River Protection Project Functions and Requirements

Author Name:
D. A. Turner
B. E. Chamberlain and J. M. Colby
Richland, WA 99352
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Abstract: The document describes the River Protection Project mission and defines the upper-level functions that must be accomplished to complete the mission. The document identifies the programmatic constraints, as well as the upper-tier requirements, that must be met to achieve these functions.

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River Protection Project
Functions and Requirements

Authors:
Blake E. Chamberlain
Julie M. Colby
David A. Turner

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P.O. Box 850
Richland, Washington
EXECUTIVE SUMMARY

The purpose of the River Protection Project Functions & Requirements document (RPP F&R document) is to describe the River Protection Project (RPP) mission objectives, define the upper-level functions that must be conducted to accomplish the mission, and identify the upper-tier requirements that must be met to achieve these functions.

The RPP F&R document was developed using the systems engineering approach to define the mission, manage system functions and requirements, and establish bases for informed decision-making. The RPP Mission Functions (Figure ES-1) include the following:

- Manage Tank Waste
- Retrieve Tank Waste
- Process Tank Waste
- Dispose Tank Waste
- Manage System-Generated Waste & Excess Facilities

Figure ES-1. River Protection Project Mission Functions.

The RPP F&R document describes the current situation (RPP initial state), determines the desired outcome (RPP end state), and establishes the higher-level mission functions and requirements that will transform the initial state to the end state. The primary drivers for the mission and the boundary conditions and physical interfaces are defined. The RPP closure end state functions and requirements are only discussed in general terms. They will be further defined when the draft Tank Closure and Waste Management Environmental Impact Statement (TC & WM EIS) (DOE/EIS-0391, 2009) is finalized and the associated Record of Decision (ROD) published.
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LIST OF TERMS

Abbreviations and Acronyms

200E  200 East Area
200W  200 West Area
222-S 222-S Analytical Laboratory
ATL  Advanced Technologies and Laboratories, Inc.
BNI  Bechtel National, Inc.
CFR  Code of Federal Regulations
Cs  cesium
CY  calendar year
DOE  U.S. Department of Energy
DOE/EIS  Department of Energy Environmental Impact Statement
DNFSB  Defense Nuclear Facilities Safety Board
DST  double-shell tank
Ecology  Washington State Department of Ecology
EIS  environmental impact statement
ETF  Effluent Treatment Facility
EPA  U.S. Environmental Protection Agency
ERDF  Environmental Restoration Disposal Facility
F&R  functions and requirements
HEPA  high efficiency particulate air
HFFACO  Hanford Federal Facility Agreement and Consent Order
HLW  high-level waste
HSF  Hanford Shipping Facility
HWMA  State of Washington Hazardous Waste Management Act of 1976
ICD  interface control document
IDF  Integrated Disposal Facility
IHLW  immobilized high-level waste
IHS  Interim Hanford Storage
ILAW  immobilized low-activity waste
IMUST  inactive miscellaneous underground storage tank
LAW  low-activity waste
LERF  Liquid Effluent Retention Facility
LLW  low-level waste
MAR  Mission Analysis Report
MLLW  mixed low-level waste
MSA  Mission Support Alliance
MTG  metric tons glass
MUST  miscellaneous underground storage tank
Na    sodium
NEPA  National Environmental Policy Act
NRC   U.S. Nuclear Regulatory Commission
OCRWM Office of Civilian Radioactive Waste Management
ORP   U.S. Department of Energy, Office of River Protection
PRC   Plateau Remediation Contractor
RCRA  Resource Conservation and Recovery Act
RL    U.S. Department of Energy, Richland Operations Office
ROD   Record of Decision
RPP   River Protection Project
RPP F&R River Protection Project Functions & Requirements document
TC & WM EIS Tank Closure and Waste Management Environmental Impact Statement
SALDS State-Approved Land Disposal Site
SNF   spent nuclear fuel
Sr    strontium
SSC   systems, structures, and components
SST   single-shell tank
Tc    technetium
TC & WM Tank Closure and Waste Management
TEDF  Treated Effluent Disposal Facility
TPA   Tri-Party Agreement
TOC   Tank Operations Contract (or) Tank Operations Contractor
TRU   transuranic
TWINS Tank Waste Information Network System
WFD   Waste Feed Delivery
WIPP  Waste Isolation Pilot Plant
WIR   waste incidental to reprocessing
WMA   Waste Management Area
WRPS  Washington River Protection Solutions
WTP   Waste Treatment and Immobilization Plant

Units
Ci    curies
gal.  gallon
Mgal  million gallons
MT    metric ton
1.0 INTRODUCTION

The RPP F&R document describes the RPP mission and defines the upper-level functions\(^1\) that must be accomplished to complete the mission. The document identifies the programmatic constraints\(^1\), as well as the upper-tier requirements\(^1\), that must be met to achieve these functions.

This report describes the RPP initial state [RPP current situation as of calendar year (CY) 2012], the desired outcome (RPP end state circa CY 2052), and establishes the functions and requirements that will transform the initial state to the end state. The RPP functions and requirements were developed using the systems engineering approach defined in Attachment 2 of U.S. Department of Energy (DOE) O 413.3B, *Program and Project Management for the Acquisition of Capital Assets*, as “a proven, disciplined approach that supports management in clearly defining the mission or problem, managing system functions and requirements, identifying and managing risk, establishing bases for informed decision-making, and verifying products and services meet customer needs. The goal of the system engineering approach is to transform mission operational requirements into system architecture, performance parameters, and design details.”

Mission analysis reports DOE/ORP-2000-10, *River Protection Project Mission Analysis and Requirements Report* and HNF-SD-WM-MAR-008, *Tank Farm Contractor Mission Analysis Report*, were issued in 2001 and 2002, respectively. The functional analyses developed in these mission analysis reports provide the basis for the RPP functions in the current mission analysis report, RPP-RPT-41742, Rev. 1, *River Protection Project Mission Analysis Report*. This mission analysis report addresses RPP functions and requirements, and defines RPP mission architecture\(^1\) based on these functions and requirements.

RPP-RPT-41742, Rev. 1 is being updated. This will be accomplished by dividing RPP-RPT-41742, Rev. 1 subject matter into two documents. The first of these two documents is the present document (RPP-51303, Rev. 0, *River Protection Project Functions and Requirements*) which updates and replaces RPP functions and direct requirements.\(^1\) The second document (RPP-RPT-41742, Rev. 2, *River Protection Project Mission Analysis Report*) will update RPP mission architecture based on the RPP-51303 functions and direct requirements - and the derived requirements\(^1\) and enabling assumptions\(^1\) required to define mission architecture fully.

A key derived requirement to be addressed in RPP-RPT-41742, Rev. 2 is the technology development and optimization work required to efficiently and cost effectively execute the RPP mission.

The RPP mission is to retrieve and treat Hanford’s tank waste and close the tank farms to protect the Columbia River (ORP-11242, Rev. 6, *River Protection Project System Plan*, Executive Summary). The upper-level functions associated with this mission are shown in Figure 1-1. These functions were derived from DOE/ORP-2000-10 and HNF-SD-WM-MAR-008. Function descriptions are provided in Section 2.0.

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\(^1\) Refer to Appendix B, Glossary, for a definition of these terms.
The RPP work scope is currently performed by three primary contractors: Washington River Protection Solutions (WRPS), the Tank Operations Contractor (TOC); Bechtel National, Inc. (BNI), the Waste Treatment and Immobilization Plant (WTP) Construction and Commissioning Contractor; and Advanced Technologies and Laboratories, Inc. (ATL), the 222-S Analytical Laboratory Analytical Services and Testing Contractor (222-S).

WRPS is responsible for the following:

- The construction, operation, and maintenance activities necessary to store, retrieve, and transfer tank waste; for certifying and transferring tank waste to the WTP for treatment; for providing supplemental pretreatment, and treatment of tank waste;
- Transport and onsite disposal of immobilized low-activity waste (ILAW) packages;
- Treatment and packaging of potential contact-handled transuranic tank waste;
- Transport of potential contact-handled transuranic tank waste packages to onsite interim storage;
- Transport of immobilized high-level waste (IHLW) packages to onsite interim storage; for onsite interim storage of IHLW packages;
- Facilitating the transfer of potential contact-handled transuranic tank waste packages and IHLW packages to offsite disposal;
- Providing treatment and disposal of secondary gaseous and liquid waste streams;
- Providing packaging of secondary solid waste; for transport of secondary solid waste packages to onsite disposal;
- Operation and maintenance of the 222-S Analytical Laboratory Complex to support analysis activities performed by ATL;
- Providing closure actions for tank farms, waste management areas, and excess facilities; and
- Providing WTP support to the DOE, Office of River Protection (ORP).

BNI is responsible for the design, construction, and commissioning of the WTP Pretreatment Facility, two vitrification facilities (one for high-level waste [HLW] and one for low-activity waste [LAW]), a dedicated analytical and radiochemical laboratory, and supporting facilities to convert radioactive tank wastes into glass for long-term storage and final disposal.

The ORP continues to define the interface between the two major contractors in a series of interface documents. A primary interface document is 24590-WTP-ICD-MG-01-019, ICD-19-Interface Control Document for Waste Feed (ICD-19). Iterative updates to ICD-19 are
anticipated as new information is generated. Other key RPP interfaces are depicted in Figure 1-3, RPP Mission Boundary and Interfaces.

1.1 INITIAL STATE

The life cycle of the RPP mission, except for closure activities, is depicted in Figure 1-2. The RPP initial state (current condition) is approximately 55 million gallons of mixed radioactive and hazardous RCRA waste (Resource Conservation and Recovery Act of 1976 (RCRA), 42 USC 6901, et.seq.) stored in existing facilities assigned to WRPS, as depicted on the left hand side of Figure 1-2 (Storage). Refer to Section 3.0 of ORP-11242, Rev. 6 for details regarding the current condition of the RPP mission.

1.2 END STATE

The RPP end state is driven by the need to protect the public and the environment. The end state is depicted on the right hand side of Figure 1-2 (Disposal). In general, the end state for the RPP mission is as follows (DOE/ORP-2000-10, River Protection Project Mission Analysis and Requirements Report, Section 2.4; DE-AC27-08RV14800, Tank Operations Contract, Section C.2.4.5):

- Single-shell tanks (SSTs), double-shell tanks (DSTs), and ancillary storage systems\(^2\) retrieved to the extent necessary for closure.
- Tank farms and Waste Management Areas\(^3\) (WMAs) closed.
- Immobilized High-Level Waste placed in long-term interim storage pending determination of a final disposal pathway.
- Immobilized Low-Activity Waste permanently disposed onsite.
- Potential contact-handled transuranic tank waste\(^4\) placed in interim storage pending determination of a final disposal pathway.
- Processing and treatment facilities (e.g. WTP) closed.

