaining legacy plus currently projected sludge from ongoing operations will have been aluminum dissolved, washed, transferred to DWPF and vitrified in 6,000 canisters by the end of FY24.

Late Wash - the facility will have processed all 4,828,000 gallons of precipitate for vitrification in DWPF by the end of FY24.

Project End State Provided by Project Manager:

The ITP, ESP and Late Wash production mission will end in FY24 when all legacy and currently projected waste from ongoing operations will be pre-treated in ITP/ESP, vitrified in DWPF and/or disposed in Saltstone. Funding for the remaining closure -related activities (waste heel removal, water washing, physical isolation and closure by filling with grout) is provided by the "Waste Removal and Tank Closure" project SR-HL03.

The full list of science research awards that have the potential to address projects such as this one, which deals with High Level Waste problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "High Level Waste".

The following awards were identified through systems engineering to have the potential to address the specific needs of this Project. Those research awards that may have the strongest link to this project are designated by the symbol "§".

Award ID	Page #	Award Title
§ 55318-CA	B-23	Improved Analytical Characterization of Solid Waste-Forms by Fundamental Development of Laser Ablation Technology
§ 60296-CA	B-35	Research Program to Investigate the Fundamental Chemistry of Technetium
§ 55137-CA	B-53	Investigation of Novel Electrode Materials for Electrochemically-Based Remediation of High- and Low-Level Mixed Wastes in the DOE Complex
§ 54656-CA	B-65	Mixing Processes in High-Level Waste Tanks
§ 54890-CA	B-69	On-Line Slurry Viscosity and Concentration Measurement as a Real-Time Waste Stream Characterization Tool
§ 54716-DC	B-97	Polyoxometalates for Radioactive Waste Treatment
§ 54982-FL	B-101	Analysis of Surface Leaching Processes in Vitrified High-Level Nuclear Wastes Using In-Situ Raman Imaging and Atomistic Modeling
§ 54807-GA	B-103	Studies Related to Chemical Mechanisms of Gas Formation in Hanford High-Level Nuclear Wastes
§ 60424-ID	B-113	High Temperature Condensed Phase Mass Spectrometric Analysis
§ 55229-IL	B-117	The NOx System in Nuclear Waste
§ 55294-IL	B-121	Superconducting Open-Gradient Magnetic Separation for the Pretreatment of Radioactive or Mixed Waste Vitrification Feeds
§ 59977-MD	B-169	Synthesis and Characterization of Templated Ion Exchange Resins for the Selective Complexation of Actinide Ions
§ 55141-MA	B-177	Imaging and Characterizing the Waste Materials Inside an Underground Storage Tank Using Seismic Normal Modes
§ 54691-MI	B-189	Radiation Effects on Materials in the Near-Field of Nuclear Waste Repository
§ 54765-NM	B-211	Enhanced Sludge Processing of HLW: Hydrothermal Oxidation of Chromium, Technetium, and Complexants by Nitrate
§ 54773-NM	B-215	Microstructural Properties of High Level Waste Concentrates and Gels with Raman And Infrared Spectroscopies
§ 59990-NM	B-221	Fundamental Chemistry, Characterization, and Separation of Technetium Complexes in Hanford Waste
§ 59993-NM	B-223	Dynamic Effects of Tank Waste Aging on Radionuclide-Complexant Interactions
§ 54595-NM	B-255	f-Element Ion Chelation in Highly Basic Media
§ 59982-NY	B-259	Reactivity of Peroxynitrite: Implications for Hanford Waste Management and Remediation
§ 55179-NY	B-267	Acoustic Probe for Solid-Gas-Liquid Suspensions
§ 54674-OH	B-271	Design and Development of a New Hybrid Spectroelectrochemical Sensor
§ 60017-PA	B-285	Removal of Technetium, Carbon Tetrachloride, and Metals from DOE Properties
§ 60219-PA	B-287	Development of Advanced Electrochemical Emission Spectroscopy for Monitoring Corrosion in Simulated DOE Liquid Waste
§ 55087-TN	B-309	Design and Synthesis of the Next Generation of Crown Ethers for Waste Separations: An Inter-Laboratory Comprehensive Proposal
§ 59978-TN	B-321	Thermospray Mass Spectrometry Ionization Processes Fundamental Mechanisms for Speciation, Separation and Characterization of Organic Complexants in DOE Wastes
§ 60217-TN	B-331	Optically-Based Array Sensors for Selective In Situ Analysis of Tank Waste
§ 54735-TX	B-343	Development of Inorganic Ion Exchangers for Nuclear Waste Remediation
§ 54621-WA	B-357	Chemical Speciation of Strontium, Americium, and Curium in High Level Waste: Predictive Modeling of Phase Partitioning During Tank Processing
§ 54628-WA	B-359	Colloidal Agglomerates in Tank Sludge: Impact on Waste Processing

Awards Related to SR-HL04 Continued

Award ID	Page #	Award Title
§ 54646-WA	B-363	Interfacial Radiolysis Effects in Tank Waste Speciation
§ 54672-WA	B-365	Radiation Effects in Nuclear Waste Materials
§ 60362-WA	B-379	Ion-Exchange Processes and Mechanisms in Glasses
§ 60123-WA	B-397	Potential-Modulated Intercalation of Alkali Cations into Metal Hexacyanoferrate Coated Electrodes
§ 60075-WA	B-401	Particle Generation by Laser Ablation in Support of Chemical Analysis of High Level Mixed Waste from Plutonium Production Operations
60328-CA	B-37	High Frequency Electromagnetic Impedance Measurements for Characterization, Monitoring and Verification Efforts
60370-CA	B-39	Rational Design of Metal Ion Sequestering Agents
55411-CA	B-49	Joint Inversion of Geophysical Data for Site Characterization and Restoration Monitoring
60319-CA	B-51	Thermodynamics of the Volatilization of Actinide Metals in the High-Temperature Treatment of Radioactive Wastes
54926-CA	B-75	Novel Ceramic-Polymer Composite Membranes for the Separation of Hazardous Liquid Waste
60141-DC	B-95	Gamma Ray Imaging for Environmental Remediation
55218-GA	B-107	Seismic Surface-Wave Tomography of Waste Sites
55382-IL	B-129	Determination of Transmutation Effects in Crystalline Waste Forms
60247-IL	B-139	Miniature Nuclear Magnetic Resonance Spectrometer for In-Situ and In-Process Analysis and Monitoring
54791-KS	B-153	Managing Tight-binding Receptors for New Separations Technologies
60231-MD	B-165	Novel Miniature Spectrometer for Remote Chemical Detection
54571-MA	B-181	Removal of Heavy Metals and Organic Contaminants from Aqueous Streams by Novel Filtration Methods
60070-MS	B-193	The Development of Cavity Ringdown Spectroscopy as a Sensitive Continuous Emission Monitor for Metals
55223-MO	B-197	De Novo Design of Ligands for Metal Separation
54724-NM	B-205	Synthesis of New Water-Soluble Metal-Binding Polymers: Combinatorial Chemistry Approach
54770-NM	B-213	New Anion-Exchange Resins for Improved Separations of Nuclear Materials
59996-NM	B-225	Plutonium Speciation, Solubilization, and Migration in Soils
54122-PA	B-281	A Broad Spectrum Catalytic System for Removal of Toxic Organics from Water By Deep Oxidation
54828-SC	B-297	Processing of High Level Waste: Spectroscopic Characterization of Redox Reactions in Supercritical Water
55205-SC	B-299	A Fundamental Study of Laser-Induced Breakdown Spectroscopy Using Fiber Optics for Remote Measurements of Trace Metals
55036-TN	B-307	Colloid Transport and Retention in Fractured Deposits
55119-TN	B-315	Phase Equilibria Modification by Electric Fields
60096-TN	B-339	Rational Synthesis of Imprinted Organofunctional Sol-Gel Materials for Toxic Metal Separation
54679-WA	B-367	Architectural Design Criteria for F-Block Metal Ion Sequestering Agents
60355-WA	B-377	Mineral Surface Processes Responsible for the Decreased Retardation (or Enhanced Mobilization) of 137Cs from HLW Tank Discharges
55146-WA	B-393	Adsorption/Membrane Filtration as a Contaminant Concentration and Separation Process for Mixed Wastes and Tank Wastes

Savannah River Operations Office

Savannah River Site

SR-HL05 - Vitrification

Problem Area: High Level Waste
Life-Cycle Cost in 2007+: $2,557,000,000
DOE Project Manager: H. B. Gnann, 803-208-6076, howard.gnann@srs.gov
Contractor Manager: S. S. Cathey, 803-725-3052, susan.cathey@srs.gov
For More Information: http://www.doe.gov/em52/pbs/sr-hl05.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Low **Worker:** Medium **Environment:** Low

Technical Approach Provided by Project Manager:

The key technologies used in the safe treatment and immobilization of this liquid high level radioactive waste are:
- Chemical Additions, to conduct precipitate hydrolysis, separate and collect mercury, separate and collect organics, and adjust waste composition as needed commensurate with the vitrification process
- Concentration, to achieve the desired mass balance of waste components at various steps in the vitrification process
- Analytical Laboratory, to determine levels of chemical additions required, and to confirm that the waste has met defined requirements prior to proceeding to the next process step
- Vitrification, to immobilize the waste in a glass matrix to prevent it from leaching into the environment; note that the EPA has determined that vitrification is the Best Demonstrated Available Technology (BDAT) for treating liquid high level waste
- Decontamination, to remove contamination from the external surfaces of the filled canister prior to storage, and to reduce contamination on failed equipment to reduce personnel exposure prior to performing maintenance
- Upset-Resistance Welding, to create a permanent seal on the top of the filled canister prior to storage
- Ventilation, to remove flammable gases from the process vessels, and to remove volatile radionuclides from the process off-gases prior to release to the environment
- Heating and Cooling, to control process reactions

The key technology development needs are:
- Develop DWPF analytical methods to improve attainment
- Upgrade DWPF liquid level and density measurement techniques
- Develop alternate recycle processing methods
- Optimize waste loading in glass
- Develop canister decontamination alternatives

Post 2006 Project Scope Provided by Project Manager:

- From FY07-14, DWPF will produce 250 canisters of waste glass per year.
- From FY15-23, DWPF will produce 200 canisters of waste glass per year.
- In FY24, DWPF will produce 72 canisters of waste glass.
- A total of 5,978 canisters of waste glass will be produced from SRS liquid high level waste over the life of the DWPF project.
- Failed equipment will be replaced as needed.
- Melters #5-11 will have been operated, removed from service, placed in Melter Storage Boxes #5-11, and stored in Failed Equipment Storage Vaults #5-11.
- Failed Equipment Storage Vaults #7-10 will have been constructed in FY12-13.
- Failed Equipment Storage Vault #11 will have been constructed in FY21-22.
- The Vitrification Building and supporting facilities will be available for Decontamination and Decommissioning activities in FY24-25.

