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Removal Action Work Plan for Disposition of Low-Level and Mixed Low-Level Waste From Burial Ground 218-W-4C

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ACRONYMS

AEA	<i>Atomic Energy Act of 1954</i>
AJHA	automated job hazard analysis
AK	acceptable knowledge
ALARA	as low as reasonably achievable
ARAR	applicable or relevant and appropriate requirement
CERCLA	<i>Comprehensive Environmental Response, Compensation, and Liability Act of 1980</i>
CWC	Central Waste Complex
DOE	U.S. Department of Energy
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
ERDF	Environmental Restoration Disposal Facility
FY	fiscal year
LDR	land disposal restriction
LLBG	Low Level Burial Grounds
LLW	low-level waste
MLLW	mixed low-level waste
NDA	nondestructive assay
PEcoS	Pacific EcoSolutions, LLC
QA	quality assurance
RCRA	<i>Resource Conservation and Recovery Act of 1976</i>
RSW	retrievably stored waste
RWP	radiological work permit
Tri-Party Agreement	<i>Hanford Federal Facility Agreement and Consent Order</i>
TRU	transuranic
WAC	<i>Washington Administrative Code</i>
WRAP	Waste Receiving and Processing

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REMOVAL ACTION WORK PLAN FOR DISPOSITION OF LOW-LEVEL AND MIXED LOW-LEVEL WASTE FROM BURIAL GROUND 218-W-4C

1.0 INTRODUCTION

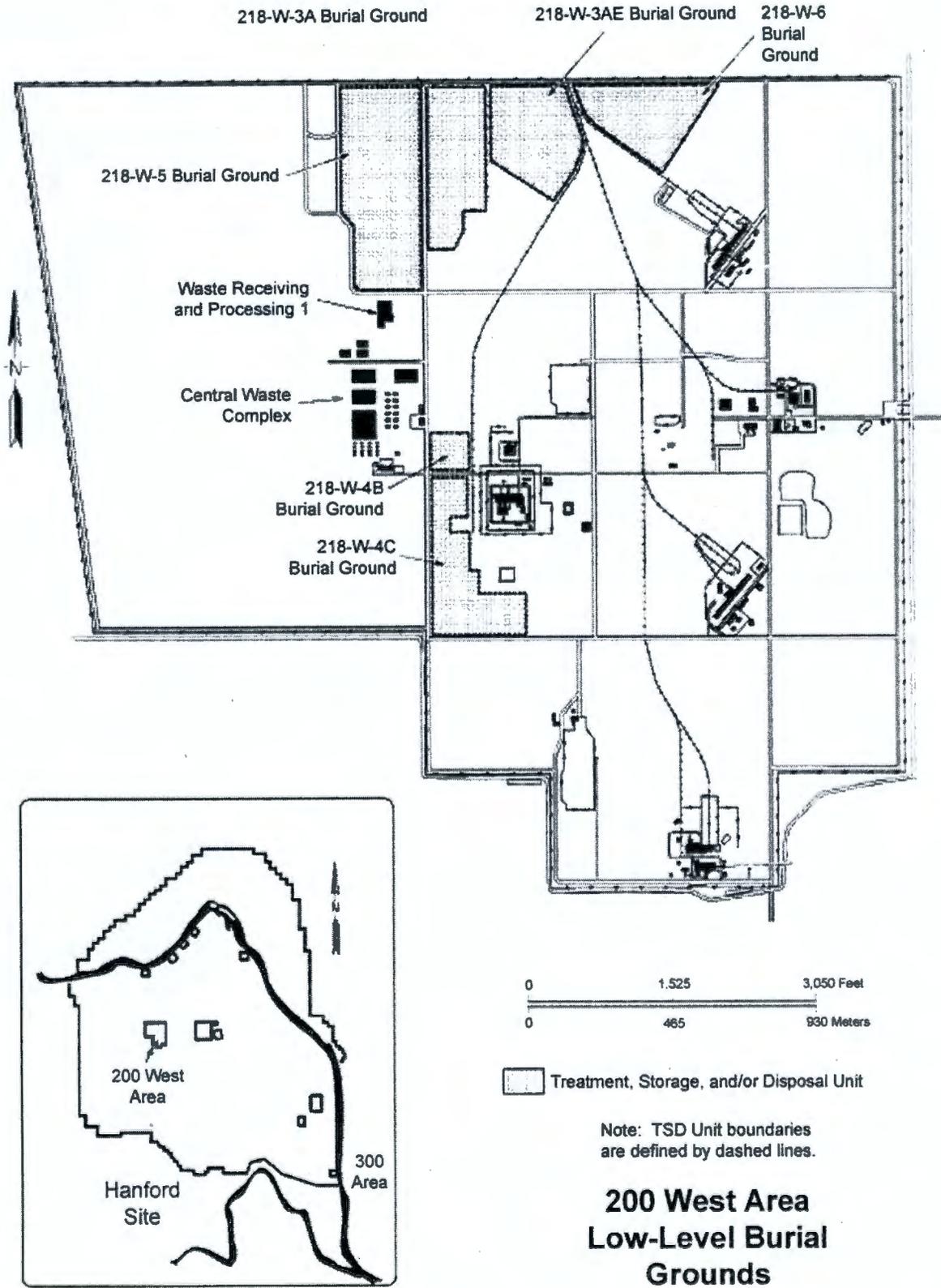
This document provides the removal action work plan for the disposition of low-level waste (LLW) and mixed low-level waste (MLLW) retrieved from Burial Ground 218-W-4C in the 200 West Area at the U.S. Department of Energy (DOE) Hanford Site. Refer to Figure 1 for a map of the 200 West Area Low-Level Burial Grounds (LLBG). The LLW and MLLW fractions of the retrievably stored waste (RSW) from Burial Ground 218-W-4C may contain hazardous substances, including radionuclides. The Washington State Department of Ecology (Ecology), the U.S. Environmental Protection Agency (EPA), and the DOE, hereinafter referred to as the Tri-Parties, determined that these wastes present a potential threat to human health and the environment. Therefore, the Tri-Parties approved and signed a time-critical removal action memorandum to accelerate the disposition of these wastes (*Comprehensive Environmental Response, Compensation, and Liability Act [CERCLA] Time Critical Removal Action Memorandum for Disposal at the Environmental Restoration Facility [ERDF] of Non-Transuranic [TRU] Waste Generated During the M-91 Retrieval Operations at Burial Ground 218-W-4C [EPA 2004]*).

The removal action meets the criteria for initiating a removal action under the CERCLA and the National Contingency Plan per 40 CFR 300, "National Oil and Hazardous Substances Pollution Contingency Plan," 300.415, "Removal action." The recommended removal action identified in the time-critical removal action memorandum (EPA 2004) is treatment (as needed) and disposal of the LLW and MLLW at the ERDF. This removal action work plan supports implementation of the time-critical removal action.