The RPP end state will be further defined by the Tank Closure and Waste Management (TC & WM) Environmental Impact Statement (EIS) and associated Record of Decision (ROD). The draft EIS (DOE/EIS-0391) provides a comprehensive and integrated look at near-term waste management and tank waste cleanup actions at Hanford. The final TC & WM EIS, scheduled to be issued during the latter part of CY 2012, will form the basis for making important decisions about Hanford’s cleanup. These decisions include:

- Treatment and disposal of tank wastes
- Supplemental treatment processes for tank wastes
- Final condition of the 177 underground tanks that store radioactive waste
- Residual tank inventories (final waste retrieval requirements)

\(^2\) Ancillary storage systems include miscellaneous underground storage tanks (MUSTs), inactive miscellaneous underground storage tanks (IMUSTs), catch tanks, double-contained receiver tanks, and other equipment associated with tank farm operations

\(^3\) A Waste Management Area includes a tank farm or group of tank farms and adjacent ancillary facilities.

\(^4\) A formal WIR determination by DOE in accordance with DOE O 435.1, Radioactive Waste Management, will be required to designate potential contact-handled transuranic tank waste as contact-handled transuranic tank waste. As appropriate, “potential contact-handled transuranic tank waste” is used in this document.
• Onsite disposal alternatives for low-level waste (LLW) and mixed low-level waste (MLLW)
• Closure actions for tank farm waste management areas
• Remediation actions for ancillary equipment and contaminated soil
• A cumulative analysis of site-wide environmental impacts, including impacts to groundwater.
Figure 1-2. River Protection Project Process Flow Diagram.
1.3 RIVER PROTECTION PROJECT MISSION BOUNDARY AND INTERFACES

Figure 1-3 shows the RPP mission boundary and interfaces. The major off-site interfaces are the IHLW final disposal pathway and the potential contact-handled transuranic tank waste final disposal pathway. The primary onsite interfaces for the RPP include the Integrated Disposal Facility (IDF), Liquid Effluent Retention Facility/Effluent Treatment Facility (LERF/ETF) [until they become part of the RPP System in 2015], and solid secondary waste disposal facilities.

Infrastructure interfaces include Utilities, Fire Protection, Safeguards and Security and Transportation Services provided by the U.S. Department of Energy, Richland Operations Office (RL) through the Mission Support Alliance (MSA) contractor.

During the RPP mission, the TOC will provide infrastructure support and waste feed to the WTP. The TOC will receive ILAW/IHLW packages and spent and failed melters from the WTP. The TOC and WTP contracts contain requirements for an effective TOC/WTP working interface.

Figure 1-3. RPP Mission Boundary and Interfaces.
2.0 RIVER PROTECTION PROJECT FUNCTIONS AND REQUIREMENTS

RPP functions and requirements were developed using the systems engineering approach defined in Attachment 2 of DOE O 413.3B, Program and Project Management for the Acquisition of Capital Assets. The objective of the system engineering approach is to clearly describe mission goals and define the functions that must be performed to transform the initial state of the mission (current situation) into the mission end state (desired outcome). Mission functions define “what” must be accomplished. Mission requirements define “how well” the mission functions must be performed. Mission constraints reflect external restrictions on how the mission may be executed (e.g. in compliance with Federal laws and regulations, DOE Orders, State administrative codes, etc.).

Each upper-level mission function is progressively decomposed (broken down) into a hierarchy of lower-level functions. The lower-level functions (e.g. a necessary and sufficient set of lower-level functions) collectively ensure the successful performance of the upper-level function. Mission requirements are allocated to each function defined during the functional analysis decomposition, subject to mission constraints. Mission requirements quantify how the functions must perform. Mission functions and requirements ultimately define mission architecture [e.g. the systems, structures, and components (SSCs) required to successfully execute the mission].

Proper execution of the systems engineering functions and requirements analysis assures that all mission functions and requirements are correctly identified, defined, and traceable.

Mission requirements addressed in this document (RPP-51303) are “direct” requirements (requirements directly traceable to a constraint, contractual commitment, interface control document, etc.). Other requirements that drive mission architecture are derived requirements (requirement not directly traceable to a single source, but derivable as a logical corollary of two or more constraints or direct requirements), or enabling assumptions (a logical deduction regarding mission architecture in the absence of an applicable direct or derived requirement). A companion document, RPP-RPT-41742, Rev. 2, River Protection Project Mission Analysis Report, will define RPP mission architecture based on the RPP functions and direct requirements in RPP-51303 and will address the derived requirements and enabling assumptions necessary to identify mission architecture fully. Refer to Appendix B, Glossary, for a definition of selected terms.

This document (RPP-51033) addresses upper-level mission functions and upper-tier mission requirements, and provides a starting point for the development of lower-level mission functions and requirements. The lower-level mission functions and requirements include system (Level 1) specifications, sub-system (Level 2) specifications, and ultimately the specifications for individual projects (e.g. specifications for the SSCs needed to execute the mission).

An overarching RPP mission requirement is that Hanford Site tank waste remediation shall be conducted in a safe, compliant manner and meet all applicable requirements of:

- 10 CFR 830, “Nuclear Safety Management”
- 10 CFR 835, “Occupational Radiation Protection”
- 10 CFR 851, “Worker Safety and Health Program”, and
• 40 CFR 61, “National Emission Standards for Hazardous Air Pollutants” as well as other applicable federal and state environmental regulations.

A number of key RPP mission requirements have yet to be fully defined and definition of these requirements is expected to evolve with time. Defense Nuclear Facilities Safety Board (DNFSB) Recommendation 2010-2, *Pulse Jet Mixing at the Waste Treatment Plant*, was issued on December 17, 2010. The recommendation addresses safety concerns related to the WTP’s pulsejet mixing system and the need to ensure that the WTP, in conjunction with the Hanford tank farm waste feed delivery (WFD) system, operates safely and effectively during the RPP mission’s 40 year operating life. In response to DNFSB Recommendation 2010-2, DOE issued an implementation plan on November 10, 2011 with the objective of investigating and mitigating the identified safety issues (DNFSB Rec. 2010-2, Rev. 0, Nov. 10, 2011). Work conducted under this implementation plan will likely have a significant impact on the WTP’s waste acceptance criteria and, in turn, the TOCs WFD plans. In particular, tank farm architecture, needed to ensure compliance with WTP waste acceptance criteria, will evolve as work identified in the implementation plan is completed.

Examples of other key RPP mission requirements that have yet to be fully defined include the following:

• DOE/EIS-0391, *Draft Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington (TC & WM EIS)* has yet to be finalized and a ROD published. The TC & WM EIS will provide a basis for making major decisions about the Hanford Site tank waste remediation mission, including decisions regarding retrieval, treatment, and disposal of waste from 149 SSTs and 28 DSTs and closure of the associated WMAs. (ORP-11242, Rev. 6, *River Protection Project System Plan*, Section 2.1).

• BNI has been directed to rebaseline the WTP project assuming a flat funding profile. The new project baseline, if implemented, might delay the date that the WTP Facility is commissioned. This could conceivably impact the project’s ability to successfully meet one or more Tri-Party Agreement (Ecology, EPA and DOE, 1989) or Consent Decree (Consent Decree, 2010, State of Washington v. DOE, Case No. 08-5085-FVS (October 25) Eastern District of Washington) milestones.

• A decision to proceed with direct LAW feed and/or direct HLW feed\(^5\) to the WTP, to offset the impact of a delay in Pretreatment Facility commissioning, would likely lead to the emergence of significant new requirements not addressed in this document.

• Future updates of 24590-WTP-RPT-PE-12-001, Rev 0, *2012 WTP Tank Utilization Assessment*, might drive new or revised mission requirements, particularly requirements related to the capacity of a Second LAW Facility.

• A decision regarding the need for supplemental waste pretreatment\(^6\) capacity will be made in the future (ORP-11242, Section 3.2.3)

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\(^5\) “Direct LAW feed” involves the transfer of a LAW feed stream directly to the WTP LAW Vitrification Facility, by-passing the WTP Pretreatment Facility. LAW pretreatment that would otherwise be provided by the WTP Pretreatment Facility (solid-liquid separation and \(^{137}\)Cs ion exchange) would be performed in modified Tank Farm facilities. “Direct HLW feed” involves the transfer of a HLW feed stream directly to the WTP HLW Vitrification Facility, by-passing the WTP Pretreatment Facility. Limited HLW pretreatment (adjustment of weight per cent solids in the feed stream) would be performed in Tank Farms.

\(^6\) Refer to Appendix B, Glossary, for a definition of terms.
• Decisions regarding the waste form and capacity of supplemental treatment\(^6\) (e.g. Second Low-Activity Waste Facility) will be made in the future (ORP-11242, Section 3.2.3).

A key RPP mission constraint is a “waste incidental to reprocessing (WIR)” determination by DOE in compliance with DOE O 435.1, *Radioactive Waste Management*, and the requirements defined in the accompanying DOE M 435.1-1, *Radioactive Waste Management Manual*, and DOE G 435.1-1, *Implementation Guide for Use with DOE M 435.1-1*. A favorable WIR determination would allow DOE to classify large volumes of decontaminated chemical waste as not “highly radioactive”, as defined in the *Nuclear Waste Policy Act of 1982* (NWPA). If key radionuclides are removed from decontaminated chemical waste to the maximum extent technically and economically practicable, the waste is not “highly radioactive” and DOE could determine the waste to be LAW and manage it accordingly (e.g. the waste could be disposed in compliance with applicable land disposal requirements).

The WTP flowsheet, which includes solid-liquid separation and removal of $^{137}$Cs by ion exchange for waste pretreatment, is designed to ensure that key radionuclides are removed from the LAW stream to the maximum extent technically and economically practicable. However, an official WIR determination by DOE, in consultation with the NRC, will be required prior to beginning onsite disposal of ILAW. Refer to Section 2.3 of ORP-11242 for a summary of the WIR determination process.

The WIR determination by DOE is a Government Furnished Service or Information (GFSI). The TOC may provide technical support to DOE to assist in the WIR determination, but the TOC is not an approving entity in this process.

The functional hierarchy (Figure 2-1) depicts the functions for the entire RPP life cycle. The top level of the mission consists of five functions:

1. Manage tank waste
2. Retrieve tank waste
3. Process tank waste
4. Dispose tank waste
5. Manage system-generated waste and excess facilities.

All sub-functions are grouped within one of these five functions, as shown on the functional hierarchy. The following sections describe RPP mission functions. Requirements for each function are included in Appendix A.
2.1 MANAGE TANK WASTE

*Perform activities to safely and efficiently store, move, concentrate, characterize and monitor tank waste.*

Management of tank waste is critical to success of the RPP mission. Sub-functions include:

- Store waste
- Move waste
- Concentrate waste
- Characterize waste
- Monitor waste.