Project End State Provided by Project Manager:

The project will end in FY24 when vitrification of all SRS liquid high level radioactive waste is complete and the facility has been de-inventoried. Closure of facilities is covered by Waste Removal Operations and Tank Closure, Project SR-HL03.

The full list of science research awards that have the potential to address projects such as this one, which deals with High Level Waste problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "High Level Waste".

The following awards were identified through systems engineering to have the potential to address the specific needs of this Project. Those research awards that may have the strongest link to this project are designated by the symbol "§".

Award ID	Page #	Award Title
§ 59827-AZ	B-9	The Influence of Radiation and Multivalent Cation Additions on Phase Separation and Crystallization of Glass
§ 55137-CA	B-53	Investigation of Novel Electrode Materials for Electrochemically-Based Remediation of High- and Low-Level Mixed Wastes in the DOE Complex
§ 54890-CA	B-69	On-Line Slurry Viscosity and Concentration Measurement as a Real-Time Waste Stream Characterization Tool
§ 55188-DC	B-93	Chemical Decomposition of High-Level Nuclear Waste Storage/Disposal Glasses Under Irradiation
§ 54716-DC	B-97	Polyoxometalates for Radioactive Waste Treatment
§ 54982-FL	B-101	Analysis of Surface Leaching Processes in Vitrified High-Level Nuclear Wastes Using In-Situ Raman Imaging and Atomistic Modeling
§ 54807-GA	B-103	Studies Related to Chemical Mechanisms of Gas Formation in Hanford High-Level Nuclear Wastes
§ 55042-GA	B-105	Quantifying Silica Reactivity in Subsurface Environments: Controls of Reaction Affinity and Solute Matrix on Quartz and SiO2 Glass Dissolution Kinetics
§ 60424-ID	B-113	High Temperature Condensed Phase Mass Spectrometric Analysis
§ 55294-IL	B-121	Superconducting Open-Gradient Magnetic Separation for the Pretreatment of Radioactive or Mixed Waste Vitrification Feeds
§ 55367-IL	B-123	Investigation of Microscopic Radiation Damage in Waste Forms Using ODNMR and AEM Techniques
§ 60313-IL	B-135	Radiation Effects on Transport and Bubble Formation in Silicate Glasses
§ 60143-IL	B-137	Foaming in Radioactive Waste Treatment and Immobilization Processes
§ 59977-MD	B-169	Synthesis and Characterization of Templated Ion Exchange Resins for the Selective Complexation of Actinide Ions
§ 54691-MI	B-189	Radiation Effects on Materials in the Near-Field of Nuclear Waste Repository
§ 60403-NM	B-243	Phase Chemistry of Tank Sludge Residual Components
§ 54595-NM	B-255	f-Element Ion Chelation in Highly Basic Media
§ 55179-NY	B-267	Acoustic Probe for Solid-Gas-Liquid Suspensions
§ 54674-OH	B-271	Design and Development of a New Hybrid Spectroelectrochemical Sensor
§ 60017-PA	B-285	Removal of Technetium, Carbon Tetrachloride, and Metals from DOE Properties
§ 60219-PA	B-287	Development of Advanced Electrochemical Emission Spectroscopy for Monitoring Corrosion in Simulated DOE Liquid Waste
§ 60020-TN	B-323	Stability of High-Level Waste Forms
§ 60217-TN	B-331	Optically-Based Array Sensors for Selective In Situ Analysis of Tank Waste
§ 54735-TX	B-343	Development of Inorganic Ion Exchangers for Nuclear Waste Remediation
§ 54621-WA	B-357	Chemical Speciation of Strontium, Americium, and Curium in High Level Waste: Predictive Modeling of Phase Partitioning During Tank Processing
§ 54628-WA	B-359	Colloidal Agglomerates in Tank Sludge: Impact on Waste Processing
§ 54672-WA	B-365	Radiation Effects in Nuclear Waste Materials
§ 54996-WA	B-371	Ionizing Radiation Induced Catalysis on Metal Oxide Particles

Awards Related to SR-HL05 Continued

Award ID	Page #	Award Title
§ 60345-WA	B-375	New Silicotitanate Waste Forms: Development and Characterization
§ 60362-WA	B-379	Ion-Exchange Processes and Mechanisms in Glasses
§ 60050-WA	B-395	Chemical Speciation of Inorganic Compounds under Hydrothermal Conditions
§ 60075-WA	B-401	Particle Generation by Laser Ablation in Support of Chemical Analysis of High Level Mixed Waste from Plutonium Production Operations
55094-CA	B-13	Chemical and Ceramic Methods Toward Safe Storage of Actinides Using Monazite
60319-CA	B-51	Thermodynamics of the Volatilization of Actinide Metals in the High-Temperature Treatment of Radioactive Wastes
54655-CA	B-63	Collaborative Research: Hydrogeological-Geophysical Methods for Subsurface Site Characterization
54926-CA	B-75	Novel Ceramic-Polymer Composite Membranes for the Separation of Hazardous Liquid Waste
60155-CO	B-83	Measurements and Models for Hazardous Chemical and Mixed Wastes
54847-CO	B-87	Photocatalytic and Chemical Oxidation of Organic Compounds in Supercritical Carbon Dioxide
54893-FL	B-99	Research Program to Determine Redox Properties and Their Effects on Speciation and Mobility of Pu in DOE Wastes
55382-IL	B-129	Determination of Transmutation Effects in Crystalline Waste Forms
60247-IL	B-139	Miniature Nuclear Magnetic Resonance Spectrometer for In-Situ and In-Process Analysis and Monitoring
55211-IL	B-141	Cavitational Hydrothermal Oxidation: A New Remediation Process
54834-IN	B-143	An Investigation of Homogeneous and Heterogeneous Sonochemistry for Destruction of Hazardous Waste
54942-IN	B-147	Spectroscopy, Modeling and Computation of Metal Chelate Solubility in Supercritical CO_2
54791-KS	B-153	Managing Tight-binding Receptors for New Separations Technologies
60231-MD	B-165	Novel Miniature Spectrometer for Remote Chemical Detection
54571-MA	B-181	Removal of Heavy Metals and Organic Contaminants from Aqueous Streams by Novel Filtration Methods
60070-MS	B-193	The Development of Cavity Ringdown Spectroscopy as a Sensitive Continuous Emission Monitor for Metals
55110-MO	B-195	An Alternative Host Matrix Based on Iron Phosphate Glasses for the Vitrification of Specialized Nuclear Waste Forms
54724-NM	B-205	Synthesis of New Water-Soluble Metal-Binding Polymers: Combinatorial Chemistry Approach
54751-NM	B-209	High Fluence Neutron Source for Nondestructive Characterization of Nuclear Waste
60015-NM	B-227	Long-term Risk from Actinides in the Environment: Modes of Mobility
60118-NM	B-229	Fundamental Thermodynamics of Actinide-Bearing Mineral Waste Forms
55387-NM	B-237	Photooxidation of Organic Wastes Using Semiconductor Nanoclusters
54639-NM	B-251	Development of an In-Situ Microsensor for the Measurements of Chromium and Uranium in Groundwater at DOE Sites
54122-PA	B-281	A Broad Spectrum Catalytic System for Removal of Toxic Organics from Water By Deep Oxidation
55171-PA	B-283	Development of Advanced In-Situ Techniques for Chemistry Monitoring and Corrosion Mitigation in SCWO Environments
54856-PA	B-289	Structural Biology of the Sequestration & Transport of Heavy Metal Toxins: NMR Structure Determination of Proteins Containing the -Cys-X-Y-Cys-metal Binding Motifs
55205-SC	B-299	A Fundamental Study of Laser-Induced Breakdown Spectroscopy Using Fiber Optics for Remote Measurements of Trace Metals
54973-TN	B-301	A Novel Energy-Efficient Plasma Chemical Process for the Destruction of Volatile Toxic Compounds

Awards Related to SR-HL05 Continued

Award ID	Page #	Award Title
55036-TN	B-307	Colloid Transport and Retention in Fractured Deposits
55119-TN	B-315	Phase Equilibria Modification by Electric Fields
55276-TN	B-319	Fundamental Chemistry and Thermodynamics of Hydrothermal Oxidation Processes
60197-TN	B-329	Microsensors for In-situ Chemical, Physical, and Radiological Characterization of Mixed Waste
60096-TN	B-339	Rational Synthesis of Imprinted Organofunctional Sol-Gel Materials for Toxic Metal Separation
54897-WA	B-391	The Sonophysics and Sonochemistry of Liquid Waste Quantification and Remediation
55146-WA	B-393	Adsorption/Membrane Filtration as a Contaminant Concentration and Separation Process for Mixed Wastes and Tank Wastes
60150-WA	B-399	Genetic Engineering of a Radiation-Resistant Bacterium for Biodegradation of Mixed Wastes

Savannah River Operations Office

Savannah River Site

SR-HL08 - Saltstone

Problem Area:	High Level Waste
Life-Cycle Cost in 2007+:	$351,000,000
DOE Project Manager:	F. R. MCCOY III, 803-725-8600, frank02.mccoy@srs.gov
Contractor Manager:	A. L. Whittenburg, 803-208-6917, anatia.whittenburg@srs.gov
For More Information:	http://www.doe.gov/em52/pbs/sr-hl08.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Low **Worker:** Medium **Environment:** Low

Technical Approach Provided by Project Manager:

The key technologies used in the safe storage and management of this low level radioactive liquid salt solution are:

- Stabilization (addition of cement, slag and flash to stabilize the waste in a solid matrix that passes the Toxicity Characteristic Leachate Procedure)
- Solidification (allows the grout to harden into a solid Saltstone waste form in engineered vaults for permanent disposal)
- Transfer Systems (pumping, piping, and mixer)

Post 2006 Project Scope Provided by Project Manager:

- Approximately 110 million gallons of waste salt solution will have been received, treated and disposed in Saltstone Vaults from FY07-FY24.(The total includes an estimated 108.3 million gallons of salt solution from the In-Tank Precipitation Facility and an estimated 1.7 million gallons of evaporator bottoms material from the Effluent Treatment Facility.)