1.1 BACKGROUND

Since 1970, an estimated 18,400 suspect TRU waste containers were placed in retrievable storage in Burial Ground 218-W-4C. Because the definition of TRU waste has changed over the years, a significant portion of the RSW that was once classified as TRU is now classified as LLW. Approximately 18,000 of the RSW containers are drums (e.g., 208 L [55 gal]), while the remaining portion of RSW is in other containers, such as boxes. The majority of the RSW drums in Burial Ground 218-W-4C are stacked vertically on asphalt pads in earth-covered trenches.

Figure 1. Map of the 200 West Area Low-Level Burial Grounds.



The DOE is required to retrieve, designate pursuant to *Washington Administrative Code (WAC) 173-303-070* through 100, and treat (if needed) the RSW from the LLBG (*Modification of Hanford Federal Facility Agreement and Consent Order (HFFACO) M-91 Series Provisions [EPA et al. 2004]*). The RSW will be segregated into three categories: TRU (including mixed TRU), LLW, and MLLW. RSW is suspected to be mixed waste and will be managed as mixed waste unless and until it is designated as non-mixed. A simplified process flow diagram for the disposition of RSW from Burial Ground 218-W-4C is provided in Figure 2. The TRU portion of the RSW from Burial Ground 218-W-4C will be processed as part of the Waste Isolation Pilot Plant certification activities to determine if a waste meets the definition of TRU to enable DOE to comply with provisions of the *Waste Isolation Pilot Plant Land Withdrawal Act of 1992*.

The time-critical removal action memorandum (EPA 2004) allows for the expedited treatment and disposal of the LLW and MLLW fractions of the RSW from Burial Ground 218-W-4C. The land disposal restrictions (LDR) in WAC 173-303-140 and 40 CFR 268, "Land Disposal Restrictions," must be met as applicable or relevant and appropriate requirements (ARAR). The LLW and MLLW fractions account for about half of the RSW from Burial Ground 218-W-4C (i.e., approximately 9,000 drums). It is anticipated that 90 percent of the MLLW will meet the definition of debris waste or radioactive lead solids under WAC 173-303-140 and the *Resource Conservation and Recovery Act of 1976 (RCRA)*.

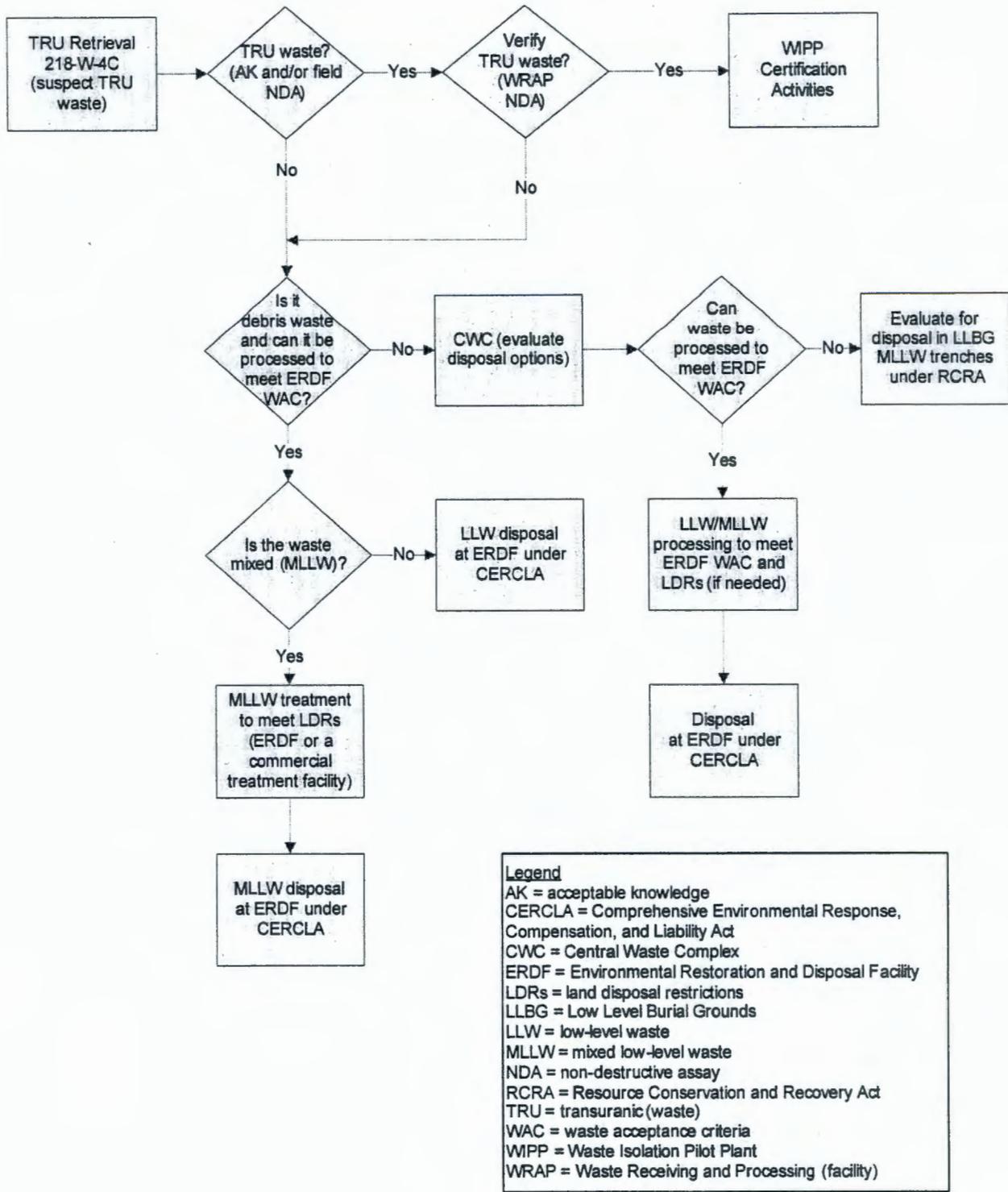
The following waste types from waste retrieval operations at Burial Ground 218-W-4C are included in the scope of this removal action work plan:

- LLW debris fraction of the RSW contained in drums,
- MLLW debris and radioactive lead solids fraction of the RSW contained in drums, and
- Secondary wastes generated by waste retrieval operations; e.g., potentially contaminated personal protective equipment, wood, plastic, paper, metal, and soil.

This removal action work plan does not address LLW and MLLW that are not debris or radioactive lead solids that are packaged in a container other than a drum, or that are stored in another burial ground (i.e., 218-W-3A, 218-E-12B, and 218-W-4B). The disposition of this waste will be addressed by subsequent CERCLA actions, such as an Engineering Evaluation/Cost Analysis.