2.1.1 Store Waste

*Perform activities to safely and efficiently store tank waste.*

Tank waste is stored in 149 SSTs, 28 DSTs, and ancillary storage facilities within either the 200E or 200W operating areas. The *STORE WASTE* sub-function includes storage of waste in the 200E and 200W operating areas, but does not include storage activities associated with waste processing and immobilization within the WTP. Stored waste includes:

- The existing DST waste inventory,
- The existing SST and ancillary storage systems waste inventories, and
• New liquid waste generated during the mission life of the tank farms (newly generated waste does not include tank retrieval wastes).

Within the RETRIEVE WASTE function, waste will be removed from the SSTs and ancillary storage facilities, then consolidated with existing wastes already stored in the DST system pending transfer to the PROCESS WASTE function. DST storage also allows for settling of sludge slurry and for excess liquid to be decanted.

Requirements included under the STORE WASTE sub-function are provided in Appendix A-1.

2.1.2 Move Waste

Provide capability to transfer supernate, waste solids, and interstitial liquids.

The MOVE WASTE sub-function is restricted to movements of waste within the DST system and does not include retrieval and transfer of wastes from SSTs and ancillary storage facilities into the DST system. Sub-functions include:

• Move DST waste
• Move newly generated wastes
• Move concentrated waste.

The MOVE WASTE sub-function uses pumps, pits and jumpers, and pipelines to move wastes safely between DSTs in the 200E and 200W Areas and from 200W to 200E via the replacement cross-site transfer system. Waste movement is initiated, as necessary, to mitigate safety issues and to collect and move dilute waste into the DST system as it is generated at the 222-S Analytical Laboratory. It includes transferring supernate and concentrated wastes between DSTs and to/from the 242-A Evaporator to optimize DST tank space.

Wastes may be moved through transfer pipelines or over surface roads in tanker vehicles. The same pipelines that are used to MOVE WASTE may also be used to RETRIEVE WASTE from SSTs.

The MOVE WASTE sub-function will exist as long as waste remains in DST storage, wastes destined for DST storage are newly generated by Hanford facilities, or the 242-A Evaporator is still functioning.

Requirements included under the MOVE WASTE sub-function are provided in Appendix A-1.

2.1.3 Concentrate Waste

Remove excess water from DST supernate to reduce dilute waste volume, maximize use of available tank space, and manage the concentration of sodium in waste feed delivered to the WTP.

Concentration of waste is essential to the success of the RPP mission. Concentration is employed to manage the DST space necessary to continue SST waste retrievals and to manage the sodium (Na) concentration in the liquid waste feed delivered to the WTP. The CONCENTRATE WASTE sub-function is currently being performed and will continue until waste treatment activities eliminate the need for concentration.
Requirements included under the *CONCENTRATE WASTE* sub-function are provided in Appendix A-1.

### 2.1.4 Characterize Waste

*Describe tank waste in terms of its physical, chemical, and radiological compositions; acquire sample material; transport samples to an analytical laboratory; and supply analytical data to support the safe storage of the waste.*

The *CHARACTERIZE WASTE* sub-function provides data of known and sufficient quality and quantity to enable necessary, defensible programmatic decisions and reduction of safety, technical, and programmatic risks.

The *CHARACTERIZE WASTE* sub-function includes waste characterization activities essential to completion of the RPP mission:

- Characterize waste in DST system to support safe storage of waste,
- Characterize waste in DST system to support certification of waste feed to be delivered to the WTP,
- Characterize waste in Waste Group A tanks to support waste remediation,
- Characterize waste in tanks AN-102 and AN-107 to support treatment of complexed (solvated) strontium (Sr) and transuranic (TRU) constituents,
- Characterize waste in AZ-101 to support remediation of high heat sludge,
- Characterize waste in DST system to support remediation of high uranium content waste,
- Characterize waste in DST system to support remediation of high zirconium content waste,
- Characterize waste in SSTs to support safe storage of waste,
- Characterize waste in SSTs to support retrieval of waste,
- Characterize waste in ancillary storage systems to support safe storage of waste,
- Characterize waste in ancillary storage systems to support retrieval of waste, and
- Characterize waste in SSTs to support retrieval and processing of potential contact-handled transuranic tank waste.

Samples of waste (e.g., grab and core samples) are transported to the laboratory. Analytical laboratory results and tank characterization reports are used to update the tank waste information network system (TWINS) database.

Specific tank characterization efforts are considered complete only when identified information requirements or sample material needs have been met. Characterization activities may extend until the completion of waste retrieval and disposal mission activities.

Requirements included under the *CHARACTERIZE WASTE* sub-function are provided in Appendix A-1.

### 2.1.5 Monitor Waste

*Conduct field observations, instrument monitoring, and assessment of analytical results to maintain integrity of storage and transfer facilities.*
Monitoring activities include, but are not limited to, visual and remote inspections of underground tanks and pipelines, corrosion monitoring, dome deflection surveys, surveillance using liquid observation wells and drywell monitoring, temperature/pressure monitoring, performance of material balances during retrieval, transfer route monitoring, leak detection, and monitoring, and geophysical surveys.

Requirements included under the MONITOR WASTE sub-function are provided in Appendix A-1.

2.2 RETRIEVE TANK WASTE

Remove, to the maximum extent practical, all the waste from an underground storage tank.

Liquid and solid phases of wastes (e.g., supernate, sludge, salt cake and interstitial liquids) are removed from tank storage. Retrieved wastes from SSTs and ancillary storage systems are transferred to the DST system. Waste from DSTs are mobilized and transferred into the PROCESS WASTE function. Tank retrieval functions are further defined by tank type to reflect the different equipment architecture(s) necessary to recover the wastes. Sub-functions include:

• Remove SST waste
• Remove potential contact-handled transuranic tank waste
• Remove ancillary storage systems waste
• Deliver waste feed.

2.2.1 Remove Single-Shell Tank Waste

Remove wastes from SSTs to the extent required for turnover of the tanks to closure.

A variety of waste retrieval techniques will be deployed; the particular technique used in a given tank will depend on the nature of the waste, tank integrity, tank design, and the presence or absence of internal obstructions. Sub-functions include:

• Remove readily mobilized SST waste
• Remove waste from SST assumed leakers
• Remove SST waste heel.

Remove readily mobilized SST waste – Bulk-retrieve SST waste by dissolution/sluicing at waste surfaces to produce slurry that can be pumped and transferred to a DST. The liquid used to dissolve/sluiice the SST waste may be DST supernate or water. With the large quantities of liquid used for dissolution, this technique is reserved for use at SSTs with sufficient integrity to contain liquids.

Remove waste from SST assumed leakers – Retrieve wastes from SSTs that are suspected/assumed to lack the integrity to prevent liquid from leaking to the environment using a batch retrieval process in which only limited amounts of liquid are accumulated in the tank to mobilize and transfer the waste.

Remove SST waste heel – Remove the hard-to-remove heel that has been encountered in most SSTs in which retrieval has progressed to near the tank bottom, to the extent necessary for turnover of the tanks to closure. A variety of techniques may be necessary to retrieve the waste...
heel and may include continuation of bulk retrieval at a slower pace, retrieval with in-tank tools (e.g., mobile arm), chemical dissolution, or enhanced chemical cleaning.

Requirements included under the REMOVE SST WASTE sub-function are provided in
Appendix A-2.

2.2.2 Remove Potential Contact-Handled Transuranic Tank Waste

Remove wastes to the extent required for turnover of the tanks to closure from up to 11 SSTs that have been identified as potentially containing contact-handled transuranic tank waste.

Potential contact-handled transuranic tank waste will be removed using the same suite of retrieval technologies discussed in Section 2.2.1, but the waste streams are to be transferred directly to a supplemental transuranic treatment facility for processing.

The REMOVE POTENTIAL CONTACT-HANDLED TRANURANIC TANK WASTE sub-function delivers potential contact-handled transuranic tank waste feed to the PROCESS POTENTIAL CONTACT-HANDLED TRANURANIC TANK WASTE function.

Requirements included under the REMOVE POTENTIAL CONTACT-HANDLED TRANURANIC TANK WASTE sub-function are provided in
Appendix A-2.

2.2.3 Remove Ancillary Storage System Waste

*Remove and transfer wastes from ancillary storage systems to the extent required for turnover of the tanks to closure.*

Ancillary storage systems include MUSTs, IMUSTs, catch tanks, double-contained receiver tanks, and other equipment associated with tank farm operations. Wastes removed from ancillary storage systems will be transferred to the DST system by pipeline or tanker truck, or disposed by other approved treatment and disposal systems.

Requirements included under the *REMOVE ANCILLARY STORAGE SYSTEM WASTE* sub-function are provided in
Appendix A-2.

2.2.4 Deliver Waste Feed

Provide for the staging, preparation, and delivery of feed into the PROCESS WASTE function.

The DELIVER WASTE FEED sub-function must support WTP processing production rates by providing sufficient waste feed to keep the vitrification facilities operating at the required capacity. This sub-function must also provide for the characterization of waste to support certification, as well as the mixing of feed, as needed, to ensure compliance with constraints on feed parameters. Sub-functions include:

- Remove stored waste from DSTs (includes retrieved SST and ancillary storage system waste in DST storage)
- Remediate waste (if necessary)
- Prepare and transfer LAW feed
- Prepare and transfer HLW feed.

This function transfers liquid supernate and sludge from the DSTs to the WTP feed receipt vessels. Low-Activity Waste feed that conforms to contract specifications of ICD-19 (24590-WTP-ICD-MG-01-019, ICD-19-Interface Control Document for Waste Feed) is prepared and certified. This may entail remediation actions for Waste Group A tanks and treatment of tank AN-102 and AN-107 supernatant to remove complexed (solvated) Sr and TRU constituents. Certified LAW feed is transferred to the PROCESS WASTE function. HLW feed that conforms to contract specifications of ICD-19 (24590-WTP-ICD-MG-01-019) is prepared and certified. This may entail remediation of the high heat sludge contained in AZ-101, blending of high uranium content waste from tank C-104, and blending of high zirconium content wastes in tanks AW-103 and AW-105. Certified HLW feed is transferred to the PROCESS WASTE function. Sampling and analysis of waste feed is included in this function.

The DELIVER WASTE FEED sub-function rectifies problems related to out-of-specification feed.

This function does not include final waste removal from DSTs to meet tank closure requirements.