Project End State Provided by Project Manager:

The project will end in FY24 when all low level radioactive salt solution has been stabilized in a cementetious matrix and allowed to harden in engineered, above-ground vaults. At that time, the Saltstone Processing Building will be available to start D&D activities. The Saltstone Disposal Vaults will be closed by backfilling around the vaults with native soils and installing successive layers of clay, gravel, geotextile fabric, and other materials and vegetation specifically designed to drain surface waters away from the disposal vaults.

The full list of science research awards that have the potential to address projects such as this one, which deals with High Level Waste problems, are listed in the <u>Index of Research Awards by Environmental Management Problem Area</u>, in the back of this appendix, under the heading "High Level Waste".

Savannah River Operations Office

Savannah River Site

SR-HL12 - High Level Waste System Upgrades

Problem Area:	High Level Waste
Life-Cycle Cost in 2007+:	$503,000,000
DOE Project Manager:	H. B. Gnann, 803-208-6076, howard.gnann@srs.gov
Contractor Manager:	S. S. Cathey, 803-725-3052, susan.cathey@srs.gov
For More Information:	http://www.doe.gov/em52/pbs/sr-hl12.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Low **Worker:** Medium **Environment:** Low

Technical Approach Provided by Project Manager:

Waste Removal:
- sludge suspension by mechanical agitation provided by slurry pumps and sludge removal via high capacity telescoping transfer pumps
- salt dissolution via mechanical agitation (slurry pumps) and salt removal via telescoping transfer jets
- salt dissolution via alternate technologies to be demonstrated (see SR-HL03) which will include density gradient, water jets and one pump agitation

Vitrification Upgrades:
- standard industrial technologies will be used.

Precipitate Upgrades:
- standard industrial technologies will be used for Late Wash upgrades while several competing technologies will be considered for ITP replacement including organic (e.g., resourcinol formaldehyde and crown ether resins) and inorganic (e.g., crystalline silico-titanate) ion exchange and smaller versions of ITP (e.g., use of many parts of the current ITP system plus a small nitrogen pressurized stainless steel tank or tanks to replace Tanks 48 and 49 and eliminate Late Wash entirely).

Piping Upgrades:
- standard industrial technologies will be used.

Post 2006 Project Scope Provided by Project Manager:

Waste Removal: Sludge and salt removal facilities will be completed on the remaining HLW tanks thus completing all waste removal project scope by FY22.
Vitrification Upgrades: Scope to enable processing of higher radioactive source term sludge and precipitate introduction will be complete by FY04. The DWPF DCS replacement will start FY09 and finish FY10. The DWPF service and utility upgrades will start FY14 and finish FY16.
Precipitate Upgrades: Late Wash and Saltstone modifications will be complete in FY03. Development of the 2nd generation ITP replacement will continue through FY15. Competing technologies will be demonstrated and a reference technology will be selected prior to FY11. The new facility will be designed, built and tested starting FY11 and finishing FY15.
Piping Upgrades: None. Scope will be complete in FY02.

Project End State Provided by Project Manager:

All functional areas of this project will be complete by FY22. All facilities and equipment provided by this project will be individually closed via PBS SR-HL03 Waste Removal Operations and Tank Closure. Final closure activities will occur after transition of all areas of the HLW System to Environmental Restoration. Final closure is funded via PBS SR-ER02.

The full list of science research awards that have the potential to address projects such as this one, which deals with High Level Waste problems, are listed in the <u>Index of Research Awards by Environmental Management Problem Area</u>, in the back of this appendix, under the heading "High Level Waste".

Savannah River Operations Office

Savannah River Site

SR-NM06 - Nuclear Materials Storage

Problem Area:	Nuclear Materials
Life-Cycle Cost in 2007+:	$440,000,000
DOE Project Manager:	Gordon M. Nichols, Jr., 803-952-2021, gordon.nichols@srs.gov
Contractor Manager:	Vincent C. Minardi, 803-952-4290, vincent.minardi@srs.gov
For More Information:	http://www.doe.gov/em52/pbs/sr-nm06.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: N/A **Worker:** N/A **Environment:** N/A

Technical Approach Provided by Project Manager:

The Actinide Packaging and Storage Facility (APSF) will provide for stabilization and repackaging of Special Nuclear Material (SNM) for interim term storage (nominally 50 years). In addition, the APSF will provide a modern vault with sufficient capacity to contain all Pu-bearing materials and other solid nuclear materials in the SRS inventory that have been included in the excess materials disposition program. The vault will not be used for the storage of waste or liquids.

The design life of the facility is 50 years. The design will be based on applicable DOE Orders and applicable national codes and standards. The facility has design features that will allow expansion for the storage of additional materials if required at a future date.

Post 2006 Project Scope Provided by Project Manager:

No foreseeable changes in scope, will continue to store material until permanent disposal decision is made.

Project End State Provided by Project Manager:

Material will be removed from the facility for permanent disposal. Storage facility will undergo deactivation and eventually D&D.

For the purposes of this ACP update, namely the development of the EM Critical Path to Closure, it has been assumed that by the year 2028 the EM program will no longer maintain ownership of this facility or its contents.

The full list of science research awards that have the potential to address projects such as this one, which deals with Nuclear Materials problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "Nuclear Materials".

The following awards were identified through systems engineering to have the potential to address the specific needs of this Project. Those research awards that may have the strongest link to this project are designated by the symbol "§".

Award ID	Page #	Award Title
60197-TN	B-329	Microsensors for In-situ Chemical, Physical, and Radiological Characterization of Mixed Waste

Savannah River Operations Office

Savannah River Site

SR-SF02 - L-Reactor Spent Nuclear Fuel Project

Problem Area: Spent Nuclear Fuel
Life-Cycle Cost in 2007+: $135,000,000
DOE Project Manager: Charles E. Anderson, 803-557-3828, charles.anderson@srs.gov
Contractor Manager: C.G. Reynolds, 803-557-9441, geoff.reynolds@srs.gov
For More Information: http://www.doe.gov/em52/pbs/sr-sf02.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Low **Worker:** High **Environment:** Low

Technical Approach Provided by Project Manager:

Basin management includes support operation, cleanup, basin equipment maintenance, procedure maintenance, sample analysis, and S&M associated with the normal basin operations including monitoring wells and chemistry control. Basin level detection and trending capabilities have been improved with the installation of upgraded sample monitoring instruments and a make-up water system flow totalizer. Basin level trending has been initiated which provides more accurate monitoring of changes in the basin level. Monitoring wells placed downgradient of the basins have improved the dispersion/dilution models. Monitoring wells are sampled monthly and evaluations of the radionuclide concentrations are issued in a quarterly report.

Specific activities in L-Area include: Shift Operations required to maintain cask handling operations within Technical Specifications, Process Requirements, and procedure requirements; surveillance of support equipment required for fire protection, habitability, and environmental protection; maintenance of operating procedures; operator training; support for housekeeping; safety initiatives to comply with OSHA; waste handling including mixed, radioactive and hazardous; waste minimization; environmental engineering; preventive and corrective maintenance; site support services that provide steam, water, fire protection water and sanitary waste treatment.

The scope of sandfilter refurbishment project is to replace key equipment that has a mission need that exceeds normal design life. With the exception of specific upgrades that were needed to address Defense Nuclear Facilities Safety Board (DNFSB) Vulnerabilities Report, most of the Disassembly Basin support systems are either near or past design life. Replacing equipment in a preemptive manner will result in less down-time and provide assurance that the support systems are available to support the Spent Nuclear Fuel Program, the Nuclear Material Stabilization Program, and the Facilities Program.

Post 2006 Project Scope Provided by Project Manager:

SNF stored in L-Basin will be shipped to the TSS facility starting in FY05 and will continue through FY10. Demobilization activities will start in FY10 and will be completed in FY11 at which time L-Reactor will be placed in a low cost S&M mode.

L-Reactor will be turned over for decommissioning by the end of 2011. HEU will be dispositioned as directed by DOE. Decommissioning activities will be covered in separate ACP Projects (PBS SR-FA20 - Reactor Monitoring Projects and PBS SR-FA12 - L-Reactor Deactivation).

Project End State Provided by Project Manager:

L-Reactor Disassembly Basin will be deinventoried by the end of FY10.
Demobilization of the facility will be complete by the end of FY11, followed by low cost S&M.
Transfer for decommissioning will occur by the end of FY11.
L-Reactor will be decommissioned to the extent necessary to meet the guidelines for a nuclear industrial zone under separate ACP Projects.
(PBS SR-FA20 - Reactor Monitoring Projects and PBS SR-FA12 - L-Reactor Deactivation).

The full list of science research awards that have the potential to address projects such as this one, which deals with Spent Nuclear Fuel problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "Spent Nuclear Fuel".

Savannah River Operations Office

Savannah River Site

SR-SF03 - Recceving Basin for Off-site Fuels (RBOF) Spent Nuclear Fuel Project

Problem Area: Spent Nuclear Fuel
Life-Cycle Cost in 2007+: $107,000,000
DOE Project Manager: Charles E. Anderson, 803-557-3828, charles.anderson@srs.gov
Contractor Manager: C.G. Reynolds, 803-557-9441, geoff.reynolds@srs.gov
For More Information: http://www.doe.gov/em52/pbs/sr-sf03.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Low **Worker:** Medium **Environment:** Low

Technical Approach Provided by Project Manager:

On-site transfer from RBOF to L-Basin, deinventory of the Taiwanese Research Reactor and EBRII fuel (to processing), and the newly installed racks in RBOF are all essential to maintaining the desired RBOF operating safety margin (typically 400 MTRE"), plus a RBOF operating reserve (typically 800 MTRE) to accommodate shipments that can only be unloaded in RBOF. Although the vacant capacity in RBOF may be slightly less that the desired 1200 MTRE during most of 1998, an acceptable margin can be maintained through careful basin management and timely on-site transfers.
[" MTRE = MTR Equivalent; i.e., equivalent storage requirement to Materials Test Reactor fuel element - Al clad fuel]

Basin management includes support operation, cleanup, basin equipment maintenance, procedure maintenance, sample analysis, and Surveillance and Maintenance (S&M) associated with the normal basin operations including deionizer regeneration, monitoring wells and chemistry control. S&M ensures the facility continues to pose acceptable risk to the environment, site workers, and the general public; maintaining the facility in accordance with the safety basis requirements; and activities necessary for cost effective management, planning, and oversight.

Specific activities include: Shift Operations required to maintain cask handling operations within Technical Safety Requirements, Process Requirements, and procedure requirements; surveillance of support equipment required for fire protection, habitability, and environmental protection; maintenance of operating procedures; operator training; support for housekeeping; safety initiatives to comply with OSHA; waste handling including mixed, radioactive and hazardous; waste minimization; environmental engineering; preventive and corrective maintenance; site support services that provide steam, water, fire protection water and sanitary waste treatment.