The LLW that meets the ERDF Waste Acceptance Criteria will be prepared and shipped to the ERDF for disposal. MLLW retrieved under this removal action may require treatment to satisfy the LDRs prior to disposal at the ERDF. If required, treatment will occur at the ERDF or another treatment facility, such as the Pacific EcoSolutions, LLC (PEcoS), mixed waste treatment facility in Richland, Washington. MLLW that has been treated to meet the LDRs and meets the requirements of the ERDF Waste Acceptance Criteria will be disposed at the ERDF under the authority of the time-critical removal action memorandum and CERCLA.

Figure 2. Disposition of 218-W-4C Retrievably Stored Waste.



1.2 PURPOSE AND SCOPE

The purpose of this removal action work plan is to document the methodology and requirements for dispositioning LLW and MLLW drums from Burial Ground 218-W-4C to the ERDF for disposal. The steps included in this removal action work plan are:

- Perform radiological characterization and identify those that are non-TRU (i.e., LLW and MLLW).
- Designate the LLW and MLLW drums and identify the subset appropriate for treatment (if required) and disposal at the ERDF.
- Verify that the waste meets the appropriate treatment and/or disposal criteria.
- Prepare and transport LLW and MLLW drums to a treatment and/or disposal facility (e.g., ERDF).
- Treat MLLW to meet the disposal facility acceptance criteria and applicable LDRs.
- Manage newly generated secondary waste from retrieval operations.
- Dispose of LLW drums, MLLW drums, and secondary waste at the ERDF.

This removal action work plan satisfies the requirement in the removal action memorandum (EPA 2004) that DOE submit a removal action work plan. This plan also includes the treatment plan required for compliance with the action memorandum and ARARs for disposing of the LLW and MLLW drums from Burial Ground 218-W-4C at the ERDF.

Retrieval operations for RSW at Burial Ground 218-W-4C are proceeding in accordance with the *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement [Ecology et al. 2004] Milestone M-91-40). The scope of this removal action work plan comprises disposition of LLW and MLLW fractions of the RSW and newly generated secondary waste (e.g., personal protective equipment, wood, plastic, contaminated soil) that meet or can be treated to meet the requirements of the ERDF Waste Acceptance Criteria and ARARs. This removal action work plan covers the LLW/MLLW characterization and designation processes and the waste management activities when it is managed as CERCLA waste per the action memorandum (EPA 2004). The LLW and MLLW will be handled as CERCLA waste in designated areas at the LLBG and Central Waste Complex (CWC) and during transportation, treatment, and disposal as described in HNF-21106, *Waste Control Plan for the Low-Level Fraction of the Retrievably Stored Waste from Burial Ground 218-W-4C*.

Of the estimated 9,000 drums of LLW and MLLW addressed by the action, approximately 450 were previously processed (radioassayed) during retrieval campaigns conducted in fiscal year (FY) 1999, FY 2000, and FY 2001. Another 1,200 drums of LLW and MLLW have been

removed from the disposal trenches and processed from October 1, 2004 through April 30, 2004. Collectively, this waste processed prior to approval of the removal action memorandum (EPA 2004) is called backlog waste.

The backlog waste is included in the scope of this removal action work plan and is either staged for retrieval at the LLBG or retrieved and stored at the CWC. Finally, the estimated 7,200 drums of LLW and MLLW remaining in the RSW trenches at Burial Ground 218-W-4C at the time of approval of the time-critical action constitute the balance of drums covered by this action. The backlog waste distinction is provided to identify those activities taken prior to the approval of the action memo and to identify the actions needed to manage the waste in accordance with the requirements established in this plan. Backlog drums will be managed in accordance with requirements established by this plan; HNF-20770, *Data Quality Objectives Summary Report for Disposition of the Low-Level Waste Fraction of Retrievably Stored Waste*; and HNF-21786, *Sampling and Analysis Plan for the Low-Level Waste Fraction of the Retrievably Stored Waste*.

The volumes of TRU RSW and the non-TRU RSW in other containers, such as boxes, are not covered by this removal action. In addition, this removal action does not apply to RSW in other burial grounds (i.e., 218-W-3A, 218-E-12B, and 218-W-4B) covered under the M-91-40 milestone. Those wastes will be addressed by subsequent CERCLA actions. This plan may be revised accordingly to include any additional elements required to complete the balance of the removal action under the M-91-40 milestone.

2.0 REMOVAL ACTION ELEMENTS

The removal action consists of those activities required to disposition the LLW and MLLW drums from Burial Ground 218-W-4C and those already removed from 218-W-4C to the CWC. All the LLW and MLLW drums to be disposed at the ERDF will undergo radioassay (unless otherwise excepted by this plan) prior to transportation to ensure the waste meets the ERDF Waste Acceptance Criteria for radioactivity. A portion of the RSW was assayed during previous retrieval campaigns as described above. At Burial Ground 218-W-4C or the CWC, the LLW and MLLW drums will be prepared for shipment to a treatment and/or disposal facility. After it has been determined that the LLW/MLLW meets the applicable waste acceptance criteria and LDRs (if applicable), and the treatment and/or disposal facility has approved the waste shipment, the waste will be transported to the appropriate facility for treatment and/or disposal under CERCLA authority per the time-critical removal action memorandum (EPA 2004).

2.1 REMOVAL ACTION WORK ACTIVITIES

The removal activities addressed in the following sections will be performed in accordance with existing LLBG, CWC, and ERDF work procedures. Common industrial equipment (e.g., forklifts) will be used to move containers, place drums on pallets, and place containers on/in trucks or trailers.

2.1.1 Radiological Characterization

The following sections describe the radiological characterization performed on backlog waste drums from 218-W-4C, drums currently being radioassayed at 218-W-4C, and drums that are determined to be LLW through radioassay at the Waste Receiving and Processing (WRAP) facility.

2.1.1.1 Backlog Waste. Waste retrieval activities for the backlog waste used two primary nondestructive assay (NDA) methods to determine whether suspect-TRU drums were LLW or TRU waste. A passive neutron radioassay unit was used during the FY 2000 pilot retrieval campaign. Gamma radioassay was the radioassay method used during the FY 1999 and FY 2001 pilot retrieval campaigns. Gamma radioassay has also been used since FY 2003 as part of the current retrieval activities. (Note: Retrieval activities did not take place during FY 2002.)

The passive neutron method may not measure non-TRU gamma-emitting radionuclides that could contribute to the curie content and that are needed to assess whether the drum exceeds the greater-than-U.S. Nuclear Regulatory Commission (NRC) Class C limits in 10 CFR 61, "Licensing Requirements for Land Disposal of Radioactive Waste," 61.55, "Waste classification." Additional radioassay, application of scaling factors, or confirmatory measurements may be needed to establish that NRC Class C limits are met. Results from the passive neutron radioassay unit will not be used for this removal action. Containers assayed using the passive neutron radioassay unit will either be reassayed under current retrieval requirements or evaluated using criteria (e.g., scaling factors, process knowledge) established in HNF-20770, *Data Quality Objectives Summary Report for Disposition of the Low-Level Waste Fraction of Retrievably Stored Waste*, and HNF-21786, *Sampling and Analysis Plan for the Low-Level Waste Fraction of the Retrievably Stored Waste*.