Requirements included under the DELIVER WASTE FEED sub-function are provided in

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7 Removal of complexed (solvated) Sr and TRU constituents in the Envelope C waste stored in tanks AN-102 and AN-107 is required to ensure that the resultant ILAW complies with WTP contractual requirements; this ensures that the ILAW meets WIR requirements in accordance with DOE M 435.1-1, Radioactive Waste Management Manual.
Appendix A-2.

2.3 PROCESS TANK WASTE

Process tank waste retrieved from DSTs, SSTs, and ancillary storage systems and convert HLW, LAW and potential contact-handled transuranic tank waste into waste forms suitable for disposal in compliance with applicable Federal, State, and local requirements, including environmental permits and other regulatory approvals and authorizations.

Sub-functions include:

- Pretreat waste
- Immobilize HLW
- Immobilize LAW
- Process potential contact-handled transuranic tank waste.

The PROCESS TANK WASTE function is initiated when staged waste feed is delivered and accepted at the WTP or a supplemental treatment facility, and will continue until all waste is treated, containerized, and placed in interim storage or disposal status. Solidified waste generated by processing facilities will be transferred for disposition under the DISPOSE TANK WASTE function. Liquid waste generated by processing facilities will either be recycled within the PROCESS TANK WASTE function or transferred to the MANAGE SYSTEM-GENERATED WASTE AND EXCESS FACILITIES function. Processing facilities, when no longer needed to support the PROCESS TANK WASTE function, will be turned over to the MANAGE SYSTEM-GENERATED WASTE AND EXCESS FACILITIES function for deactivation, decontamination, decommissioning, and demolition.

2.3.1 Pretreat Waste

2.3.1.1 WTP Pretreatment Facility

Receive both HLW feed and LAW feed from the DST system; concentrate dilute waste; separate solids from liquid phases; perform caustic and oxidative leaching, as needed, to enhance processing efficiency; separate waste streams into a HLW fraction and a LAW fraction; transfer the HLW and LAW feeds to the appropriate immobilization facility; and receive and process recycle streams.

Pretreatment will begin when tank waste is transferred to the WTP from the DST system and will continue until all wastes have been prepared as feed for HLW or LAW immobilization.

Requirements included under the PRETREAT WASTE (WTP Pretreatment Facility) sub-function are provided in

8 Early startup of HLW and/or LAW immobilization may require the return of some secondary liquid waste to the DST system (e.g. the MANAGE WASTE function) since the WTP Pretreatment Facility is assumed not to be available. This represents an exception to normal operations in which secondary liquid waste is either be recycled within the PROCESS TANK WASTE function or transferred to the MANAGE SYSTEM-GENERATED WASTE AND EXCESS FACILITIES function.
Appendix A-3.

2.3.1.2 Supplemental Pretreatment

*Receive LAW feed from the DST system; separate solids from liquid phases; perform waste pretreatment, as needed, to meet immobilization facility waste acceptance criteria. Receive and process recycle streams*  

Pretreatment will begin when tank waste is transferred to supplemental pretreatment from the DST system and will continue, as needed, until all wastes have been prepared as feed for LAW immobilization.

Requirements included under the *PRETREAT WASTE* sub-function (Supplemental Pretreatment) are provided in

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9 There is not a supplemental pretreatment requirement at the present time. Whether supplemental pretreatment (if required) would be designed to receive and process its recycle streams, or transfer these recycle streams to the WTP Pretreatment Facility for processing, is a future RPP mission architectural decision.
2.3.2 Immobilize High-Level Waste

*Receive and immobilize pretreated HLW and selected radionuclides (from pretreatment solids separation and $^{137}$Cs ion exchange) in borosilicate glass waste form, seal the immobilized waste into primary disposal containers, decontaminate the container outer surfaces, and test the integrity of the sealed containers, certify the waste, and transfer for interim storage pending determination of a final disposal pathway.*

The IHLW will be certified for acceptance into the Office of Civilian Radioactive Waste Management (OCRWM) system. The IHLW waste containers will be loaded in a transport vehicle for transfer to interim storage under the MANAGE SYSTEM-GENERATED WASTE AND EXCESS FACILITIES function.

Requirements included under the IMMOBILIZE HLW sub-function are provided in Appendix A-3.

2.3.3 Immobilize Low-Activity Waste

2.3.3.1 WTP LAW Facility

*Receive and immobilize the LAW fraction of the waste in borosilicate glass, package the waste such that disposal facility waste acceptance criteria are met, and transfer waste packages for final disposal.*

The ILAW glass will be poured into stainless steel packages that are acceptable for onsite disposal. The ILAW waste package is loaded in a transport vehicle for transfer to the DISPOSE WASTE function for final disposal.

Requirements included under the IMMOBILIZE LAW (WTP LAW facility) sub-function are provided in
Appendix A-3.

2.3.3.2 Second Low-Activity Waste Facility

Design, permit, procure, construct, and operate supplemental treatment facilities to augment immobilization, processing capacities as needed to accelerate mission completion. Receive and immobilize the LAW fraction of the waste in borosilicate glass or an alternate waste form, package the waste such that disposal facility waste acceptance criteria are met, and transfer waste packages for final disposal.

Alternate waste forms are packaged to meet the acceptance criteria for the selected disposal method. The ILAW waste package is loaded in a transport vehicle for transfer to the DISPOSE WASTE function for final disposal.

Requirements included under the IMMobilize LAW (Second Low-Activity Waste Facility) sub-function are provided in Appendix A-3.

2.3.4 Process Potential Contact-Handled Transuranic Tank Waste

Process retrieved potential contact-handled transuranic tank waste to remove water from the retrieved sludge, and package the dried product, which will be stored at the Central Waste Complex pending determination of a final disposal pathway.

Requirements included under the PROCESS POTENTIAL CONTACT-HANDED TRANSURANIC TANK WASTE sub-function are provided in
Appendix A-3.

2.4 DISPOSE TANK WASTE

Dispose IHLW pending determination of a final disposal pathway; dispose potential contact-handled transuranic tank waste pending determination of a final disposal pathway; and dispose ILAW and secondary waste onsite in compliance with regulatory requirements and disposal facility waste acceptance criteria.

Sub-functions include:

- Dispose IHLW
- Dispose potential contact-handled transuranic tank waste
- Dispose ILAW
- Dispose secondary waste.

Disposal will begin when waste is accepted for disposal and will continue until all wastes have been placed in a compliant final disposal configuration.

2.4.1 Dispose Immobilized High-Level Waste

Receive IHLW canisters at the Hanford Shipping Facility (HSF); temporarily store IHLW canisters at the HSF pending shipment offsite; place IHLW canisters into casks; and load casks on transport vehicles for shipment offsite to a final disposal pathway.

Immobilized High-Level Waste disposal is not an RPP function. Immobilized High-Level Waste disposal will be performed by the OCRWM. A final disposal pathway (offsite repository) for IHLW packages has yet to be identified. The HSF will receive IHLW canisters from Interim Hanford Storage (IHS), place the canisters into shipping casks, and load the casks onto transport vehicles for offsite shipment.

Requirements included under the DISPOSE IHLW sub-function are provided in Appendix A-4.

2.4.2 Dispose Potential Contact-Handled Transuranic Tank Waste

Place potential contact-handled transuranic tank waste packages into shipping containers, and load shipping containers onto transport vehicles for offsite shipment.

Disposal of potential contact-handled transuranic tank waste is not an RPP function. Potential contact-handled transuranic tank waste disposal will be performed by the operator of the final disposal pathway. A final disposal pathway for potential contact-handled transuranic tank waste has yet to be identified.

Requirements included under the DISPOSE POTENTIAL CONTACT-HANDLED TRANSURANIC TANK WASTE sub-function are provided in Appendix A-4.

2.4.3 Dispose Immobilized Low-Activity Waste

Receive ILAW canister transport vehicles; off-load ILAW canisters from the transport vehicle; prepare ILAW canisters for disposal; and place ILAW canisters in a permitted disposal cell at the onsite disposal facility.
2.4.4 Dispose Secondary Waste

Accept secondary wastes generated by the MANAGE TANK WASTE, RETRIEVE TANK WASTE, and PROCESS TANK WASTE functions, dispose in a permitted disposal facility, or discharge treated effluents to the environment.

Sub-functions include:

- Dispose gaseous effluents
- Dispose secondary liquid waste
- Dispose secondary solid waste.

Dispose Gaseous Effluents – Gaseous effluents will be treated at the respective processing facilities for compliance with Hanford air permits and released to the atmosphere.

Dispose Secondary Liquid Waste – Liquid effluents not requiring treatment will be discharged to the Treated Effluent Disposal Facility (TEDF). Contaminated liquid effluents will be treated in the Effluent Treatment Facility (ETF) in the MANAGE SYSTEM-GENERATED WASTE AND EXCESS FACILITIES function prior to discharge at the State-Approved Land Disposal Site (SALDS).

Dispose Secondary Solid Waste – Secondary solid waste that meets the waste acceptance criteria for Hanford solid waste will be disposed onsite. Secondary solid waste includes, but is not limited to, spent ion-exchange resin, spent activated carbon beds, high efficiency particulate air (HEPA) filters, spent catalyst, failed contaminated equipment, and ETF solid waste. Spent and failed HLW and LAW vitrification melters will be transferred to a permitted onsite disposal facility for disposal. Disposal at licensed off-site facilities may be used for solid wastes, if technically feasible and cost-effective.

Requirements included under the DISPOSE SECONDARY WASTE sub-function are provided in Appendix A-4.

2.5 MANAGE SYSTEM-GENERATED WASTE AND EXCESS FACILITIES

Prepare and certify system-generated waste for transfer to interfacing disposal facilities; close tanks, tank farms, ancillary facilities and associated waste management areas; and deactivate, isolate, and close excess facilities and processing facilities.

Sub-functions include:

- Manage IHLW
- Manage potential contact-handled transuranic tank waste
- Manage ILAW
- Manage secondary waste
- Close tanks, WMAs and facilities.

Solid and liquid wastes are prepared to meet waste acceptance criteria and transferred to the DISPOSE TANK WASTE function. Processing facilities, when no longer needed to support the
PROCESS TANK WASTE function, will be turned over to the MANAGE SYSTEM-GENERATED WASTE AND EXCESS FACILITIES function for closure.

The MANAGE SYSTEM-GENERATED WASTE AND EXCESS FACILITIES function will continue until system-generated waste is no longer received from sources external to tank farm operations, solid and liquid wastes have been placed in a disposal facility in a compliant final disposal configuration, and storage and processing facilities have been closed.

2.5.1 Manage Immobilized High-Level Waste

Accept sealed canisters of IHLW from the HLW vitrification facility and transport the canisters to an interim storage facility; maintain safe, compliant storage of IHLW canisters pending determination of a final disposal pathway.

IHLW will be stored and monitored at IHS pending determination of a final disposal pathway. The IHLW canisters will eventually be retrieved and transferred to the HSF for offsite shipment.