Post 2006 Project Scope Provided by Project Manager:

Deinventory of the RBOF Facility will be completed in the year 2011, assuming that the new Transfer & Storage Service is available for receipts in 2005. Basin Management and S&M activities will continue until deinventory is complete. Demobilization activities will commence after deinventory is complete, followed by long-term monitoring. Demobilization should be completed in about 2012, assuming deinventory is on schedule, at which time RBOF will be turned over for decommissioning. Decommissioning activities will be covered in separate projects (RBOF Deactivation Project - SR-FA13 and RBOF Monitoring Project - SR-FA22).

Project End State Provided by Project Manager:

RBOF will be deinventoried in 2011 and demobilization should be completed in about 2012, at which time RBOF will be ready for decommissioning. RBOF will be decommissioned to the extent necessary to meet the guidelines for a nuclear industrial zone. Decommissioning activities will be covered in separate projects (RBOF Deactivation Project - SR-FA13 and RBOF Monitoring Project - SR-FA22).

The full list of science research awards that have the potential to address projects such as this one, which deals with Spent Nuclear Fuel problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "Spent Nuclear Fuel".

Savannah River Operations Office

Savannah River Site

SR-SF09 - Spent Nuclear Fuel Transfer and Storage

Problem Area:	Spent Nuclear Fuel
Life-Cycle Cost in 2007+:	$909,000,000
DOE Project Manager:	Charles E. Anderson, 803-557-3828, charles.anderson@srs.gov
Contractor Manager:	C.G. Reynolds, 803-557-9441, geoff.reynolds@srs.gov
For More Information:	http://www.doe.gov/em52/pbs/sr-sf09.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Low **Worker:** High **Environment:** N/A

Technical Approach Provided by Project Manager:

Efforts are underway to determine the actions which will be required to prepare spent nuclear fuels, not scheduled to be processed, for eventual disposal in a geologic repository. The current plan is to prepare these spent nuclear fuels for direct/co-disposal along with high-level waste glass. Conceptually, this involves removal of the spent fuel from existing wet storage, drying, packaging in repository acceptable canisters, and subsequent storage of these canisters for an interim period pending shipment to the repository. The Department of Energy is also undertaking an alternative treatment technology development program that will identify a suitable repository waste form if direct disposal is not acceptable.

Post 2006 Project Scope Provided by Project Manager:

Foreign Research Reactor Fuel shipments are currently scheduled to be completed during FY 2009. Domestic Research Reactor Fuel shipments will continue beyond FY 2030. Exchanges of aluminum, stainless steel and zirconium fuel to and from Idaho will be ongoing between FY 2010 and FY 2016. These shipments will be received directly by the Transfer and Storage Service (TSS) for conditioning, repackaging and temporary storage.

The L Reactor and RBOF Fuel Basins will be deinventoried to the TSS facilities by FY 2010 and FY 2011 respectively. These deinventory schedules are contingent on the availability of the TSS facility during FY2005. Fuel receipts, exchanges and shipments to the repository will continue to 2035.

Project End State Provided by Project Manager:

The facilities associated with this service will be deactivated by the vendor as a stipulation in the original contract. The Department of Energy would be responsible for eventual decommissioning and dismantlement (D&D) of the facility. These activities will not take place, according to the current schedules, until after the year 2032. The final end state has not been established. It can be assumed that the end state will be consistent with the end state selected for the rest of the Savannah River Site currently identified as a Nuclear Industrial Zone and cleanup to industrial standards.

The full list of science research awards that have the potential to address projects such as this one, which deals with Spent Nuclear Fuel problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "Spent Nuclear Fuel".

Savannah River Operations Office

Savannah River Site

SR-SW01 - Consolidated Incinerator Facility

Problem Area: Mixed Waste
Life-Cycle Cost in 2007+: $535,000,000
DOE Project Manager: John M. Reynolds, 803-208-1674, john.reynolds@srs.gov
Contractor Manager: A. Maxted, 803-208-1675, tony.maxted@srs.gov
For More Information: http://www.doe.gov/em52/pbs/sr-sw01.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Medium **Worker:** N/A **Environment:** High

Technical Approach Provided by Project Manager:

The CIF is the first SRS facility to offer volume reduction /destruction of SRS generated waste. This is accomplished through combustion and conversion of the waste streams to benign carbon dioxide (CO2) and water (H2O). Incineration is a proven low risk technology that has been used in industries world-wide for decades. The rotary kiln incinerator chosen for the CIF is a proven design that has been used successfully at numerous facilities for many years. It is simple to control and maintain, yet versatile enough to incinerate a variety of wastes via a continuous feed process.

Significant elements of the operation and management of CIF include:
a) Receipt of generated liquid and solid wastes
b) Reduction, by incineration, of the toxicity and volume of received wastes
c) Monitoring incineration performance to ensure waste destruction efficiency is maintained
d) Solidification of ash and blowdown and transfer to the appropriate regulated waste storage or disposal facility
e) Scrubbing and filtering exhaust gases to reduce acidity and remove particulate matter;
f) Chemical analysis, on-line monitoring and state regulated testing to ensure operations are conducted in accordance with SCDHEC and EPA regulations.

In relation to (f) above, regulations do not currently require Continuous Emission Monitors (CEMs) for metals or organics on hazardous waste incinerator stacks. However, the EPA is aggressively seeking CEM technologies which will provide this capability and the next revision of the Clean Air Regulations is expected to include this requirement, specifically for mercury and particulate emissions. In this context, SRS Need SR-1004 is vital in providing CIF with the capability to meet the new regulations.

Early operating experience with CIF has shown that, with certain types of feed material, the off-gas HEPA filters are blinding at an alarming rate, causing excessive maintenance requirements. This problem has been partially overcome by running the recirculating blowdown stream more dilute, but this generates larger volumes of blowdown which the existing blowcrete/ashcrete system cannot keep up with. SRS Need SR-1011 has been written to address this problem by providing an evaporator to reduce the volume of blowdown and an improved stabilization system (such as Phosphate-bonded Ceramic) which can be used on a concentrated salt-solution. Without this improvement, the throughput of CIF will be severely limited.

Post 2006 Project Scope Provided by Project Manager:

Incineration will continue to treat benzene from the SRS Defense Waste Processing Facility (DWPF), purex solvent from the SRS canyons, mandated treatment of mixed waste streams, low-level boxed waste, and aqueous waste for another ten years of service. CIF will also adapt to other waste generator treatment needs, as they arise.

Project End State Provided by Project Manager:

Project end state will occur when identified waste streams (primarily hazardous and mixed wastes) have been processed through CIF. When CIF has completed its mission, it will be turned over to the Environmental Restoration Division for final closure.

The full list of science research awards that have the potential to address projects such as this one, which deals with Mixed Waste problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "Mixed Waste".

The following awards were identified through systems engineering to have the potential to address the specific needs of this Project. Those research awards that may have the strongest link to this project are designated by the symbol "§".

Award ID	Page #	Award Title
§ 60370-CA	B-39	Rational Design of Metal Ion Sequestering Agents
§ 60155-CO	B-83	Measurements and Models for Hazardous Chemical and Mixed Wastes
§ 54847-CO	B-87	Photocatalytic and Chemical Oxidation of Organic Compounds in Supercritical Carbon Dioxide
§ 55012-CO	B-89	Extraction and Recovery of Mercury and Lead from Aqueous Waste Streams Using Redox-active Layered Metal Chalcogenides
§ 55247-IL	B-119	Sensors Using Molecular Recognition in Luminescent, Conductive Polymers
§ 55211-IL	B-141	Cavitational Hydrothermal Oxidation: A New Remediation Process
§ 54942-IN	B-147	Spectroscopy, Modeling and Computation of Metal Chelate Solubility in Supercritical CO_2
§ 54791-KS	B-153	Managing Tight-binding Receptors for New Separations Technologies
§ 54864-KS	B-157	Supramolecular Chemistry of Selective Anion Recognition for Anions of Environmental Relevance
§ 60231-MD	B-165	Novel Miniature Spectrometer for Remote Chemical Detection
§ 54571-MA	B-181	Removal of Heavy Metals and Organic Contaminants from Aqueous Streams by Novel Filtration Methods
§ 60070-MS	B-193	The Development of Cavity Ringdown Spectroscopy as a Sensitive Continuous Emission Monitor for Metals
§ 55223-MO	B-197	De Novo Design of Ligands for Metal Separation
§ 54751-NM	B-209	High Fluence Neutron Source for Nondestructive Characterization of Nuclear Waste
§ 54770-NM	B-213	New Anion-Exchange Resins for Improved Separations of Nuclear Materials
§ 55387-NM	B-237	Photooxidation of Organic Wastes Using Semiconductor Nanoclusters
§ 55171-PA	B-283	Development of Advanced In-Situ Techniques for Chemistry Monitoring and Corrosion Mitigation in SCWO Environments
§ 54973-TN	B-301	A Novel Energy-Efficient Plasma Chemical Process for the Destruction of Volatile Toxic Compounds
§ 55103-TN	B-311	Utilization of Kinetic Isotope Effects for the Concentration of Tritium
§ 55276-TN	B-319	Fundamental Chemistry and Thermodynamics of Hydrothermal Oxidation Processes
§ 60096-TN	B-339	Rational Synthesis of Imprinted Organofunctional Sol-Gel Materials for Toxic Metal Separation
§ 54679-WA	B-367	Architectural Design Criteria for F-Block Metal Ion Sequestering Agents
§ 54897-WA	B-391	The Sonophysics and Sonochemistry of Liquid Waste Quantification and Remediation
§ 55146-WA	B-393	Adsorption/Membrane Filtration as a Contaminant Concentration and Separation Process for Mixed Wastes and Tank Wastes
§ 60150-WA	B-399	Genetic Engineering of a Radiation-Resistant Bacterium for Biodegradation of Mixed Wastes
60319-CA	B-51	Thermodynamics of the Volatilization of Actinide Metals in the High-Temperature Treatment of Radioactive Wastes
55137-CA	B-53	Investigation of Novel Electrode Materials for Electrochemically-Based Remediation of High- and Low-Level Mixed Wastes in the DOE Complex