A gamma radioassay method was used by Canberra during the FY 1999 retrieval campaign. Less than 60 drums were determined to be LLW using this unit. The performance specifications for the radioassay were defined in contract requisition 4660. For FY 2001, contractor-approved procedures and procurement documents were used to perform these measurements. For FY 2003 through April 2004, the requirements for the radioassay are the same as the requirements for the drums remaining in 218-W-4C as described in Sections 2.1.1.2 and 2.1.1.3.

Review of radioassay results for backlog drums will take place in accordance with requirements established by this plan; HNF-20770, *Data Quality Objectives Summary Report for Disposition of the Low-Level Waste Fraction of Retrievably Stored Waste*; and HNF-21786, *Sampling and Analysis Plan for the Low-Level Waste Fraction of the Retrievably Stored Waste*.

2.1.1.2 Mobile Radioassay. A qualified contractor is providing the mobile NDA equipment and services and is responsible for setting up, maintaining, calibrating, and providing radioassay results. The following is a list of information typically included with the final NDA results:

- The container identification number and container net and gross weight in kilograms;
- The sequence file number, radioassay date and time, and name and version of any software used for the radioassay and data analysis and the names of the individuals performing the

radioassay and data analysis;

- A discussion of the data and any qualifiers including comments on any noncompliance issue or other issue important to the determination of LLW or TRU;
- Waste classification (TRU or LLW);
- Total TRU activity in every container in nCi/g;
- Total fissile gram equivalents in grams;
- Total plutonium mass in grams;
- The measured value in curies +/- the uncertainty value calculated at the two-sided 95-percent confidence level of each isotope of concern detected or identified by ratio; and
- Identification of isotopic ratios used for plutonium quantification.

The radioassay contractor is qualified by meeting and working to contractor-approved performance requirements. TRU retrieval personnel support radioassay and review radioassay results using contractor-approved procedures.

2.1.1.3 Waste Receiving and Processing (WRAP) Radioassay. RSW determined to be TRU from process knowledge and/or mobile radioassay is processed through WRAP for Waste Isolation Pilot Plant certification. At WRAP, NDA personnel perform measurements of each TRU waste container using calorimetry, gamma energy radioassay, or imaging passive/active neutron systems to determine the radioactive material composition and quantify radionuclide masses. A small fraction of this TRU waste may be reclassified as LLW due to the detection methods used at WRAP. These LLW containers will be transferred to the CWC for storage and evaluation for disposal at the ERDF. LLW containers assayed using calorimetry and/or the passive neutron radioassay unit will either be reassayed with the gamma energy radioassay system or evaluated using criteria (e.g., scaling factors, process knowledge) established in HNF-20770, *Data Quality Objectives Summary Report for Disposition of the Low-Level Waste Fraction of Retrievably Stored Waste*, and HNF-21786, *Sampling and Analysis Plan for the Low-Level Waste Fraction of the Retrievably Stored Waste*.

NDA personnel at the WRAP facility follow contractor-approved procedures in performing NDA. NDA personnel at the WRAP facility quantify radionuclide values in accordance with contractor-approved procedures. NDA personnel at WRAP use acceptable knowledge (AK) data, assay measurements and calculations to establish an isotopic profile of each waste container. The isotopic distribution is reported in batch data reports in accordance with contractor-approved procedures.

2.1.2 Waste Designation

Waste designations are conducted in accordance with WAC 173-303-070 through -100 using contractor-approved procedures. The waste designation relies on the AK documentation and characterization for certifying TRU waste for disposal at the Waste Isolation Pilot Plant. The use of AK documentation and characterization information obtained on the TRU waste fraction serves as a basis for the designation of LLW and MLLW fractions subject to this removal action. Unlike the TRU or LLW determination, which is based on radionuclide content and may vary from drum to drum independent of the original waste-generating source, waste designation is dependent on the original waste-generating source and the waste-generating processes. Therefore, it is appropriate to utilize characterization information gathered on all RSW drums to support LLW and MLLW designation.

It may be necessary to gather additional data on the LLW and MLLW drums through the use of offsite treatment facilities, such as PEcoS. These treatment facilities can provide visual verification of waste containers to ensure the waste contents match the historical documentation. This option may be essential for certain small-volume, original waste-generating sources or for original waste-generating sources where a high percentage of drums radioassay as LLW and MLLW, leaving few drums subject to the TRU waste certification process.

The designation process will be implemented using the following steps.

1. Identification of Waste Sources. Information on the characterization of the RSW is gathered as part of the retrieval planning process. Records are reviewed and the original waste-generating sources for the waste identified.
2. Waste Source Classification. Each waste source is classified into an existing TRU AK waste stream, or a new TRU AK package is developed. Details of the use of the AK documentation and TRU waste certification program are contained in HNF-20770, *Data Quality Objectives Summary Report for Disposition of the Low-Level Waste Fraction of Retrievably Stored Waste*, and HNF-21786, *Sampling and Analysis Plan for the Low-Level Waste Fraction of the Retrievably Stored Waste*. The AK documentation will be used to identify waste streams, to develop the waste designation for RSW, to determine the physical form of waste, and to quantify/update the radionuclides present in the waste.
3. Designation Documentation. Existing solid waste information tracking system information, the waste burial records, facility process information, records, and material safety data sheets are obtained. Key information is compiled and includes such items as container identification, container gross weight, waste materials, isotopic content, hazardous constituents, and Chemical Abstracts Service Number. A designation document is developed for each waste stream that summarizes the chemical constituents (including concentration to be expected in waste stream), how these constituents and concentrations were identified, any assumptions used, and the waste designation. The objective of the designation is to identify and quantify dangerous waste constituents such that treatment in accordance with applicable regulations can be performed.

4. Cross-Reference Each Container to a Specific Designation. Each container record will be reviewed, and the correct designation document will be identified. The container contents and packaging information are reviewed. A determination is made if the waste source designation and debris categorization are applicable.

2.1.3 Waste Verification

A verification program will be implemented to ensure that the waste from each original waste-generating source matches the description provided on the waste records, the AK documentation, and designation for the appropriate original waste-generating source. Requirements for waste verification will be established in HNF-20770, *Data Quality Objectives Summary Report for Disposition of the Low-Level Waste Fraction of Retrievably Stored Waste*, and HNF-21786, *Sampling and Analysis Plan for the Low-Level Waste Fraction of the Retrievably Stored Waste*.