Requirements included under the MANAGE IHLW sub-function are provided in Appendix A-5.

2.5.2 Manage Potential Contact-Handled Transuranic Tank Waste

Accept sealed containers of potential contact-handled transuranic tank waste from the supplemental transuranic treatment facility; transport the containers to the Central Waste Complex for interim storage; maintain safe, compliant storage of the potential contact-handled transuranic tank waste containers pending determination of a final disposal pathway.

Potential contact-handled transuranic tank waste containers will be stored and monitored at the Central Waste Complex pending determination of a final disposal pathway. The potential contact-handled transuranic tank waste containers will eventually be retrieved from storage and disposed via the final disposal pathway.

Requirements included under the MANAGE POTENTIAL CONTACT-HANDELTRANURANIC TANK WASTE sub-function are provided in Appendix A-5.

2.5.3 Manage Immobilized Low-Activity Waste

Accept sealed canisters of ILAW from a LAW immobilization facility, and transport the ILAW canisters from the LAW immobilization facility to a permitted onsite disposal facility.

Requirements included under the MANAGE ILAW sub-function are provided in Appendix A-5.

2.5.4 Manage Secondary Waste

Treat gaseous effluents generated during RPP mission operations for release to the atmosphere. Prepare liquid and solid secondary wastes generated during RPP mission operations to meet onsite disposal facility waste acceptance criteria.

Gaseous effluents will be treated at the respective processing facilities for compliance with Hanford air permits.
Liquid effluents not requiring treatment will be transferred to the Treated Effluent Disposal Facility (TEDF). Effluents requiring treatment (e.g., 242-A Evaporator condensate and WTP effluents) will be transferred to the Liquid Effluent Retention Facility (LERF) in preparation for treatment in the ETF.

Secondary solid wastes will be stabilized and packaged in compliance with onsite disposal facility waste acceptance criteria.

Requirements included under the MANAGE SYSTEM-GENERATED WASTE sub-function are provided in Appendix A-5.

2.5.5 Close Tanks and Waste Management Areas

Deactivate, isolate, interim close, and close WMAs per applicable regulations, and remediate contaminated soils, as required, from pipeline runs and past-practice waste management units.

The extent of closure activities will be identified in the RCRA permit after it has been modified to reflect the decisions made in the final TC & WM EIS Record of Decision. Development of post-closure monitoring activities to extend beyond the completion of disposal and closure activities is included in this sub-function.

Requirements included under the CLOSE TANKS AND WASTE MANAGEMENT AREAS sub-function are provided in Appendix A-5.

2.5.6 Close Facilities

Deactivate and isolate ancillary equipment and transfer structures, as well as deactivate, decontaminate, decommission, and demolish tank farm structures, treatment facilities, and ancillary structures used during the tank-waste remediation mission.

The extent of closure activities will be identified in the RCRA permit after it has been modified to reflect the decisions made in the TC & WM EIS Record of Decision. Development of post-closure monitoring activities to extend beyond the completion of disposal and closure activities is included in this sub-function.

Requirements included under the CLOSE FACILITIES sub-function are provided in Appendix A-5.
3.0 REFERENCES


Defense Nuclear Facilities Safety Board (DNFSB) Recommendation 2010-2, *Pulse Jet Mixing at the Waste Treatment Plant*


APPENDIX A. FUNCTIONS AND REQUIREMENTS
### LIST OF TERMS

**Abbreviations and Acronyms**

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CFR</td>
<td>Code of Federal Regulations</td>
</tr>
<tr>
<td>Cs</td>
<td>cesium</td>
</tr>
<tr>
<td>DOE</td>
<td>U.S. Department of Energy</td>
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<tr>
<td>DNFSB</td>
<td>Defense Nuclear Facilities Defense Board</td>
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<tr>
<td>DST</td>
<td>double-shell tank</td>
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<tr>
<td>Ecology</td>
<td>Washington State Department of Ecology</td>
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<tr>
<td>EIS</td>
<td>environmental impact statement</td>
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<tr>
<td>ETF</td>
<td>Effluent Treatment Facility</td>
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<tr>
<td>HFFACO</td>
<td>Hanford Federal Facility Agreement and Consent Order</td>
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<tr>
<td>HLW</td>
<td>high-level waste</td>
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<tr>
<td>HSF</td>
<td>Hanford Shipping Facility</td>
</tr>
<tr>
<td>HWMA</td>
<td>State of Washington Hazardous Waste Management Act of 1976</td>
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<tr>
<td>ICD</td>
<td>interface control document</td>
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<tr>
<td>IDF</td>
<td>Integrated Disposal Facility</td>
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<tr>
<td>IHLW</td>
<td>immobilized high-level waste</td>
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<tr>
<td>ILAW</td>
<td>immobilized low-activity waste</td>
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<tr>
<td>HIS</td>
<td>Interim Hanford Storage</td>
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<tr>
<td>IMUST</td>
<td>inactive miscellaneous underground storage tank</td>
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<tr>
<td>LAW</td>
<td>low-activity waste</td>
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<tr>
<td>LERF</td>
<td>Liquid Effluent Retention Facility</td>
</tr>
<tr>
<td>LFL</td>
<td>lower flammability limit</td>
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<tr>
<td>LLW</td>
<td>low-level waste</td>
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<tr>
<td>OCRWM</td>
<td>Office of Civilian Radioactive Waste Management</td>
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<tr>
<td>RCRA</td>
<td>Resource Conservations and Recovery Act</td>
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<tr>
<td>RPP</td>
<td>River Protection Project</td>
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<tr>
<td>SALDS</td>
<td>State-Approved Land Disposal Site</td>
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<tr>
<td>SNF</td>
<td>spent nuclear fuel</td>
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<tr>
<td>Sr</td>
<td>strontium</td>
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<tr>
<td>SST</td>
<td>single-shell tank</td>
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<tr>
<td>TEDF</td>
<td>Treated Effluent Disposal Facility</td>
</tr>
<tr>
<td>TOC</td>
<td>Tank Operations Contract (or) Tank Operations Contractor</td>
</tr>
<tr>
<td>TRU</td>
<td>transuranic</td>
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<tr>
<td>WAC</td>
<td>Washington Administrative Code</td>
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<tr>
<td>WIPP</td>
<td>Waste Isolation Pilot Plant</td>
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<tr>
<td>WIR</td>
<td>waste incidental to reprocessing</td>
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<tr>
<td>WTP</td>
<td>Waste Treatment and Immobilization Plant</td>
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</table>
INTRODUCTION

Appendix A contains requirements related to the River Protection Project (RPP) mission. This appendix is separated into five sections. The titles of these sections and the text to which they apply are as follows:

Appendix A-1    Manage Tank Waste - Section 2.1
Appendix A-3  Process Tank Waste - Section 2.3
Appendix A-4  Dispose Tank Waste - Section 2.4
Appendix A-5  Manage System-Generated Waste and Excess Facilities - Section 2.5.
Appendix A-6  References
APPENDIX A-1
MANAGE TANK WASTE

A-1.1 Store Waste

Maintain Safe and Compliant Waste Storage System

Maintain waste storage and infrastructure in a safe and stable configuration. Manage and maintain tank farm equipment and infrastructure to meet current and future operational use needs. Enhance the reliability of tank farm equipment, and evaluate the capability of that equipment to support the long-term mission (DE-AC27-08RV14800, Tank Operations Contract, Section C.2.1.2).

- The SST system shall be capable of storing waste until all SSTs are closed by January 31, 2043 (Tri-Party Agreement [TPA] milestone M-045-00, Ecology, EPA and DOE, 1989).
- Single-shell tank management shall comply with the operating specifications for the SSTs (OSD-T-151-00013, Operating Specifications for Single-Shell Waste Storage Tanks, Section 1.0).
- The DST system shall have the capability to receive and store newly generated liquid wastes from external waste generators (RPP-29002, Double-Shell Tank System Waste Analysis Plan, Section 3A.2.1).
- The DST system shall be capable of accepting and storing waste until all DSTs are closed, no later than September 30, 2052 (TPA Milestone M-042-00A, Ecology, EPA and DOE, 1989).
- DST management shall comply with the operating specifications for the double-shell waste storage tanks (OSD-T-151-00007, Operating Specifications for the Double-Shell Storage Tanks, Introduction).
- The DST system shall be managed to avoid buoyant-displacement gas release events (TOC Authorization Agreement, Sections 5.4 and 5.5; HNF-SD-WM-TSR-006, Tank Farms Technical Safety Requirements, Section 3.4).
- The DST system shall be managed in accordance with criticality prevention specifications for tank farm operations (DOE O 420.1B, Facility Safety, Attachment 2, Chapter III, Section 3.b; HNF-SD-WM-TSR-006, Section 5.9.5).
- Upgrades shall be planned and executed in Tank Farms and related facilities to support safe, reliable, compliant storage, and tank waste retrieval, staging, delivery, and treatment (DE-AC27-08RV14800, Section C.2.1.2).
- New systems and additions or modifications of existing tank systems shall incorporate secondary containment, spill prevention, and leak detection design features (WAC 173-303-640, “Tank Systems”, Section 4).
- Spare capacity with adequate capabilities for off-normal or emergency situations involving high-level waste storage or treatment shall be maintained to receive the largest volume of waste contained in any one storage vessel, pretreatment facility, or

### A-1.2 Move Waste

#### Maintain Safe and Compliant Waste Transfer System

Provide capability to transfer tank waste between DSTs and to/from DSTs and 242-A Evaporator to mitigate or resolve safety concerns and manage tank space. Provide support to SST retrieval operation (e.g., transfers to optimize DST usage). Upgrade tank farms to support safe, reliable, and compliant waste feed delivery (WFD) operations (DE-AC27-08RV14800, Section C.2.1.2).

- The equipment required to receive waste from Hanford Site facilities in support of the Hanford Site cleanup mission shall be maintained (DE-AC27-08RV14800, Section C.2.1.2).
- The DST system shall have the capability to receive and transfer newly generated liquid wastes from external waste generators (RPP-29002, Section 3A.2.1).
- Waste retrieved from 28 DSTs shall be delivered to the WTP and supplemental treatment facilities\(^2\) (DE-AC27-08RV14800, Section C.1.4).
- Resource Conservation and Recovery Act (RCRA)-compliant transfer conveyances shall be used to transfer waste between 200 Area facilities (*Resource Conservation and Recovery Act of 1976* (RCRA), 42 USC 6901, et seq.).

### A-1.3 Concentrate Waste

#### Provide Reliable and Compliant Concentration Capacity

Enhance the reliability of the 242-A Evaporator to extend the life of the facility (DE-AC27-08RV14800, Section C.2.1.2). Provide supplemental evaporative capacity to augment 242-A Evaporator operations, as necessary.