Awards Related to SR-SW01 Continued

Award ID	Page #	Award Title
54890-CA	B-69	On-Line Slurry Viscosity and Concentration Measurement as a Real-Time Waste Stream Characterization Tool
54926-CA	B-75	Novel Ceramic-Polymer Composite Membranes for the Separation of Hazardous Liquid Waste
54893-FL	B-99	Research Program to Determine Redox Properties and Their Effects on Speciation and Mobility of Pu in DOE Wastes
60424-ID	B-113	High Temperature Condensed Phase Mass Spectrometric Analysis
60247-IL	B-139	Miniature Nuclear Magnetic Resonance Spectrometer for In-Situ and In-Process Analysis and Monitoring
54834-IN	B-143	An Investigation of Homogeneous and Heterogeneous Sonochemistry for Destruction of Hazardous Waste
54724-NM	B-205	Synthesis of New Water-Soluble Metal-Binding Polymers: Combinatorial Chemistry Approach
60163-NM	B-249	Investigation of Techniques to Improve Continuous Air Monitors Under Conditions of High Dust Loading in Environmental Setting
54639-NM	B-251	Development of an In-Situ Microsensor for the Measurements of Chromium and Uranium in Groundwater at DOE Sites
55179-NY	B-267	Acoustic Probe for Solid-Gas-Liquid Suspensions
54674-OH	B-271	Design and Development of a New Hybrid Spectroelectrochemical Sensor
54122-PA	B-281	A Broad Spectrum Catalytic System for Removal of Toxic Organics from Water By Deep Oxidation
54856-PA	B-289	Structural Biology of the Sequestration & Transport of Heavy Metal Toxins: NMR Structure Determination of Proteins Containing the -Cys-X-Y-Cys-metal Binding Motifs
55087-TN	B-309	Design and Synthesis of the Next Generation of Crown Ethers for Waste Separations: An Inter-Laboratory Comprehensive Proposal
60197-TN	B-329	Microsensors for In-situ Chemical, Physical, and Radiological Characterization of Mixed Waste
60218-TN	B-333	Novel Mass Spectrometry Mutation Screening for Contaminant Impact Analysis
54735-TX	B-343	Development of Inorganic Ion Exchangers for Nuclear Waste Remediation
54996-WA	B-371	Ionizing Radiation Induced Catalysis on Metal Oxide Particles
60050-WA	B-395	Chemical Speciation of Inorganic Compounds under Hydrothermal Conditions

Savannah River Operations Office

Savannah River Site

SR-SW02 - Transuranic Waste Project

Problem Area:	Mixed Waste
Life-Cycle Cost in 2007+:	$506,000,000
DOE Project Manager:	William L. Noll III, 803-725-2219, william.noll@srs.gov
Contractor Manager:	J. A. D'Amelio, 803-557-6311, joseph.damelio@srs.gov
For More Information:	http://www.doe.gov/em52/pbs/sr-sw02.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Urgent **Worker:** Medium **Environment:** Urgent

Technical Approach Provided by Project Manager:

The TRU Waste project focuses on retrieval of 8,809 TRU waste drums to ensure continued safe storage prior to shipment to WIPP. Additional efforts will be directed at identifying the characterization and assay capability specific to SRS needs. These efforts consist of; re-evaluating excess site facilities for waste characterization, inspection, and treatment, and analyzing treatment options with emphasis on stable waste-forms allowing safe shipment to the DOE-approved geologic repository for TRU waste at the Waste Isolation Pilot Plant (WIPP) in New Mexico. Technology development initiative for TRU Waste (SRS Need SR-1010) can provide capabilities to efficiently inspect, sort and repack waste packages. Initiative (SRS Need SR-1003) has the potential to reduce the intrusive characterization required and thus reduce personnel exposure. The TRU waste project will also remain cognizant of the plans and developments at other DOE sites, commercial facilities, and international locations outside SRS.

Treatment of some TRU waste-types will be required to meet current shipping requirements. A TRU Waste treatment facility (identified as Sort, Segregate & Repackage) is required to provide means for processing/certifying waste for shipment to WIPP for disposal. This facility will be used to open the TRU waste containers, assay the containers, sort contents, repackage waste, size reduce large containers and large equipment, certify the final waste form and ship the waste to WIPP. Initiative (SRS Need SR-1012) is needed to provide remote size reduction to reduce personnel hazards and exposure. Privatization initiatives will be implemented as appropriate for waste treatment. The high-activity Plutonium-238 (Pu-238) waste exceeds the wattage limits specified for transportation and currently cannot be economically shipped. Pu-238 represents approximately 50 percent of the TRU waste volume at SRS, and 95 percent of total curies. There are currently no existing treatment facilities for TRU waste at SRS.

Per a compliance agreement with the South Carolina Department of Health and Environmental Control (SCDHEC), SRS will begin discussions with SCDHEC regarding alternative treatment options for Mixed TRU Waste in July 1998 if the Secretary of Energy does not decide to operate WIPP by that time. Also, SRS is committed to submit a RCRA Part B permit application to SCDHEC by the 4th Quarter of FY2008 for a TRU waste treatment facility.

This plan relies on the significant cost savings and risk reduction that will be achieved, if the technology development initiative for Expanded Transportation system capabilities for Transuranic Waste (SRS Need SR-1001) is successfully completed. It provides for the development of techniques for mitigation hydrogen (H2) generation in TRUPACT (gettors, recombiners, development of ASME STD for H2 concentrations in TYPE B containers), and evaluation of alternative options for TRU Packaging.

If technology development initiative SR-1001 is not achieved, then (SRS Need SR-1007) Development of Thermal Destruction Capability for Elimination of Organics from High Activity Pu 238, will likely be required to ship higher levels of Pu238 waste in TRUPACT II containers.

Post 2006 Project Scope Provided by Project Manager:

A TRU Waste facility will be in place and operational with processing being performed on high activity TRU Waste containers. This facility will incorporate existing processing technology, robotics technology currently being developed, and equipment and services provided through privatization initiatives. This facility is intended to be operational from 2012 - 2032.
The retrieval of TRU waste storage Pad #1 will be performed after FY2006.
The TRU Waste treatment facility will process/treat TRU waste through FY2029.
Shipments of TRU Waste to WIPP will continue beyond 2006.

Project End State Provided by Project Manager:

Project End State will occur following the completion of all missions at SRS that generate TRU Waste. When all TRU Waste has been disposed of, all facilities will be operationally closed and turned over to the Environmental Restoration Division for final closure.

The full list of science research awards that have the potential to address projects such as this one, which deals with Mixed Waste problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "Mixed Waste".

The following awards were identified through systems engineering to have the potential to address the specific needs of this Project. Those research awards that may have the strongest link to this project are designated by the symbol "§".

Award ID	Page #	Award Title
§ 55247-IL	B-119	Sensors Using Molecular Recognition in Luminescent, Conductive Polymers
§ 59934-IN	B-149	Hazardous Gas Production by Alpha Particles in Solid Organic Transuranic Waste Matrices
§ 60231-MD	B-165	Novel Miniature Spectrometer for Remote Chemical Detection
§ 60070-MS	B-193	The Development of Cavity Ringdown Spectroscopy as a Sensitive Continuous Emission Monitor for Metals
§ 54751-NM	B-209	High Fluence Neutron Source for Nondestructive Characterization of Nuclear Waste
§ 59981-NM	B-219	Real-Time Broad Spectrum Characterization of Hazardous Waste by Membrane Introduction Mass Spectrometry
55318-CA	B-23	Improved Analytical Characterization of Solid Waste-Forms by Fundamental Development of Laser Ablation Technology
60247-IL	B-139	Miniature Nuclear Magnetic Resonance Spectrometer for In-Situ and In-Process Analysis and Monitoring
59978-TN	B-321	Thermospray Mass Spectrometry Ionization Processes Fundamental Mechanisms for Speciation, Separation and Characterization of Organic Complexants in DOE Wastes
60197-TN	B-329	Microsensors for In-situ Chemical, Physical, and Radiological Characterization of Mixed Waste

Savannah River Operations Office

Savannah River Site

SR-SW03 - Mixed Low Level Waste Project

Problem Area:	Mixed Waste
Life-Cycle Cost in 2007+:	$174,000,000
DOE Project Manager:	William L. Noll III, 803-725-2219, william.noll@srs.gov
Contractor Manager:	L. T. Reid, 803-952-4125, luke.reid@srs.gov
For More Information:	http://www.doe.gov/em52/pbs/sr-sw03.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Medium **Worker:** Medium **Environment:** Urgent

Technical Approach Provided by Project Manager:

Mixed Waste is and will continue to be stored in RCRA regulated storage facilities until it can be treated and/or disposed.

The surveillance and maintenance activities at Mixed Waste facilities are a continual effort that include container inspections as required by RCRA, effluent monitoring and verification of containment to ensure no hazardous or radioactive material releases occur, grounds and equipment maintenance and remedial actions to prevent environmental releases from degraded containers.

Characterization and waste preparation activities for treatment or disposal will be expanded to include non-CIF waste streams. Identification of an existing facility is expected to begin in FY1998 with characterization and waste preparation activities slated to begin in FY2000. Initial waste streams to undergo characterization and offsite treatment include W062 and W069. Wastes identified for incineration will be treated in CIF (see PBS SR-SS0044)

Investigation of treatment activities for the non-incinerable MW is an on-going process, with a review of options planned to be conducted annually. This review will identify and evaluate the feasibility to use commercial vendors to treat the waste. Capabilities to treat waste onsite will be further evaluated to identify treatments that could be set up in existing permitted facilities.

Investigation of treatment activities with other sites in the DOE complex will also be performed annually. These include the following activities:

a) Use INEL to treat mercury and mercury contaminated waste.
b) Use ORNL to treat PCB and PCB contaminated waste.

An options analysis for the transport and disposal of MW is scheduled to be performed during FY1998 with this activity repeated periodically to update or optimize the disposal process. The goal for disposal of the first treated MW is planned to occur during FY1999 focusing on streams that are currently treated and in storage pending identification of an appropriate disposal site (SR W015, W023, W024, and ashcrete). All activities associated with meeting a disposal site's waste acceptance criteria will be completed.

Varying cost and risk reductions can be achieved through the use of technology deployment as follows:

- Development and deployment of treatment processes for MLLW Soils (SRS need number SR-1002). This will provide the treatment processes and equipment to remove/immobilize radiological and hazardous constituents from large quantities of MLLW soils.

- Development and deployment of equipment and techniques for characterization of radiological and hazardous constituents and concentrations in mixed waste streams (SRS need SR-1003).

- Development and deployment of processes and equipment to stabilize large quantities of radioactive elemental mercury generated at DWPF, SRS need SR-1006, provides significant cost and risk reduction.
- Performance Assessments Conservatisms Reduction Models development, (SRS need number SR-1008). This will develop alternative models for reducing conservatisms in existing Performance Assessment Limits allowing increased Shallow Land Disposal.