2.1.4 Shipment Preparation and Transportation of Waste

Hazardous materials and wastes, including radioactive and other nuclear materials, will be safely packaged and transported in a manner to protect workers, the public, and the environment. Hazardous materials will be transported in accordance with U.S. Department of Transportation requirements for offsite or DOE requirements for onsite shipments. Offsite shipments will meet the requirements of 49 CFR Subchapter C, "Hazardous Materials Regulations." Onsite shipments will meet the requirements of DOE/RL-2001-36, *Hanford Sitewide Transportation Safety Document*. DOE/RL-2001-36 defines the requirements for the Hanford Transportation and Packaging Program, which complies with the DOE transportation safety requirements specified in DOE Order 460.1A, *Packaging and Transportation Safety*.

Contractor-approved procedures that implement these transportation requirements will be followed for both onsite and offsite shipments. Containers will be selected and prepared for shipment for treatment and/or disposal. Documentation for each container will be reviewed against the requirements of the ERDF Waste Acceptance Criteria and applicable waste profile(s). The review will include ensuring all characterization data required by HNF-20770, *Data Quality Objectives Summary Report for Disposition of the Low-Level Waste Fraction of Retrievably Stored Waste*, and HNF-21786, *Sampling and Analysis Plan for the Low-Level Waste Fraction of the Retrievably Stored Waste*, has been gathered. Review of the waste contents and characterization will be performed to make sure acceptance limits are met. For example, checks will be completed to ensure the waste is below NRC Class C limits, is eligible for treatment, and is not prohibited waste. Waste containers will either be vented or gas generation calculations will be performed to ensure waste packages do not exceed the pressure limit of 1.5 atmospheres at 20°C (68°F). Containers that meet all acceptance requirements will be batched into shipments. Paperwork will be prepared and approval obtained from ERDF to ship the waste.

The waste containers will be removed from their current staging/storage locations and transferred to CERCLA waste staging areas at the LLBG or CWC. Smears will be collected to confirm compliance with surface contamination limits as necessary. As appropriate, the containers will

be relabeled and marked for transport. RSW will be transported in approved shipping containers that meet the onsite or offsite transportation requirements. Examples of approved containers could include the retrieved container itself, an overpack, or a cargo container. An alternative container could also be selected provided the applicable transportation requirements are met. Shipping paperwork and any paperwork necessary for the receiving facility will be completed as part of shipment preparations.

2.1.5 Waste Treatment

MLLW requiring treatment will be received and off-loaded at the appropriate treatment facility (e.g., ERDF) using common industrial equipment (e.g., forklifts). Waste treatment will be performed in accordance with the Waste Treatment Plan provided in Section 5.0 of this work plan.

2.1.6 Newly Generated Secondary Waste

LLW or MLLW may be generated during retrieval operations and/or during preparation for shipment of RSW from Burial Ground 218-W-4C to the appropriate treatment and/or disposal facility (e.g., ERDF). The generation of radioactive and mixed waste will be minimized to the extent practical.

2.1.6.1 Waste Characterization and Designation. Secondary waste streams generated during retrieval operations could consist of debris and/or soil. The debris waste stream consists of such materials as wood (generally pallets and plywood) used in supporting or protecting the waste packages, tarps, and personnel protective equipment generated during retrieval operations. Waste associated with the wood dunnage (e.g., plastic strapping, tape, staples, nails) could also be included. If secondary waste has come into direct contact with RSW or there is visual evidence of contamination, then the appropriate RSW designation(s) will be applied to the waste as appropriate.

Waste soils will either be uncontaminated soil and managed as LLW (radioactive only) or contaminated and managed as a separate MLLW stream. This secondary waste soil is separate from the small number of RSW drums at 218-W-4C containing contaminated soils. RSW soils will be transferred to CWC for further treatment and disposal evaluations.

The secondary waste will be designated based on process knowledge; sampling and analysis, if appropriate; and the radiological characterization of Hanford soils. Process knowledge is based on radiological surveys and visual examination and/or the AK documentation. The radiological characterization information provided in PNNL-13230, *Hanford Site Environmental Report for Calendar Year 1999*, will be used to characterize secondary waste. Waste generated at the LLBG or CWC is designated in accordance with WAC 173-303-070 through -100 using contractor-approved procedures. The waste designation and characterization data requirements for secondary waste are detailed in HNF-20770, *Data Quality Objectives Summary Report for*

Disposition of the Low-Level Waste Fraction of Retrievably Stored Waste, and HNF-21786, Sampling and Analysis Plan for the Low-Level Waste Fraction of the Retrievably Stored Waste.

2.1.6.2 Waste Handling, Storage, and Packaging. Newly generated radioactive or mixed waste at the LLBG or CWC will be placed in drums, boxes, or an ERDF roll-off container located in an accumulation area. The container will be staged at 218-W-4C or stored at the CWC in accordance with the Waste Control Plan (HNF-21106) until approved and transported to ERDF for disposal. Radioactive or mixed waste generated from treatment and disposal activities performed at the ERDF will be treated, as necessary, and disposed at the ERDF.

2.1.7 Waste Disposal

The ERDF is authorized to operate through a CERCLA Record of Decision issued by the EPA, as amended (*Record of Decision, U.S. Department of Energy Environmental Restoration Disposal Facility, Hanford Site, Benton County, Washington* [EPA et al. 1995]). The ERDF is a CERCLA disposal facility accepting waste generated from remediation activities at the Hanford Site under CERCLA authority, such as bulk soil, demolition debris, and miscellaneous contaminated material. The ERDF is designed to minimum technology requirements for RCRA Subtitle C landfills and *Toxic Substances Control Act* specifications for chemical landfills.

Waste entering the ERDF is controlled on the basis of source, physical form, and contaminant concentration and activity levels. Prior to disposal, the waste must be certified that it meets the requirements of the ERDF Waste Acceptance Criteria. In addition, an LDR compliance determination must be made for waste containing dangerous/hazardous constituents in accordance with WAC 173-303-140 and 40 CFR 268.

LLW meeting the ERDF Waste Acceptance Criteria will be transported directly from the LLBG or CWC to the ERDF for disposal. MLLW will be treated to meet LDRs and the ERDF Waste Acceptance Criteria and then disposed at the ERDF. Secondary wastes meeting the ERDF Waste Acceptance Criteria can also be treated, if required, and disposed at the ERDF. LLW and MLLW will be placed in lined disposal trenches using common industrial equipment (e.g., backhoe). Disposal of the LLW and MLLW will be conducted under CERCLA authority as defined in the action memorandum (EPA 2004). MLLW that does not meet or cannot be treated to meet the ERDF Waste Acceptance Criteria will be stored at the CWC and evaluated for alternative disposition pathways, such as the MLLW trenches at the LLBG.