- Evaporator operations shall be provided to support DST space management, SST waste retrieval, and WFD activities (DE-AC27-08RV14800, Section C.2.1.2).
- Actions shall be performed to optimize the use of available DST space to facilitate SST waste retrieval, and to improve waste feed characteristics (DE-AC27-08RV14800, Section C.2.7.1).
- Upgrades to the 242-A Evaporator shall be completed, as necessary, to support the RPP mission (DE-AC27-08RV14800, Section C.2.1.2).

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\(^1\) In compliance with DOE M 435.1-1, *Radioactive Waste Management Manual*, tank farms must maintain a minimum available space of 1.265 Mgal to receive waste in the event of a DST leak. Tank farms are also obligated to accommodate an emergency return of 1.1 Mgal feed from the WTP (24590-WTP-ICD-MG-01-019, *ICD-19 - Interface Control Document for Waste Feed*, Section 2.5). These volumes are not additive. The space required to receive WTP emergency returns is counted as part of the DST emergency space allocation. The emergency space is not associated with a specific tank but is distributed throughout the DST system.

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A-7
A-1.4 Characterize Waste

Perform Tank Waste Sampling and Characterization

Perform waste sample collection, waste analyses, and characterization, as required, to assure safe storage of tank waste, certify waste shipments, and optimize process operations (DE-AC27-08RV14800, Section C.2.1.2).

- A ready-to-serve waste tank sampling system and sample transportation capability shall be maintained to perform tank waste sampling and characterization in support of safe storage and evaporator operations, and to preserve tank integrity (DE-AC27-08RV14800, Section C.2.1.2).
- All wastes transferred into the DST system shall be sampled in accordance with the DST System Waste Analysis Plan (RPP-29002, Rev. 0, Section 3A.2.1.1 and Appendix A, Section V).
- For waste transfers subject to the requirements of HNF-SD-WM-OCD-015, Tank Farms Waste Transfer Compatibility Program, and where sufficient data are not available to provide an adequate representation of waste transfer, sampling and analysis in accordance with HNF-SD-WM-DQO-001, Data Quality Objectives for Tank Farms Waste Compatibility Program, shall be requested prior to transfer (HNF-SD-WM-OCD-015, Section 2.2).

A-1.5 Monitor Waste

Maintain Tank System Integrity

SST and DST integrity assessments, surveillance, installation of liquid observation wells, monitoring, and reporting shall be performed to comply with the following:

- RPP-7574, Double-Shell Tank Integrity Program Plan; and RPP-10435, Single-Shell Tank System Integrity Assessment Report.
  - Non-destructive testing and evaluation of SSTs and IMUSTS shall be performed to assure continued tank integrity commensurate with the waste contained in each tank and associated risk (DE-AC27-08RV14800, Section C.2.1.2).
  - Non-destructive testing and evaluation of DSTs shall be performed to meet RCRA requirements, status tank corrosion, and assure continued tank integrity (DE-AC27-08RV14800, Section C.2.1.2).
  - DST chemistry shall be controlled to minimize tank corrosion (OSD-T-151-00007, Section 1.5).

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2 Refer to Appendix B, Glossary, for a definition of this term.
Provide Leak Detection and Mitigation

Transfer leak detection system must be operational to detect the accumulation of waste leaked into waste transfer-associated structures. These systems detect the accumulation of waste and provide an alarm to initiate operator response and waste transfer pump shutdown. The transfer leak detection system may also actuate an interlock for automatic shutdown of the waste transfer pump(s). Minimizing the potential for waste leaks during SST and DST waste transfers and WFD operations is essential to the safety and protection of workers, the public, and the environment.

- The SST system shall be monitored for leak detection in compliance with RPP-9937, Single-Shell Tank System Leak Detection and Monitoring Functions and Requirements Document (RPP-16922, Environmental Specification Requirements, Section 6.1).
- The DST system shall be monitored for leak detection and overfill protection (RPP-16922, Sections 5.3 and 5.4).
- In compliance with good engineering practice, transfer pumps shall be shut down immediately upon receipt of an alarm from either a transfer leak detection system or a service water pressure detection system.
- In compliance with good engineering practice, transfer pumps shall be shut down immediately upon detection of the loss of diluent flow during a transfer that requires in-line dilution.

Monitor Waste Tank Flammable Gas Concentrations

Provide monitoring to verify that the flammable gas concentration in the tank headspace is \( \leq 25\% \) of the lower flammability limit (LFL), which confirms that sufficient ventilation is available to control the steady-state generation of flammable gas in the tanks (HNF-SD-WM-TSR-006, Sections B 3.1 and B 3.2).

- Analysis of the time to LFL for DST’s and SST’s shall be verified or revised prior to waste transfers, large water additions and chemical additions (HNF-SD-WM-TSR-006, Section 5.9).
Appendix A-2
Retrieve Tank Waste

A-2.1 Remove Single-Shell Tank Waste

Perform Safe and Compliant SST Retrievals

Design, install, and complete technology demonstrations and retrieval activities to support transition and closure of SSTs and tank farms. Provide annual updates of RPP-PLAN-40145, Single-Shell Tank Waste Retrieval Plan (DE-AC27-08RV14800, Section C.2.2.1).

- Approximately 30 Mgal of waste shall be retrieved from the SSTs into the DST system (DE-AC27-08RV14800, Section C.2.2.1; HNF-EP-0182, Tank Waste Summary Report for Month Ending December 31, 2011).
- Retrieval operations in 200E and 200W shall concentrate within one tank farm or group of adjacent farms at a time (RPP-PLAN-40145, Section 8.1).
- Waste transfers to DSTs shall comply with the waste blending and segregation controls in the Feed Control List (HNF-SD-WM-OCD-015, Tank Farms Waste Transfer Compatibility Program, Section 3.4.1.1).
- Tank waste shall be retrieved in accordance with applicable Tri-Party Agreement [TPA] milestones, Consent Decree requirements, and closure requirements in State approved closure plans [TPA Milestone Series Number M-045-00, Ecology, EPA and DOE, 1989; Consent Decree, 2010, State of Washington v. DOE, Case No. 08-5085-FVS (October 25) Eastern District of Washington, Section IV.B.4.a and Appendix C, Part 1].
- Complete C Farm retrievals by September 30, 2014 (Milestone B-1, Consent Decree).
- Start five additional SST retrievals by December 31, 2017 (Milestone B-3, Consent Decree).
- Complete nine additional SST retrievals by September 30, 2022 (Milestone B-4, Consent Decree).

Retrieval Technology Development Activities

Develop and demonstrate technologies to improve the efficiencies and equipment reliability for retrieving saltcake, hard heel, and other wastes from SSTs; evaluate alternative retrieval technologies and leak detection methods for SSTs (DE-AC27-08RV14800, Section C.2.2.1).
A-2.2 Remove Potential Contact-Handled Transuranic Tank Waste

Perform Safe and Compliant Potential Contact-Handled Transuranic Tank Waste Retrievals

Design, install, and complete technology demonstrations and retrieval activities to support retrieval of potential contact-handled transuranic waste from selected SSTs.

- Potential contact-handled transuranic tank waste from selected SSTs\(^3\) shall be retrieved for treatment in a supplemental transuranic treatment facility\(^4\) (DE-AC27-08RV14800, Section C.2.4.5).

A-2.3 Remove Ancillary Storage Systems Waste

Perform Safe and Compliant Ancillary Storage Systems Retrievals

Design, install, and complete technology demonstrations and retrieval activities to support retrieval of wastes from ancillary storage systems.

- Waste contained in IMUSTs, catch tanks, double-contained receiver tanks, and other equipment associated with tank farm operations shall be retrieved and transferred to the DST system, or disposed by other approved treatment and disposal systems (DE-AC27-08RV14800, Section C.2.2.1).

A-2.4 Deliver Waste Feed

Perform Safe and Compliant Waste Feed Delivery

Waste Treatment and Immobilization Plant

Retrieve and deliver waste feed to support hot commissioning, startup, and completion of WTP pretreatment processing and vitrification of tank wastes in accordance with Milestone Series Number M-62-00 of the HFFACO (Ecology, EPA and DOE, 1989). Waste feed delivery to the WTP may entail remediation actions for Waste Group A tanks; treatment of tank AN-102 and AN-107 supernatant to remove complexed (solvated) strontium (Sr) and transuranic (TRU) constituents\(^5\); blending of the high heat sludge contained in AZ-101; blending of high uranium content waste from tank C-104; and blending of high zirconium content wastes in tanks AW-103 and AW-105.


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3 The selected SSTs may include the four B-200 series tanks, the four T-200 series tanks, T-104, T-110, and T-111 (RPP-21970, CH-TRUM WPU&SE 11-Tank Material Balance, Section 3.0).

4 Prerequisites may include the Tank Closure and Waste Management Environmental Impact Statement (TC & WM EIS) Record of Decision (ROD) and a formal waste incidental to reprocessing (WIR) determination, in accordance with DOE M 435.1-1, Radioactive Waste Management Manual.

5 Removal of complexed (solvated) Sr and TRU constituents in the Envelope C waste stored in tanks AN-102 and AN-107 is required to ensure that the resultant ILAW complies with WTP contractual requirements; this ensures that the ILAW meets WIR requirements in accordance with DOE M 435.1-1, Radioactive Waste Management Manual.
• The Tank Operations Contractor (TOC) shall reliably provide feed to waste treatment facilities to support continued operations (DE-AC27-08RV14800, Section C.2.3.1).
• Waste feed samples shall be collected and analyzed to demonstrate waste feed compliance with WTP permits, Safety Authorization Basis and process parameters (24590-WTP-ICD-MG-01-019, ICD-19 – Interface Control Document for Waste Feed, Table 1, Section 1.1).6
• Samples for each waste feed campaign shall be provided to the WTP at least 180 days prior to the projected transfer of the waste feed batch to the WTP (24590-WTP-ICD-MG-01-019, Table 1, Section 1.1).
• Capability shall be provided to deliver up to 145,000 gallons of HLW feed per batch followed by transfer line flush solution (24590-WTP-ICD-MG-01-019, Table 1, Section 1.1).
• Capability shall be provided to deliver up to 1.125 Mgal of LAW feed followed by transfer line flush solution (24590-WTP-ICD-MG-01-019, Table 1, Section 1.1).
• Transfer line flushes shall comply with applicable ICD-19 requirements (24590-WTP-ICD-MG-01-019, Section 2.4.2).
• Waste transfer lines from the DST system to the WTP shall comply with the materials, temperature, and pressure design parameters of ICD-19 (24590-WTP-ICD-MG-01-019, Tables 2, 3 and 4, Section 2.1.1).
• A WTP/TOC interface with permissive signal/shutdown (interlock) signal for WFD transfer pumps shall be provided (24590-WTP-ICD-MG-01-019, Table 1, Section 1.1).