Post 2006 Project Scope Provided by Project Manager:

Storage of MW will continue beyond FY 2006 until all waste is treated and ultimately disposed. a) Storage will continue to be provided for all legacy waste until the end of FY2012, with the exception of Tritiated Oil. Tritiated Oil will remain in storage until the tritium decays sufficiently or until appropriate treatment technologies are developed. b) Space will continue to be provided for the interim storage or staging of newly generated MW awaiting treatment or disposal. The storage of existing legacy liquid waste in the solvent tanks will continue through FY2019. c) Surveillances and monitoring activities for all storage buildings are a continual effort. Other activities pertaining to the operation of storage buildings include but are not limited to general facility maintenance, maintenance of boundary fences, markings and notices, inspection and data collection at sumps and wells, and the maintenance of the associated records.

Treatment of legacy waste is expected to be completed by FY2019, with the exception of Tritiated Oil. Tritiated Oil will remain in storage until the tritium decays sufficiently or until appropriate treatment technologies are developed. a) Characterization and preparation for CIF treatment of all remaining legacy waste that can be treated by that process will be completed by FY2019. b) A review of treatment options will continue to occur on an annual basis if needed. Options analysis for the transport and disposal of MW will continue to be completed periodically to update or optimize the disposal process. All activities associated with meeting a disposal site's waste acceptance criteria will be completed. All legacy waste currently in inventory, is scheduled to be disposed of by FY2020. The disposal of ashcrete and other newly generated waste streams will continue until all treated MW is disposed. The ITP filters should all be disposed of by FY2032.

Project End State Provided by Project Manager:

The MW Project is projected to reach end state by FY2024 with the exception of the continued storage and disposal of benzene contaminated filters and Tritiated Oil. Tritiated Oil will remain in storage until the tritium decays sufficiently or until appropriate treatment technologies are developed. End state for disposal of the filters is expected to be FY2032.

The full list of science research awards that have the potential to address projects such as this one, which deals with Mixed Waste problems, are listed in the <u>Index of Research Awards by Environmental Management Problem Area</u>, in the back of this appendix, under the heading "Mixed Waste".

The following awards were identified through systems engineering to have the potential to address the specific needs of this Project. Those research awards that may have the strongest link to this project are designated by the symbol "§".

Award ID	Page #	Award Title
§ 60326-AZ	B-11	Isolation of Metals from Liquid Wastes: Reactive Scavenging in Turbulent Thermal Reactors
§ 60370-CA	B-39	Rational Design of Metal Ion Sequestering Agents
§ 60155-CO	B-83	Measurements and Models for Hazardous Chemical and Mixed Wastes
§ 54847-CO	B-87	Photocatalytic and Chemical Oxidation of Organic Compounds in Supercritical Carbon Dioxide
§ 55012-CO	B-89	Extraction and Recovery of Mercury and Lead from Aqueous Waste Streams Using Redox-active Layered Metal Chalcogenides
§ 55247-IL	B-119	Sensors Using Molecular Recognition in Luminescent, Conductive Polymers
§ 55211-IL	B-141	Cavitational Hydrothermal Oxidation: A New Remediation Process
§ 54942-IN	B-147	Spectroscopy, Modeling and Computation of Metal Chelate Solubility in Supercritical CO_2

Awards Related to SR-SW03 Continued

Award ID	Page #	Award Title
§ 59934-IN	B-149	Hazardous Gas Production by Alpha Particles in Solid Organic Transuranic Waste Matrices
§ 54791-KS	B-153	Managing Tight-binding Receptors for New Separations Technologies
§ 54864-KS	B-157	Supramolecular Chemistry of Selective Anion Recognition for Anions of Environmental Relevance
§ 60231-MD	B-165	Novel Miniature Spectrometer for Remote Chemical Detection
§ 54571-MA	B-181	Removal of Heavy Metals and Organic Contaminants from Aqueous Streams by Novel Filtration Methods
§ 60070-MS	B-193	The Development of Cavity Ringdown Spectroscopy as a Sensitive Continuous Emission Monitor for Metals
§ 55110-MO	B-195	An Alternative Host Matrix Based on Iron Phosphate Glasses for the Vitrification of Specialized Nuclear Waste Forms
§ 55223-MO	B-197	De Novo Design of Ligands for Metal Separation
§ 54751-NM	B-209	High Fluence Neutron Source for Nondestructive Characterization of Nuclear Waste
§ 54770-NM	B-213	New Anion-Exchange Resins for Improved Separations of Nuclear Materials
§ 59981-NM	B-219	Real-Time Broad Spectrum Characterization of Hazardous Waste by Membrane Introduction Mass Spectrometry
§ 55387-NM	B-237	Photooxidation of Organic Wastes Using Semiconductor Nanoclusters
§ 55171-PA	B-283	Development of Advanced In-Situ Techniques for Chemistry Monitoring and Corrosion Mitigation in SCWO Environments
§ 54973-TN	B-301	A Novel Energy-Efficient Plasma Chemical Process for the Destruction of Volatile Toxic Compounds
§ 55103-TN	B-311	Utilization of Kinetic Isotope Effects for the Concentration of Tritium
§ 55276-TN	B-319	Fundamental Chemistry and Thermodynamics of Hydrothermal Oxidation Processes
§ 60096-TN	B-339	Rational Synthesis of Imprinted Organofunctional Sol-Gel Materials for Toxic Metal Separation
§ 54679-WA	B-367	Architectural Design Criteria for F-Block Metal Ion Sequestering Agents
§ 54897-WA	B-391	The Sonophysics and Sonochemistry of Liquid Waste Quantification and Remediation
§ 55146-WA	B-393	Adsorption/Membrane Filtration as a Contaminant Concentration and Separation Process for Mixed Wastes and Tank Wastes
§ 60150-WA	B-399	Genetic Engineering of a Radiation-Resistant Bacterium for Biodegradation of Mixed Wastes
59827-AZ	B-9	The Influence of Radiation and Multivalent Cation Additions on Phase Separation and Crystallization of Glass
55318-CA	B-23	Improved Analytical Characterization of Solid Waste-Forms by Fundamental Development of Laser Ablation Technology
60319-CA	B-51	Thermodynamics of the Volatilization of Actinide Metals in the High-Temperature Treatment of Radioactive Wastes
55137-CA	B-53	Investigation of Novel Electrode Materials for Electrochemically-Based Remediation of High- and Low-Level Mixed Wastes in the DOE Complex
54926-CA	B-75	Novel Ceramic-Polymer Composite Membranes for the Separation of Hazardous Liquid Waste
54893-FL	B-99	Research Program to Determine Redox Properties and Their Effects on Speciation and Mobility of Pu in DOE Wastes
54807-GA	B-103	Studies Related to Chemical Mechanisms of Gas Formation in Hanford High-Level Nuclear Wastes
55294-IL	B-121	Superconducting Open-Gradient Magnetic Separation for the Pretreatment of Radioactive or Mixed Waste Vitrification Feeds
60143-IL	B-137	Foaming in Radioactive Waste Treatment and Immobilization Processes
60247-IL	B-139	Miniature Nuclear Magnetic Resonance Spectrometer for In-Situ and In-Process Analysis and Monitoring

Awards Related to SR-SW03 Continued

Award ID	Page #	Award Title
54834-IN	B-143	An Investigation of Homogeneous and Heterogeneous Sonochemistry for Destruction of Hazardous Waste
54724-NM	B-205	Synthesis of New Water-Soluble Metal-Binding Polymers: Combinatorial Chemistry Approach
60015-NM	B-227	Long-term Risk from Actinides in the Environment: Modes of Mobility
60041-OK	B-275	Removal of Radioactive Cations and Anions from Polluted Water Using Ligand-Modified Colloid-Enhanced Ultrafiltration
54122-PA	B-281	A Broad Spectrum Catalytic System for Removal of Toxic Organics from Water By Deep Oxidation
60017-PA	B-285	Removal of Technetium, Carbon Tetrachloride, and Metals from DOE Properties
54856-PA	B-289	Structural Biology of the Sequestration & Transport of Heavy Metal Toxins: NMR Structure Determination of Proteins Containing the -Cys-X-Y-Cys-metal Binding Motifs
55205-SC	B-299	A Fundamental Study of Laser-Induced Breakdown Spectroscopy Using Fiber Optics for Remote Measurements of Trace Metals
55087-TN	B-309	Design and Synthesis of the Next Generation of Crown Ethers for Waste Separations: An Inter-Laboratory Comprehensive Proposal
55119-TN	B-315	Phase Equilibria Modification by Electric Fields
59978-TN	B-321	Thermospray Mass Spectrometry Ionization Processes Fundamental Mechanisms for Speciation, Separation and Characterization of Organic Complexants in DOE Wastes
60197-TN	B-329	Microsensors for In-situ Chemical, Physical, and Radiological Characterization of Mixed Waste
54735-TX	B-343	Development of Inorganic Ion Exchangers for Nuclear Waste Remediation
54672-WA	B-365	Radiation Effects in Nuclear Waste Materials
54996-WA	B-371	Ionizing Radiation Induced Catalysis on Metal Oxide Particles
60362-WA	B-379	Ion-Exchange Processes and Mechanisms in Glasses
60050-WA	B-395	Chemical Speciation of Inorganic Compounds under Hydrothermal Conditions

Savannah River Operations Office

Savannah River Site

SR-SW04 - Low Level Waste Project

Problem Area:	Mixed Waste
Life-Cycle Cost in 2007+:	$206,000,000
DOE Project Manager:	William L. Noll, 803-725-2219, william.noll@srs.gov
Contractor Manager:	L. C. Thomas, 803-557-8080, cliff.thomas@srs.gov
For More Information:	http://www.doe.gov/em52/pbs/sr-sw04.html

Maximum Public, Worker, and Environmental Risks in the year 2007 and beyond:
Public: Medium **Worker:** Medium **Environment:** Urgent

Technical Approach Provided by Project Manager:

The E Area Vault facility (EAV) consists of a Low Activity Waste (LAW) vault, an Intermediate-Level Non-Tritium (ILNT) vault, an Intermediate-Level Tritium (ILTV) vault, a Long-Lived Waste Storage Building, and slit trenches for contaminated soil and rubble. A Sort and Segregate facility for legacy and newly generated low level wastes is planned to be completed in FY98. All Low level wastes are planned to be disposed as they are generated with the exception of Heat exchangers, Reactor deionizers, and Naval reactor components, which are being stored. In FY1998 the largest portion of stored waste is that awaiting vendor treatment or sort and segregation. In addition Contaminated Large Equipment which has not been declared waste is being stored. Naval Reactor components and other large equipment are stored on gravel pads awaiting results of composite PA required as part of DNFSB 94-2 follow-up for shallow land disposal. Large equipment will continue to be stored until final implementation of the Savannah River Site Large Equipment Disposition Plan. Currently no disposal method exists for the long-lived waste. It is either being kept by the generator or stored on pads in the existing Solid Waste Disposal Facility until treatment and/or disposal technologies can be developed. This project includes development and implementation of this technology. The Consolidated Incineration Facility LLW ashcrete and stabilized blowdown will also be placed in interim storage until completion of a composite performance assessment and development of operational procedures for final trench disposal.