2.2 WASTE HAZARDS

The removal action consists of moving containers that contain mixed dangerous and radioactive waste. Possible hazards are physical, chemical, and radiological in nature.

The primary hazard is the physical hazard associated with moving containers using industrial equipment and tools. Personnel may be exposed to situations where slips, trips, falls, crushing, or pinching could occur.

Under normal operating conditions, chemical and radiological hazards are contained within the waste container. Chemical and radiological hazards may exist in the event of a container breach. The primary radiological constituents present in the waste are mixed fission products, activated metals, and TRU isotopes in concentrations less than 100 nCi/g. The MLLW containers have varying amounts of hazardous chemicals including corrosive and toxic chemicals.

3.0 SAFETY AND HEALTH MANAGEMENT CONTROLS

The LLBG and CWC are both classified as Category II nuclear facilities as described in DOE-approved nuclear safety documents. Nuclear safety requirements for these facilities are implemented via DOE-approved documents.

The ERDF is a below Category III nuclear facility, as described in DOE-approved nuclear safety documents.

3.1 EMERGENCY MANAGEMENT

All emergency planning and preparedness activities for the LLBG and CWC are conducted in accordance with contractor-approved procedures and the requirements of DOE/RL-94-02, *Hanford Emergency Management Plan*; applicable DOE orders; and state and federal regulations (i.e., 29 CFR 1910, "Occupational Safety and Health Standards," 1910.38, "Emergency action plans," and WAC 173-303-340, -350, and -360). The ERDF implements these emergency planning and preparedness requirements through contractor-approved procedures.

The Hanford Site Emergency Management Program provides procedures so that, in the event of an emergency, actions are taken to prevent or minimize impact to workers, the public, the Hanford Site, facilities, and the environment; that emergencies are promptly recognized and classified; that emergencies are reported and notifications are made; and that reentry activities are properly and safely accomplished.

3.2 HEALTH AND SAFETY PROGRAM

The LLBG and CWC occupational safety and health program is based primarily on requirements contained in 29 CFR 1910 and 29 CFR 1926, "Safety and Health Regulations for Construction." The ERDF occupational safety and health program is conducted in accordance with a contractor-approved program. These requirements focus on workplace hazards and the controls necessary to mitigate risks to workers. Common hazards associated with removal action activities include, but are not limited to, walking/working surfaces, material-handling equipment, pinch points, and ergonomics.

3.2.1 Worker Safety Program

The LLBG and CWC safety and health program was established for employees involved in treatment, storage, and disposal facility operations and activities. The program ensures the safety and health of workers during routine operations and activities at the LLBG or CWC and complies with the requirements of 29 CFR 1910.120(p), "Hazardous waste operations and emergency response".

The Integrated Environment, Safety, and Health Management System provides the framework for all work activities conducted at the LLBG or CWC. Elements within the framework include the following:

- An organizational structure and associated documentation that reflects the formal chain of command and the overall responsibilities of facility personnel (i.e., management to first-line worker);
- The Project Hanford Management System procedures and other documents used to implement safety and health requirements identified by the Occupational Safety and Health Administration, DOE, and national standards organizations;
- Operations and activities conducted in accordance with facility procedures and process documentation;
- A formalized process for hazard identification and tailoring of controls to meet the specific needs of diverse work activities;
- A baseline assessment that addresses LLBG and CWC facility, operational hazards, and associated controls;
- Worker training commensurate with individual job duties and work assignments; and
- A medical surveillance program administered to comply with Occupational Safety and Health Administration requirements including 29 CFR 1910.120.

3.2.2 Activity Hazards Analysis

The following safety items were completed for retrieval of the suspect TRU waste under Tri-Party Agreement (Ecology et al. 2004) Milestone M-91-40 and are applicable to activities being conducted under this removal action.

A baseline hazard assessment was prepared for the LLBG and CWC that identifies chemical, physical, biological, and ergonomic hazards and specifies the controls and requirements necessary for safe conduct of work. Activities to be performed are controlled by approved procedures. As part of the procedure development process, an automated job hazard analysis (AJHA) was developed by the work team and approved by involved subject matter experts. The

AJHA addresses hazards specific to the work activity including any identified subtasks. Elements of the AJHA include the following:

- Identification of operational work activity hazards,
- Tailoring of controls to the work activity,
- Specification of personal protective clothing and equipment,
- Work site control measures,
- Emergency response, and
- Involvement of workers and subject matter experts in the AJHA development, review, and approval process.

In addition to the baseline hazard assessment and AJHAs developed for operational work activities, radiological work permits (RWP) have been prepared for work involving potential radiological hazards. The RWP extends the radiological protection program (discussed in Section 3.2.3) to the specific operation. All personnel assigned to the project and all work site visitors must strictly adhere to requirements identified in the procedures, AJHAs, and RWPs.

Before work begins at Burial Ground 218-W-4C or the CWC, a pre-shift briefing is held with affected workers. This briefing includes information on the status of the facility and the activities approved for performance during the work shift. Hazards that may be encountered and the associated requirements are also addressed. At the conclusion of the work shift, a post-shift briefing is held to obtain feedback from workers and to status project efforts. Special briefings may be held, as needed, throughout the duration of the project.

A similar process exists for activities conducted at the ERDF. A comprehensive Health and Safety Plan is maintained and administered by the Disposal Operations Subcontractor. In addition, a job-specific Activity Hazard Analysis and an RWP will be prepared to address the activities associated with receiving, treating, and disposing of the waste in ERDF disposal cells. ERDF workers will be trained to these documents, and they will be reviewed regularly at Plan-of-the-Day meetings. Continual feedback from workers will be used to make adjustments and refine these documents as the work evolves.

3.2.3 Radiological Controls and Protection

10 CFR 835, "Occupational Radiation Protection," establishes the radiation protection standards, limits, and program requirements to protect workers from ionizing radiation that may result from the conduct of DOE activities. Radiation protection for the removal action activities occurring at the LLBG or CWC is implemented a contractor-approved program. Radiation protection for the removal action activities occurring at the ERDF is implemented by a contractor-approved program. Radiation protection also requires that measures be taken to maintain radiation exposures as low as reasonably achievable (ALARA). A combination of personal protective

that meets the ERDF Waste Acceptance Criteria and applicable LDRs will be disposed at the ERDF per the time-critical removal action memorandum (EPA 2004). The commercial treatment facility will be RCRA permitted for the required treatment. The ERDF is a Hanford CERCLA waste disposal facility designed to meet the substantive requirements for a dangerous waste landfill including secondary containment, leachate detection, and final cover.

4.1.2 WAC 173-303-140, Land Disposal Restrictions

Ecology incorporates by reference the federal LDRs, which are applicable to the disposition of dangerous or mixed wastes generated during this removal action. See Section 4.1.3 for the ARARs related to treatment requirements and disposal prohibitions.