Second Low-Activity Waste Facility

Deliver waste feed to support hot commissioning, startup, and completion of supplemental immobilization (Second LAW Facility) LAW processing in accordance with Milestone Series Number M-62-00 of the HFFACO (Ecology, EPA and DOE, 1989).

• The TOC shall reliably provide feed to waste treatment facilities to support continued operations (DE-AC27-08RV14800, Section C.2.3.1).
• Low-activity portions of tank waste shall be reliably provided to waste treatment facilities in time to support hot commissioning and operation (DE-AC27-08RV14800, Section C.2.3.1).
• Waste feed delivery, including blending and mixing of tank waste, shall be performed to support optimized and reliable feed delivery to waste treatment facilities (DE-AC27-08RV14800, Section C.2.3.1).
• Supplemental treatment waste acceptance specifications shall be developed consistent with the design of the facility and the waste form to be processed, and in compliance with the facility’s permit and authorization basis requirements (DE-AC27-08RV14800, Section C.2.3.3).

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6 This requirement implies that a certain minimal volume of back-up (contingency) feed that has been sampled and certified should be maintained in the DST system to reliably support waste feed delivery to waste treatment facilities. No citable requirement for a specific volume of contingency feed has been identified.

7 WTP waste acceptance criteria, and the tank farm engineering features needed to ensure compliance with the waste acceptance criteria, are expected to evolve as work identified in the DOE implementation plan to address DNFSB Recommendation 2010-2 is completed.
Waste Feed Returns

Provide capability to receive emergency returns of feed from the WTP (24590-WTP-ICD-MG-01-019, Table 1, Section 1.1).

- Waste returns from the WTP shall comply with DST waste compatibility requirements (HNF-SD-WM-OCD-015, Section 1.1.1).
- A minimum of 1.1 Mgal DST tank space shall be maintained to receive emergency return transfer of feed from the WTP\(^8\) (24590-WTP-ICD-MG-01-019, Section 2.5).

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\(^8\) In compliance with DOE M 435.1-1, *Radioactive Waste Management Manual*, tank farms must maintain a minimum available space of 1.265 Mgal to receive waste in the event of a DST leak. Tank farms are also obligated to accommodate an emergency return of 1.1 Mgal feed from the WTP as indicated by this requirement. These volumes are not additive. The space required to receive WTP emergency returns is counted as part of the DST emergency space allocation. The emergency space is not associated with a specific tank but is distributed throughout the DST system.
APPENDIX A-3
PROCESS TANK WASTE

Hanford tank waste consists of approximately 190 million curies in 55 million gallons of highly radioactive and mixed hazardous waste stored in underground storage tanks at the Hanford Site. The tank waste includes solids (sludge), liquids (supernatant), and salt cake (dried salts that will dissolve in water forming supernatant). The tank waste will be remediated through treatment and immobilization to protect the environment and meet regulatory requirements (DE-AC27-01RV14136, Design, Construction, and Commissioning of the Hanford Tank Waste Treatment and Immobilization Plant, Section C.1). The (WTP) Contractor shall comply with applicable Federal, DOE, State, and local regulations and requirements for: (1) non-radiological worker safety and health; (2) radiological, nuclear, and process safety; (3) quality assurance; and (4) environmental protection [DE-AC27-01RV14136, Section C.4, sub-section (a)].

The design of the WTP facilities shall comply with all requirements in the WTP Contract, and design requirements identified in approved deliverables and work products specified in Sections C.6, Standards, C.7, Facility Specification, C.8, Operational Specifications, and C.9, Interface Control Documents [DE-AC27-01RV14136, Section C.3, sub-section (f)(2)(i)].

The WTP shall be designed to have a forty year operating life for the operating facilities (Pretreatment Facility, HLW Facility, LAW Facility), Analytical Laboratory, and Balance of Facilities, exclusive of ancillary facilities (i.e., warehouses, construction support facilities, and administrative offices) [(DE-AC27-01RV14136, Section C.7, sub-section (a)(1)].

The minimum integrated WTP availability shall be 70% [DE-AC27-01RV14136, Section C.7, sub-section (b)(1)].

During the Cold Commissioning test period, testing shall be conducted to verify that the WTP will perform in accordance with design specifications using DOE-approved non-radioactive simulated waste feeds that demonstrate the ability of the facility to treat tank waste [DE-AC27-01RV14136, Section C.6, Standard 5, sub-section (e)].

Hot start of the WTP shall commence by December 31, 2019 (Milestone A-17, Consent Decree, 2010, State of Washington v. DOE, Case No. 08-5085-FVS (October 25) Eastern District of Washington), and initial plant operations shall be achieved by December 31, 2022 (Milestone A-01, Consent Decree).

A-3.1 Pretreat Waste

WTP Pretreatment Facility

Feed Receipt

The WTP shall be designed to treat waste feed envelope compositions specified in WTP Contract Specification 7, Low-Activity Waste Envelopes Definition (DE-AC27-01RV14136, Specification 7, Section 7.1) and WTP Contract Specification 8, High-Level Waste Definition Envelope (DE-AC27-01RV14136, Specification 8, Section 8.1). Waste treatment capacity requirements are specified in Table C.7-1.1 of the WTP Contract [DE-AC27-01RV14136, Section C.7, sub-section (b)].
Treatment Capability

Develop, deploy, and operate treatment capability in accordance with the major and interim requirements specified in Milestone Series Number M-62-00 of the HFFACO (Ecology, EPA and DOE, 1989).

- Complete Pretreatment Facility construction by December 31, 2017 (Milestone A-14, Consent Decree).
- Start Pretreatment Facility cold commissioning on December 31, 2018 (Milestone A-15, Consent Decree).
- Complete Pretreatment Facility hot commissioning by December 31, 2019 (Milestone A-16, Consent Decree).
- Achieve initial WTP plant operations by December 31, 2022 (Milestone A-01, Consent Decree).
- The WTP HLW Pretreatment line shall be operated in order to produce feed to HLW Vitrification that results in IHLW in compliance with Specification 1, Immobilized High-Level Waste Product [DE-AC27-01RV14136, Section C.6, Standard 5, sub-section (g)(5)(i)].
- The WTP LAW Pretreatment line shall be operated to produce feed to the LAW that results in ILAW in compliance with Specification 2, Immobilized Low-Activity Waste Product [DE-AC27-01RV14136, Section C.6, Standard 5, sub-section (g)(5)(i)].

Pretreatment Processing

The general strategy for pretreatment includes separating waste streams into LAW and HLW fractions using dissolution and filtering, separation of selected radionuclides, concentration, and limited effluent treatment. Pretreatment may occur within the WTP or at supplemental pretreatment facilities.

- Pretreatment Facility availability shall support a minimum integrated WTP availability of 70% [DE-AC27-01RV14136, Section C.7, sub-section (b)(1)].
- Pretreatment shall include the following major process functions: (i) ultra-filtration, (iii) Cs removal, (v) waste concentration, (vi) liquid effluent treatment, and (vii) washing, caustic leaching, and oxidative leaching of HLW solids\(^1\) [DE-AC27-01RV14136, Section C.7, sub-section (d)(1)].
- The Pretreatment Facility shall have the established capability to conduct sludge washing, caustic leaching, and oxidative leaching on HLW sludge and entrained solids. The Pretreatment Facility shall include capabilities to permit operational flexibility for sludge washing, caustic leaching, and oxidative leaching flowsheet and treatment capacity [DE-AC27-01RV14136, Section C.7, sub-section (b)(7)].
- The WTP Pretreatment Facility shall have a treatment capacity of 860 MT as-delivered (HLW) solids per year and 2,620 MT-Na (LAW) per year\(^9\) [DE-AC27-01RV14136, Section C.7, sub-section (b)(1)].
- The Pretreatment Facility shall have the capability to receive and store 1.5 Mgal of LAW feed. The design shall include the capability to receive without interruption

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\(^{9}\) This requirement omits process function (ii) Sr/TRU Removal and process function (iv) Technetium (Tc) Removal. These process functions are included in the BNI contract but are not included here because they are no longer part of the RPP baseline.
1.125 Mgal (4,260 m³) of LAW feed while processing from the remaining capacity of 0.375 Mgal of LAW feed. The tanks shall be connected to allow blending [DE-AC27-01RV14136, Section C, sub-section 7(b)(4)].

- The Pretreatment Facility shall have the feed-forward capability for a nominal 240,000 gallons of feed lag storage for HLW vitrification facility operations, based upon the facility design capacity, while being capable of receiving without interruption no less than 145,000 gallons of HLW feed per batch. HLW feed batch receipt facilities shall be designed to allow receipt without interruption to waste feed processing [DE-AC27-01RV14136, Section C.7, sub-section (b)(5)].

- The Pretreatment Facility shall have the capability to prepare at least 81,000 gallons of transferable and blended HLW feed within a single vessel for transfer to the HLW Vitrification Facility [DE-AC27-01RV14136, Section C.7, sub-section (b)(6)].

- The Pretreatment Facility shall have the capability to return to the DST Farms process streams in accordance with Specification 9, Liquids or Slurries Transferred to DOE Tanks by Pipeline [DE-AC27-01RV14136, Section C.7, sub-section (a)(6)].

- Hot Commissioning includes testing the facility using radioactive materials transferred from the tank farms. The Pretreatment Facility shall be tested to demonstrate the flow of radioactive feed material through the facility to produce LAW and HLW feed, which may be placed into lag storage or fed forward to support coincident LAW and/or HLW Hot Commissioning [DE-AC27-01RV14136, Section C.6, Standard 5, sub-section (g)].

Supplemental Pretreatment

Supplemental pretreatment capacity will be deployed, if required. The ORP Baseline Case operating scenario does not currently require supplemental pretreatment capacity (ORP-11242, Rev. 6, Section 3.2.3).

- Design of supplemental pretreatment shall incorporate solid/liquid separation and waste feed pretreatment necessary to meet LAW immobilization facility waste acceptance specifications (DE-AC27-08RV14800, Tank Operations Contract, Section C.2.4.3).

- The Contractor shall design treatment processes to ensure that the treated waste meets the standards for on-site disposal under DOE, RCRA, and Ecology permit requirements (DE-AC27-08RV14800, Section C.2.4.5).