There are three different categories of soils currently disposed of in the SWDF. Suspect soils are currently used as back-fill and are not counted in waste generation volumes. Slightly contaminated soil and rubble is disposed of directly in slit trenches near the Intermediate Level Vault. Soil and rubble exceeding shallow land disposal acceptance criteria is containerized and disposed of in the LAWV or ILV as appropriate.

Improved volume reduction capabilities are essential in optimizing utilization of existing disposal capacity. A commercial vendor is used for volume reducing approximately 20% of SRS low level legacy wastes. Volume reduction ratios are reasonably expected to reach or exceed 8:1. For LLW at the CIF, VR ratios of 20:1, or more, can be expected.

Surveillance and maintenance for the Low Level Waste facilities includes container inspections as required by DOE Order 5820.2A, effluent monitoring and verification of containment to ensure no radioactive material releases occur, grounds and equipment maintenance and remedial actions to prevent environmental releases from degraded containers.

Waste treatment activities are conducted to treat the waste prior to disposal to ensure that the most cost effective volume reduction is employed to reduce the total lifecycle costs. These activities include onsite treatment such as incineration (CIF), shredding and compaction and preparation for offsite shipment and treatment. This PBS assumes a SW Sort and Segregate Facility is available in the 3rd Quarter of FY97. Also planned, but not completed, is the location/operation of an onsite supercompactor at SRS. These components will contribute to significant savings of vault space if successfully completed. Low level waste disposal facilities which meet performance assessment objectives required by DOE Order 5820.2A are designed to reduce releases over the life of the facility and ensure low exposures to the workers and public.

Significant cost reduction can be achieved if the Performance Assessments Conservatisms Reduction Models (SRS need number SR-1008), technical development project is successfully completed. This project will develop an alternative model for removing conservatisms in existing Performance Assessment Limits for Disposal of LLW. It will reduce or eliminate the need for developing extensive design packaging requirements for some wastes to meet existing facilities disposal WACs. The plan for these activities has an FY98 scheduled completion.

Significant improvement in the handling/disposal of Contaminated Large Equipment can be achieved by developing a capability to remote handle/size reduce CLE (SRS need number SR-1013), on site. In particular, the remote removal of lead counterweights from separations equipment (jumpers, pumps, etc.), will make this equipment amenable for treatment and disposal as LLW.

If the technical development project for Low Level Waste (SRS need number SR-1009), Spent Deionizer Resins Treatment, is successfully completed, it will provide treatment technology needed to treat/immobilize spent deionizer resins and other long lived waste to meet disposal PA requirements. No current means of disposal of this waste exists and it must be stored indefinitely.

Post 2006 Project Scope Provided by Project Manager:

Low Level Waste storage, treatment, and disposal activities will continue beyond FY2006.

Steady State operation is scheduled to be reached in FY2000, with the exception of legacy Contaminated Large Equipment and spent deionizers, in storage. New waste will be treated and disposed to support ongoing site missions.

The second generation disposal unit design and construction is scheduled to be started in FY2007. The units are to support a new site tritium production mission (if needed).

Project End State Provided by Project Manager:

Project End State will occur following the completion of all missions at SRS that generate Low Level Waste. When all Low Level Waste has been disposed of, all facilities will be closed.

The full list of science research awards that have the potential to address projects such as this one, which deals with Mixed Waste problems, are listed in the Index of Research Awards by Environmental Management Problem Area, in the back of this appendix, under the heading "Mixed Waste".

Index of Research Awards by Environmental Management Problem Area

High Level Waste

Research Awards in the High Level Waste Environmental Management Problem Area.

Award ID	Page #	Award Title
59827-AZ	B-9	The Influence of Radiation and Multivalent Cation Additions on Phase Separation and Crystallization of Glass
55318-CA	B-23	Improved Analytical Characterization of Solid Waste-Forms by Fundamental Development of Laser Ablation Technology
60296-CA	B-35	Research Program to Investigate the Fundamental Chemistry of Technetium
55137-CA	B-53	Investigation of Novel Electrode Materials for Electrochemically-Based Remediation of High- and Low-Level Mixed Wastes in the DOE Complex
54656-CA	B-65	Mixing Processes in High-Level Waste Tanks
54890-CA	B-69	On-Line Slurry Viscosity and Concentration Measurement as a Real-Time Waste Stream Characterization Tool
55188-DC	B-93	Chemical Decomposition of High-Level Nuclear Waste Storage/Disposal Glasses Under Irradiation
54716-DC	B-97	Polyoxometalates for Radioactive Waste Treatment
54982-FL	B-101	Analysis of Surface Leaching Processes in Vitrified High-Level Nuclear Wastes Using In-Situ Raman Imaging and Atomistic Modeling
54807-GA	B-103	Studies Related to Chemical Mechanisms of Gas Formation in Hanford High-Level Nuclear Wastes
55042-GA	B-105	Quantifying Silica Reactivity in Subsurface Environments: Controls of Reaction Affinity and Solute Matrix on Quartz and SiO2 Glass Dissolution Kinetics
60424-ID	B-113	High Temperature Condensed Phase Mass Spectrometric Analysis
55229-IL	B-117	The NOx System in Nuclear Waste
55294-IL	B-121	Superconducting Open-Gradient Magnetic Separation for the Pretreatment of Radioactive or Mixed Waste Vitrification Feeds
55367-IL	B-123	Investigation of Microscopic Radiation Damage in Waste Forms Using ODNMR and AEM Techniques
60313-IL	B-135	Radiation Effects on Transport and Bubble Formation in Silicate Glasses
60143-IL	B-137	Foaming in Radioactive Waste Treatment and Immobilization Processes
59977-MD	B-169	Synthesis and Characterization of Templated Ion Exchange Resins for the Selective Complexation of Actinide Ions
55141-MA	B-177	Imaging and Characterizing the Waste Materials Inside an Underground Storage Tank Using Seismic Normal Modes
54691-MI	B-189	Radiation Effects on Materials in the Near-Field of Nuclear Waste Repository
54765-NM	B-211	Enhanced Sludge Processing of HLW: Hydrothermal Oxidation of Chromium, Technetium, and Complexants by Nitrate
54773-NM	B-215	Microstructural Properties of High Level Waste Concentrates and Gels with Raman And Infrared Spectroscopies
59990-NM	B-221	Fundamental Chemistry, Characterization, and Separation of Technetium Complexes in Hanford Waste
59993-NM	B-223	Dynamic Effects of Tank Waste Aging on Radionuclide-Complexant Interactions
60403-NM	B-243	Phase Chemistry of Tank Sludge Residual Components
54595-NM	B-255	f-Element Ion Chelation in Highly Basic Media
59982-NY	B-259	Reactivity of Peroxynitrite: Implications for Hanford Waste Management and Remediation
55179-NY	B-267	Acoustic Probe for Solid-Gas-Liquid Suspensions
54674-OH	B-271	Design and Development of a New Hybrid Spectroelectrochemical Sensor
60017-PA	B-285	Removal of Technetium, Carbon Tetrachloride, and Metals from DOE Properties

Index of Research Awards by Environmental Management Problem Area Continued

High Level Waste Continued

Spent Nuclear Fuel

Research Awards in the Spent Nuclear Fuel Environmental Management Problem Area.

Index of Research Awards by Environmental Management Problem Area Continued

Mixed Waste

Research Awards in the Mixed Waste Environmental Management Problem Area.

Award ID	Page #	Award Title
60326-AZ	B-11	Isolation of Metals from Liquid Wastes: Reactive Scavenging in Turbulent Thermal Reactors
60370-CA	B-39	Rational Design of Metal Ion Sequestering Agents
60155-CO	B-83	Measurements and Models for Hazardous Chemical and Mixed Wastes
54847-CO	B-87	Photocatalytic and Chemical Oxidation of Organic Compounds in Supercritical Carbon Dioxide
55012-CO	B-89	Extraction and Recovery of Mercury and Lead from Aqueous Waste Streams Using Redox-active Layered Metal Chalcogenides
55247-IL	B-119	Sensors Using Molecular Recognition in Luminescent, Conductive Polymers
55211-IL	B-141	Cavitational Hydrothermal Oxidation: A New Remediation Process
54942-IN	B-147	Spectroscopy, Modeling and Computation of Metal Chelate Solubility in Supercritical CO_2
59934-IN	B-149	Hazardous Gas Production by Alpha Particles in Solid Organic Transuranic Waste Matrices
54791-KS	B-153	Managing Tight-binding Receptors for New Separations Technologies
54864-KS	B-157	Supramolecular Chemistry of Selective Anion Recognition for Anions of Environmental Relevance
60231-MD	B-165	Novel Miniature Spectrometer for Remote Chemical Detection
54571-MA	B-181	Removal of Heavy Metals and Organic Contaminants from Aqueous Streams by Novel Filtration Methods
60070-MS	B-193	The Development of Cavity Ringdown Spectroscopy as a Sensitive Continuous Emission Monitor for Metals
55110-MO	B-195	An Alternative Host Matrix Based on Iron Phosphate Glasses for the Vitrification of Specialized Nuclear Waste Forms
55223-MO	B-197	De Novo Design of Ligands for Metal Separation
54751-NM	B-209	High Fluence Neutron Source for Nondestructive Characterization of Nuclear Waste
54770-NM	B-213	New Anion-Exchange Resins for Improved Separations of Nuclear Materials
59981-NM	B-219	Real-Time Broad Spectrum Characterization of Hazardous Waste by Membrane Introduction Mass Spectrometry
55387-NM	B-237	Photooxidation of Organic Wastes Using Semiconductor Nanoclusters
55171-PA	B-283	Development of Advanced In-Situ Techniques for Chemistry Monitoring and Corrosion Mitigation in SCWO Environments
54828-SC	B-297	Processing of High Level Waste: Spectroscopic Characterization of Redox Reactions in Supercritical Water
54973-TN	B-301	A Novel Energy-Efficient Plasma Chemical Process for the Destruction of Volatile Toxic Compounds
55103-TN	B-311	Utilization of Kinetic Isotope Effects for the Concentration of Tritium
55276-TN	B-319	Fundamental Chemistry and Thermodynamics of Hydrothermal Oxidation Processes
60096-TN	B-339	Rational Synthesis of Imprinted Organofunctional Sol-Gel Materials for Toxic Metal Separation
55115-TX	B-345	The Adsorption and Reaction of Halogenated Volatile Organic Compounds (VOC's) on Metal Oxides
54506-TX	B-347	Acid-Base Behavior in Hydrothermal Processing of Wastes
54679-WA	B-367	Architectural Design Criteria for F-Block Metal Ion Sequestering Agents
54897-WA	B-391	The Sonophysics and Sonochemistry of Liquid Waste Quantification and Remediation
55146-WA	B-393	Adsorption/Membrane Filtration as a Contaminant Concentration and Separation Process for Mixed Wastes and Tank Wastes

Index of Research Awards by Environmental Management Problem Area Continued

Mixed Waste Continued

Award ID	Page #	Award Title
60150-WA	B-399	Genetic Engineering of a Radiation-Resistant Bacterium for Biodegradation of Mixed Wastes

Nuclear Materials

Research Awards in the Nuclear Materials Environmental Management Problem Area.