4.1.3 40 CFR 268, Land Disposal Restrictions

The following substantive requirements are applicable to waste generated during this removal action:

- Identify applicable LDR treatment standards
- Treat waste to meet LDR treatment standards.

The applicable requirements from 40 CFR 268 will be met by performing the following actions.

- Applicable LDR treatment standards are identified per WAC 173-303-140, 40 CFR 268, and approved-contractor procedures. Potential LDR treatment standards for the MLLW include those for hazardous waste (40 CFR 268.40), hazardous debris (40 CFR 268.45), underlying hazardous constituents (40 CFR 268.48), and contaminated soil (40 CFR 268.49).
- The MLLW must be treated prior to disposal at the ERDF. The majority of the MLLW will be debris and will be treated to meet the alternative treatment standards for hazardous debris in 40 CFR 268.45. MLLW classified in the radioactive lead solids treatment subcategory will also be treated via macroencapsulation per 40 CFR 268.42, "Treatment standards expressed as specified technologies." Treatment will likely consist of macroencapsulation as described in Section 5.0, "Waste Treatment Plan." Newly generated contaminated soils will be treated to meet the alternative treatment standards for contaminated soil in 40 CFR 268.49. If the MLLW will not meet the criteria for alternative treatment standards for hazardous debris or contaminated soil, the waste will be treated to meet the hazardous waste treatment standards in 40 CFR 268.40 including underlying hazardous constituents in 40 CFR 268.48 when applicable.
- MLLW that cannot be treated at this time to meet LDRs and the ERDF Waste Acceptance Criteria will be stored at the CWC to evaluate treatment and disposal options.

- Treatment will be conducted at permitted facilities in accordance with applicable permit requirements or at the ERDF per the *Amended Record of Decision for the Environmental Restoration Disposal Facility* (EPA et al. 1997).

4.2 WASTE MANAGEMENT

Waste management activities performed in this removal action shall be in accordance with the Tri-Party Agreement Milestone M-91-40, the waste management ARARs identified in the action memorandum (EPA 2004), applicable permit requirements, and the *Waste Control Plan for the Low-Level Fraction of the Retrievably Stored Waste from Burial Ground 218-W-4C* (HNF-21106).

Activities at the ERDF will be performed in accordance with the amended ERDF Record of Decision (EPA et al. 1997).

Radioactive wastes are governed under the authority of the *Atomic Energy Act of 1954* (AEA). The *Environmental Restoration Disposal Facility Waste Acceptance Criteria* (BHI-00139) implements the AEA requirements for radioactive waste disposal. The waste form and radioactive constituents of the waste will be compared to the *Environmental Restoration Disposal Facility Waste Acceptance Criteria* to ensure compliance with radioactive waste disposal requirements.

5.0 WASTE TREATMENT PLAN

This section of the removal action work plan (i.e., the treatment plan) describes the stabilization processes used to macroencapsulate the MLLW, allowing compliant disposal at ERDF under CERCLA authority. Macroencapsulation of the MLLW debris and radioactive lead solids will be performed either at the ERDF or a commercial treatment facility, such as PEcoS. This plan covers the treatment options and process description for macroencapsulation of MLLW debris and radioactive lead solids at a commercial treatment facility and at the ERDF. A CERCLA offsite determination per 40 CFR 300.440, "Procedures for planning and implementing off-site response actions," would be required prior to waste shipments to offsite treatment and/or disposal facilities.

5.1 WASTE DESCRIPTION

The waste covered by the treatment plan in this section is the MLLW portion of the RSW from Burial Ground 218-W-4C that meets the RCRA definition of "debris" in 40 CFR 268.2(g), "Definitions applicable in this part," and is amenable to the alternative treatment standards for hazardous debris in 40 CFR 268.45. MLLW in the radioactive lead solids treatment subcategory will also be treated via macroencapsulation per 40 CFR 268.42. The MLLW not eligible for

macroencapsulation per 40 CFR 268.42 and 268.45 (e.g., nondebris) will be addressed by a subsequent treatment plan and/or CERCLA action. This treatment plan may be revised in the future to address treatment and disposal of nondebris waste from the LLBG.

The waste container contents include failed process equipment; miscellaneous facility solid waste (paper, plastics, glassware, cloth, metal, ceramics, wood, and solidified liquids); decontamination and demolition debris (concrete, piping); contaminated soil; and radioactive lead solids. Depending on the original waste-generating source, the MLLW could carry a variety of EPA hazardous waste numbers for characteristic and listed waste. The waste may also carry the following Washington State dangerous waste codes as applicable: WSC2 (solid corrosive), WT01 and WT02 (toxic), WP01 and WP02 (persistent), and W001 (polychlorinated biphenyls).

5.2 WASTE TREATMENT STANDARDS AND METHODOLOGY

The MLLW debris and radioactive lead solids described in this treatment plan will be treated by macroencapsulation per 40 CFR 268.42 and 268.45. Macroencapsulation is an immobilization technology defined in Table 1 of 40 CFR 268.42 and Table 1 of 40 CFR 268.45 as "application of surface coating materials such as polymeric organics (e.g., resins and plastics) or use of a jacket of inert inorganic materials to substantially reduce surface exposure to potential leaching media." Macroencapsulation is a technology-based treatment standard for debris and radioactive solids that does not require sampling and analysis to verify compliance with treatment standards for specific hazardous constituents as specified for some treatment subcategories in 40 CFR 268.40 or universal treatment standards for underlying hazardous constituents listed in 40 CFR 268.48.

5.3 COMMERCIAL TREATMENT METHOD

MLLW debris and/or radioactive lead solids may be treated by macroencapsulation at a commercial mixed waste treatment facility to meet LDR standards. The macroencapsulation process would be a permitted treatment process under RCRA that meets 40 CFR 268.42 and/or 40 CFR 268.45 standards.

5.3.1 Commercial Macroencapsulation Process Description

The treatment process would be initiated by accepting the waste per the requirements specified in the facility's RCRA Permit. MLLW debris packages that meet the acceptance requirements may be compacted into "pucks" for volume reduction and staged for macroencapsulation.

The macroencapsulation package is first prepared by pouring a grout slab in the bottom of the shipping container and allowing it to adequately cure (normally 72 hours). The pucked waste packages are placed inside the shipping container on top of the grout slab. Sufficient space is maintained between the side walls and top of the shipping container and the pucked waste packages (typically 5 cm [2 in.] or more). The encapsulating media (a flowable low-porosity

grout) is then poured inside the shipping container to completely flood the pucked waste packages and fill all of the interstitial voids. The grout forms a monolith, completely encapsulating the waste. The macroencapsulated packages are allowed to adequately cure (normally 72 hours), after which they will be inspected for free liquids and to determine if the grout cured correctly.