Award ID	Page #	Award Title
55094-CA	B-13	Chemical and Ceramic Methods Toward Safe Storage of Actinides Using Monazite
60319-CA	B-51	Thermodynamics of the Volatilization of Actinide Metals in the High-Temperature Treatment of Radioactive Wastes
55382-IL	B-129	Determination of Transmutation Effects in Crystalline Waste Forms
60247-IL	B-139	Miniature Nuclear Magnetic Resonance Spectrometer for In-Situ and In-Process Analysis and Monitoring
59967-NM	B-217	Aqueous Electrochemical Mechanisms in Actinide Residue Processing
60118-NM	B-229	Fundamental Thermodynamics of Actinide-Bearing Mineral Waste Forms
60077-TN	B-327	Development of Nuclear Analysis Capabilities for DOE Waste Management Activities
60387-WA	B-381	Distribution & Solubility of Radionuclides & Neutron Absorbers in Waste Forms for Disposition of Plutonium Ash & Scraps, Excess Plutonium, and Miscellaneous Spent Nuclear Fuels

Remedial Action

Research Awards in the Remedial Action Environmental Management Problem Area.

Award ID	Page #	Award Title
55014-AL	B-1	Kinetics and Mechanisms of Metal Retention/Release in Geochemical Processes in Soil
55164-AL	B-3	Advanced Experimental Analysis of Controls on Microbial Fe(III) Oxide Reduction
54898-AZ	B-5	Molecular Dissection of the Cellular Mechanisms Involved in Nickel Hyperaccumulation in Plants
54908-AZ	B-7	Partitioning Tracers for In Situ Detection and Quantification of Dense Nonaqueous Phase Liquids in Groundwater Systems
55097-CA	B-15	Heavy Metal Pumps in Plants
55278-CA	B-17	Molecular Genetics of Metal Detoxification: Prospects for Phytoremediation
54698-CA	B-19	Rapid Mass Spectrometric DNA Diagnostics for Assessing Microbial Community Activity During Bioremediation
55264-CA	B-21	Subsurface High Resolution Definition of Subsurface Heterogeneity for Understanding the Biodynamics of Natural Field Systems: Advancing the Ability for Scaling to Field Conditions
55343-CA	B-25	Enzyme Engineering for Biodegradation of Chlorinated Organic Pollutants
55351-CA	B-27	Evaluation of Isotopic Diagnostics for Subsurface Characterization and Monitoring: Field Experiments at the TAN and RWMC (SDA) Sites, INEL
55359-CA	B-31	Chaotic-Dynamical Conceptual Model to Describe Fluid Flow and Contaminant Transport in a Fractured Vadose Zone
55396-CA	B-33	Sorption of Colloids, Organics, and Metals onto Gas-Water Interfaces: Transport Mechanisms and Potential Remediation Technology

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Remedial Action Continued

Index of Research Awards by Environmental Management Problem Area Continued

Remedial Action Continued

Index of Research Awards by Environmental Management Problem Area Continued

Remedial Action Continued

Decontamination and Decommissioning

Research Awards in the Decontamination and Decommissioning Environmental Management Problem Area.

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Health / Ecology / Risk

Research Awards in the Health / Ecology / Risk Environmental Management Problem Area.

Index of High Cost Environmental Management Projects by Problem Area

High Level Waste

Projects in the High Level Waste Environmental Management Problem Area.

"+" Designates projects which must remain active in the year 2007 and beyond to manage high risks.

Spent Nuclear Fuel

Projects in the Spent Nuclear Fuel Environmental Management Problem Area.

"+" Designates projects which must remain active in the year 2007 and beyond to manage high risks.

Index of High Cost Environmental Management Projects by Problem Area Continued

Mixed Waste

Projects in the Mixed Waste Environmental Management Problem Area.

"+" Designates projects which must remain active in the year 2007 and beyond to manage high risks.

Nuclear Materials

Projects in the Nuclear Materials Environmental Management Problem Area.

"+" Designates projects which must remain active in the year 2007 and beyond to manage high risks.

Remedial Action

Projects in the Remedial Action Environmental Management Problem Area.

"+" Designates projects which must remain active in the year 2007 and beyond to manage high risks.

Index of High Cost Environmental Management Projects by Problem Area Continued

Remedial Action Continued

Project ID	Page #	Project Title
+ OR-46301	C-107	Portsmouth Remedial Action
+ OH-FN-07	C-115	Silos
+ RL-ER01	C-125	100 Area Remedial Action
+ RL-ER02	C-129	200 Area Remedial Action
+ RL-ER03	C-133	300 Area Remedial Action
RL-ER08	C-147	Groundwater Management
RF013	C-211	Closure Caps Project
RF014	C-213	Industrial Zone Closure Project
SR-ER03	C-223	Lower Three Runs & Operations Project
+ SR-ER06	C-227	Upper Three Runs Project

Decontamination and Decommissioning

Projects in the Decontamination and Decommissioning Environmental Management Problem Area.

"+" Designates projects which must remain active in the year 2007 and beyond to manage high risks.

Project ID	Page #	Project Title
+ AL013	C-11	LANL Waste Management - Legacy Waste
ID-ER-110	C-27	Decontamination and Decommissioning
ID-OIM-113	C-37	Post-2006 Surveillance, Maintenance, and Monitoring
+ OR-43202	C-69	ORNL Melton Valley Watershed Remedial Action
OR-43204	C-77	ORNL Bethel Valley Deactivation and Decommissioning
OR-44302	C-87	East Tennessee Technology Park (ETTP) Process Equipment D&D
+ OR-44303	C-93	East Tennessee Technology Park (ETTP) D&D
SP-SPRU	C-111	Separations Process Research Unit (SPRU)
+ RL-ER05	C-139	Facility Surveillance & Maintenance - ADS 3500
+ RL-ER06	C-141	Decontamination and Decommissioning
RL-ER07	C-145	Post Closure Surveillance & Maintenance
+ RL-TP05	C-155	Plutonium Finishing Plant Deactivation
RL-TP10	C-163	Accelerated Deactivation
+ RL-TP13	C-167	Landlord Project
SR-FA02	C-233	F Canyon Deactivation Project
SR-FA04	C-235	H Canyon Deactivation Project
SR-FA06	C-237	235-F Deactivation Project
SR-FA16	C-239	F-Area Monitoring
SR-FA17	C-241	H-Area Monitoring and Minor Facility Monitoring
SR-FA18	C-243	M Area Monitoring Project
SR-FA20	C-245	Reactors Monitoring Project
SR-FA22	C-247	Receiving Basin for Off-site Fuels (RBOF) Monitoring Project

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Health / Ecology / Risk

Projects in the Health / Ecology / Risk Environmental Management Problem Area.

"+" Designates projects which must remain active in the year 2007 and beyond to manage high risks.

Project ID	Page #	Project Title
+ AL013	C-11	LANL Waste Management - Legacy Waste
+ ID-ER-103	C-17	Idaho Chemical Processing Plant Remediation
+ ID-HLW-103	C-35	High-Level Waste Treatment and Storage
+ OR-38111	C-61	Mixed Low Level Waste Management
+ OR-43202	C-69	ORNL Melton Valley Watershed Remedial Action
+ OR-43203	C-73	ORNL Bethel Valley Remedial Action
+ OR-44301	C-81	East Tennessee Technology Park (ETTP) Remedial Action
+ OR-44303	C-93	East Tennessee Technology Park (ETTP) D&D
+ OR-48101	C-99	Offsite Remedial Action
+ OR-45301	C-103	Paducah Remedial Action
+ OR-46301	C-107	Portsmouth Remedial Action
+ OH-FN-07	C-115	Silos
+ RL-ER01	C-125	100 Area Remedial Action
+ RL-ER02	C-129	200 Area Remedial Action
+ RL-ER03	C-133	300 Area Remedial Action
+ RL-ER05	C-139	Facility Surveillance & Maintenance - ADS 3500
+ RL-ER06	C-141	Decontamination and Decommissioning
+ RL-TP02	C-153	Waste Encapsulation and Storage Facility (WESF) Sub-Project
+ RL-TP05	C-155	Plutonium Finishing Plant Deactivation
+ RL-TP07	C-161	Plutonium Finishing Plant (PFP) Vault Management
+ RL-TP13	C-167	Landlord Project
+ RL-TW04	C-169	Retrieval Project
+ RL-TW05	C-173	Process Waste Support
+ RL-TW06	C-177	Process Waste Privatization Phase I
+ RL-TW07	C-181	Process Waste Privatization Phase II
+ RL-TW08	C-185	Process Waste Privatization Infrastructure
+ RL-WM05	C-201	Liquid Effluents Project
+ RL-ST01	C-205	PNNL WASTE MANAGEMENT
+ SR-ER06	C-227	Upper Three Runs Project
+ SR-HL01	C-249	H-Tank Farm
+ SR-HL02	C-253	F-Tank Farm
+ SR-HL04	C-261	In Tank Precipitation/Extended Sludge Processing/Late Wash (ITP/ESP/LW) Operations
+ SR-SF02	C-275	L-Reactor Spent Nuclear Fuel Project
+ SR-SF09	C-279	Spent Nuclear Fuel Transfer and Storage
+ SR-SW01	C-281	Consolidated Incinerator Facility
+ SR-SW02	C-285	Transuranic Waste Project
+ SR-SW03	C-287	Mixed Low Level Waste Project
+ SR-SW04	C-291	Low Level Waste Project

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