5.3.2 Commercial Treatment Acceptance Criteria

The performance standard specified in 40 CFR 268.45 for macroencapsulation states that "... encapsulating material must completely encapsulate debris and be resistant to degradation by the debris and its constituents and materials into which it may come in contact after placement (leachate, other waste, microbes)." The standard specified in 40 CFR 268.42 states "... macroencapsulation with surface coating materials such as polymeric organics (e.g., resins and plastics) or with a jacket of inert inorganic materials to substantially reduce surface exposure to potential leaching media." A grout formulation would be selected by the commercial treater based on their permit and treatment process. When cured, the macroencapsulated MLLW will be visually inspected for the presence of free liquids on the top surface and to ensure that each macroencapsulation package has been filled to 90-percent capacity or greater. If liquids are encountered, appropriate absorbent materials will be added. A certified LDR form for the MLLW would be completed that states the waste has been successfully treated in accordance with the treater's RCRA permit requirements and 40 CFR 268.45 alternative treatment standards for macroencapsulation of hazardous debris or 40 CFR 268.42 for radioactive lead solids.

5.4 ERDF TREATMENT METHOD

MLLW will be treated by macroencapsulation at the ERDF to meet LDR standards prior to disposal in lined trenches under CERCLA authority. Treatment of the waste at the ERDF will be performed consistent with the amended ERDF Record of Decision (EPA et al. 1997). Treatment of secondary waste may also be accomplished using other appropriate, approved treatment methods. The ERDF macroencapsulation process is based on a macroencapsulation technique utilized at the LLBG to encapsulate stacks of LLW containers in disposal trenches using established grout formulations.

5.4.1 ERDF Macroencapsulation Process Description

ERDF will macroencapsulate the MLLW debris containers that meet the acceptance criteria in the disposal trenches forming macromonoliths. High-integrity concrete slabs will be poured in the lined trenches at ERDF. Waste containers will be stacked in an array adequately spaced away from the form walls to allow complete encapsulation by the grout formulation. Structural forms will be erected on all sides of the cured slab, forming walls. The waste containers inside the forms will be flood grouted, forming the walls and cap of the macromonolith at the same time. Grout placement techniques will be adjusted, as necessary, to prevent containers from floating. When cured, the slip forms will be removed and placed into position for the next batch.

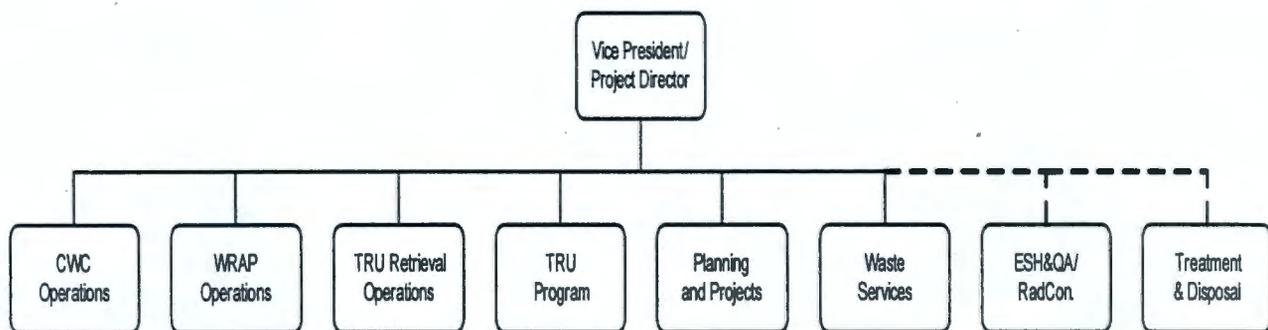
5.4.2 ERDF Treatment Acceptance Criteria

The performance standard specified in 40 CFR 268.45 for macroencapsulation states that “. . . encapsulating material must completely encapsulate debris and be resistant to degradation by the debris and its constituents and materials into which it may come in contact after placement (leachate, other waste, microbes).” The standard specified in 40 CFR 268.42 states “. . . macroencapsulation with surface coating materials such as polymeric organics (e.g., resins and plastics) or with a jacket of inert inorganic materials to substantially reduce surface exposure to potential leaching media.” The macromonolith will be inspected to ensure all containers are completely encapsulated. The set concrete macromonolith must satisfy certain strength requirements to withstand the overburden soil and maintain its integrity, preventing subsidence. The quality of the concrete formulation will typically be verified for each batch to ensure appropriate mixture ratios of Portland cement, water, specified additives, and inert aggregate are being used.

6.0 PROJECT MANAGEMENT AND ORGANIZATION

Figure 3 provides a simplified version of the Solid Waste Stabilization and Disposition management and organization chart. The organization chart depicts only those project organizations involved in activities tied to this removal action.

Figure 3. Simplified Solid Waste Stabilization and Disposition Organization Chart.



6.1 QUALITY ASSURANCE (QA) REQUIREMENTS

QA for the removal action is performed in accordance with 10 CFR 830, “Nuclear Safety Management,” 830.122, “Quality assurance criteria”; DOE O 414.1B, *Quality Assurance*; and EPA QA/R-5, *EPA Requirements for Quality Assurance Project Plans*. The QA activity is graded on the potential impacts to the environment, safety, health, reliability, and continuity of operations. Specific activities include QA implementation, responsibilities and authorities, document control, QA records, audit/assessments, and self-assessments.

The removal action activities at the ERDF are performed in accordance with a contractor-approved program.

6.1.1 QA Implementation

The QA activities for the removal action are implemented in accordance with a contractor-approved program.. Conditions adverse to quality will be identified, and corrective action will be completed in accordance with contractor-approved procedures.

6.1.2 Responsibilities and Authority

Project responsibilities and authorities are described in contractor-approved procedures.

6.1.3 Document Control

Project procedures are managed in accordance with contractor-approved procedures.

6.1.4 QA Records

QA records are controlled in accordance with contractor-approved procedures.

6.1.5 Audits/Assessments

External audits are performed by the DOE Office of Independent Assessment and Quality Assurance and other organizations to ensure project compliance with QA program requirements.

6.1.6 Self-Assessments

Self-assessments are conducted by project personnel in accordance with contractor-approved procedures.

6.2 REMOVAL ACTION ENDPOINT CRITERIA

The endpoint criteria define the conditions that must exist before the CERCLA action memorandum (EPA 2004) is considered complete. The time-critical action will be complete when all of the following criteria are demonstrated as being met for the LLW debris fraction of the RSW contained in drums, MLLW debris and radioactive lead solids fraction of the RSW contained in drums, and secondary wastes generated by waste retrieval operations:

- Retrieval of the LLW and MLLW fractions of RSW drums from Burial Ground 218-W-4C
- Treatment (as required) to meet the requirements of WAC 173-303-140 and 40 CFR 268
- Disposal of this waste at the ERDF or the MLLW trenches in the LLBG.

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