A-3.2 Immobilize High-Level Waste

Immobilize HLW Waste

The preferred alternative to remediate Hanford tanks waste includes immobilizing the HLW for ultimate disposal in the national repository [DE-AC27-01RV14136, Section C.1]. The HLW

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10 The baseline case, ORP-11242, Rev. 6, River Protection Project System Plan, achieves a sustained average treatment capacity of 3,491 MT waste sodium per year and 1,274 MT as-delivered solids per year, both exceeding the minimum contractual treatment capacity. The end date for completing treatment of all tank waste [December 31, 2047, in accordance with Tri-Party Agreement (TPA) Milestone M-062-00, Ecology, EPA, and DOE, 2011] could be delayed if these rates are not achieved and no compensatory changes made.

11 The ORP Baseline Case operating scenario does not currently require supplemental pretreatment capacity (ORP-11242, Rev. 6, River Protection Project System Plan, Section 3.2.3). DE-AC27-08RV14800, Sections C.2.4.3 and C.2.4.4 states that, depending on future waste treatment decisions, ORP may direct the Tank Operations Contractor to commence design, permitting, construction and operation of supplemental LAW treatment capacity.
tank waste fraction is comprised of the long half-life radioactive tank waste solids (as well as other non-radioactive solids) and the radionuclides separated from the LAW fraction, including those from $^{137}\text{Cs}$ ion exchange. HLW is a mixed, characteristic, and listed waste regulated under RCRA, and must meet specific treatment and performance standards for storage and repository disposal of the final waste form [DE-AC27-01RV14136, Section C.1]. The Pretreatment Facility shall have the established capability to conduct sludge washing, caustic leaching, and oxidative leaching on HLW sludge and entrained solids [DE-AC27-01RV14136, Section C.7, subsection (b)(7)]. The HLW melter feed will be prepared from treated HLW solids, concentrates from radionuclide recovery processes, and glass forming chemicals [DE-AC27-01RV14136, Section C.7, subsection (d)(2)(i)].

- Complete HLW Facility construction by December 31, 2016 (Milestone A-02, Consent Decree).
- Start HLW Facility cold commissioning on June 30, 2018 (Milestone A-03, Consent Decree).
- Complete HLW Facility hot commissioning by December 31, 2019 (Milestone A-04, Consent Decree).
- HLW Facility availability shall support a minimum integrated WTP availability of 70% [DE-AC27-01RV14136, Section C.7, sub-section (b)(1)].
- HLW Vitrification shall include the following major process functions: (i) HLW feed preparation, (ii) HLW vitrification, (iii) HLW Melter Offgas Treatment, (iv) HLW canister closure, decontamination, and inspection [DE-AC27-01RV14136, Section C.7, sub-section (d)(2)].
- HLW feed shall be converted to a borosilicate glass in a glass melter. The glass product shall meet Specification 1, Immobilized High-Level Waste Product [DE-AC27-01RV14136, Section C.7, sub-section (d)(2)(ii)].
- The IHHLW form shall meet State of Washington Hazardous Waste Management Act of 1976 (HWMA) and RCRA de-listing technical requirements in accordance with Specification 1, Immobilized High-Level Waste Product [DE-AC27-01RV14136, Section C.6, Standard 2, sub-section (a)(3)(i)(B)].
- The WTP shall be designed, constructed, and operated so that the IHHLW product does not designate as characteristic or criteria for dangerous waste or extremely hazardous waste pursuant to WAC 173-303-070, “Designation of Dangerous Waste”, and is not restricted from land disposal pursuant to WAC 173-303-140, “Land Disposal Restrictions” and 40 CFR 268, “Land Disposal Restrictions” (DE-AC27-01RV14136, Section C.8, Specification 1, sub-section 1.2.2.1.4).
- Loading of non-volatile components shall be achieved such that the concentration of at least one of the waste components or waste component combinations listed in TS-1.1, Minimum Component Limits in High-Level Waste Glass, in Section C of the WTP contract exceeds its minimum weight percent in the IHHLW glass$^{12}$ (DE-AC27-01RV14136, Section C.8, Specification1, sub-section 1.2.2.1.5).

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$^{12}$ The baseline case, ORP-11242, Rev. 6, River Protection Project System Plan, achieves an IHHLW waste oxide loading of approximately 37-weight %, exceeding the minimum contractual requirement. The end date for completing treatment of all tank waste [December 31, 2047, in accordance with Tri-Party Agreement (TPA) Milestone M-062-00, Ecology, EPA, and DOE, 2011] could be delayed if the ORP-11242 baseline case glass waste oxide loading is not achieved and no compensatory changes made.
• The product loading of IHLW glass shall not violate the limits in any requirement of Specification 1, *Immobilized High-Level Waste Product*, (DE-AC27-01RV14136, Section C.8, Specification1, sub-section 1.2.2.1.5).

• The HLW Vitrification Facility shall be designed with two HLW melter systems to support a combined design capacity of at least 6.0 MTG/day with the original melters and at least 7.5 MTG/day with replacement melters [DE-AC27-01RV14136, Section C.7, sub-section (b)(3)].

• The WTP HLW Vitrification Facility shall have a treatment capacity of at least 5.25 MT glass per day (DE-AC27-01RV14136, Section C.7, Table C.7-1.1).

• After hot commissioning, the HLW Facility will produce a minimum of 3.6 metric tons of glass (MTG) per day with a design capacity of at least 6.0 MTG per day (24590-WTP-ICD-MG-01-019, Section 2.2.4.2).


• The IHLW canister shall include design features that allow for handling the canister (24590-WTP-ICD-MG-01-014, Section 3.1.1).

• All HLW shall be treated no later than December 31, 2047 (Tri-Party Agreement [TPA] Milestone M-062-00, Ecology EPA, and DOE, 2011).

**A-3.3 Immobilize Low-Activity Waste**

**WPT LAW Facility**

The LAW Vitrification Facility will immobilize the LAW fraction of the waste in glass, which is poured into LAW stainless steel packages (DE-AC27-01RV14136, Section C). The filled ILAW containers will be transferred to a permitted onsite disposal facility for disposal.

• Complete construction of LAW Facility by December 31, 2014 (Milestone A-07, Consent Decree).

• Start LAW Facility cold commissioning on December 31, 2018 (Milestone A-08, Consent Decree).

• Complete LAW Facility hot commissioning by December 31, 2019 (Milestone A-09, Consent Decree).

• LAW Facility availability shall support a minimum integrated WTP availability of 70% [DE-AC27-01RV14136, Section C.7, sub-section (b)(1)].

• LAW Vitrification shall include the following major process functions: (i) LAW feed preparation, (ii) LAW vitrification, (iii) LAW melter offgas treatment, (iv) LAW container closure, decontamination, and inspection [DE-AC27-01RV14136, Section C.7, sub-section (d)(3)].
• The LAW Vitrification Facility shall be designed to support a facility design capacity of 30 MTG/day [DE-AC27-01RV14136, Section C.7, sub-section (b)(2)].
• The LAW Vitrification Facility shall be capable of vitrifying treated LAW Envelopes A, B, and C in compliance with the waste loading specifications identified in Specification 2.2.2.2, Waste Loading* [DE-AC27-01RV14136, Section C.7, sub-section (b)(2)].
• The WTP LAW Facility shall have a treatment capacity of 21 MT glass per day [DE-AC27-01RV14136, Section C.7, sub-section (b)(1), Table C.7-1.1].
• The LAW feed shall be converted to a glass that meets Specification 2, Immobilized Low-Activity Waste Product, in the WTP contract [DE-AC27-01RV14136, Section C.7, sub-section (d)(3)(ii)].
• The WTP Contractor shall plan, develop, obtain, report, and certify the information required to demonstrate that the treated waste in the ILAW product is not prohibited from land disposal pursuant to WAC 173-303-140, “Land Disposal Restrictions” and 40 CFR 268, “Land Disposal Restrictions” [DE-AC27-01RV14136, Section C, Standard 6, sub-section (e)(2)(i)].
• The ILAW product shall be in the form of a package. The constituent parts of each package are a sealed stainless-steel container enclosing a poured glass waste form and an optional filler material of sand or glass (DE-AC27-01RV14136, Section C.8, Specification 2, sub-section 2.2.2.1).
• The loading of waste sodium from Envelope A in the ILAW glass shall be greater than 14 weight percent based on Na₂O. The loading of waste sodium from Envelope B in the ILAW glass shall be greater than 3.0 weight percent based on Na₂O. The loading of waste sodium from Envelope C in the ILAW glass shall be greater than 10 weight percent based on Na₂O¹³ (DE-AC27-01RV14136, Section C.8, Specification 2, Immobilized Low-Activity Waste Product, Section 2.2.2.2).
• The radionuclide concentration of the ILAW form shall not exceed Class C limits as defined in 10 CFR 61.55, Waste Classification. In addition, the average glass concentrations of \(^{137}\)Cs and \(^{90}\)Sr shall be limited as follows: \(^{137}\)Cs < 3 Ci/m³ and \(^{90}\)Sr < 20 Ci/m³ (DE-AC27-01RV14136, Section C.8, Specification 2, sub-section 2.2.2.8).
• Simulant shall be used to demonstrate the normal flow of WTP feed material, individual facility production capability, and the ability to predict product quality, and produce acceptable ILAW products [DE-AC27-01RV14136, Section C.6, Standard 5, sub-section (b)].
• All LAW shall be treated no later than December 31, 2047 (TPA Milestone M-062-00, Ecology EPA, and DOE, 2011).

Second Low-Activity Waste Facility

Design, procure, construct, and operate supplemental treatment facilities to augment pretreatment and immobilization processing capacities as needed to accelerate mission completion.

¹³ The baseline case, ORP-11242, Rev. 6, River Protection Project System Plan, achieves an ILAW sodium oxide loading of approximately 18-wt %, exceeding the minimum contractual requirement. The end date for completing treatment of all tank waste [December 31, 2047, in accordance with Tri-Party Agreement (TPA) Milestone M-062-00, Ecology, EPA, and DOE, 2011] could be delayed if the ORP-11242 baseline case sodium oxide loading is not achieved and no compensatory changes made.
• The second LAW facility shall be capable of immobilizing LAW through 2047 to support the TPA milestone for treating all tank waste (TPA Milestone M-062-00, Ecology, EPA and DOE, 1989).
• Start construction of Supplemental Vitrification Treatment Facility and/or WTP Enhancements by April 30, 2018 (TPA Milestone M-062-32-T01, Ecology, EPA and DOE, 1989).
• Complete construction of Supplemental Treatment Vitrification Facility and/or WTP Enhancements by April 30, 2021(TPA Milestone M-062-33-T01, Ecology, EPA and DOE, 1989).
• Complete hot commissioning of Supplemental Treatment Vitrification Facility and/or WTP Enhancements by December 30, 2022 (TPA Milestone M-062-34-T01, Ecology, EPA and DOE, 1989).
• Design treatment processes to ensure that the treated waste meets the standards for on-site disposal under DOE, RCRA, and Ecology permit requirements (DE-AC27-08RV14800, Section C.2.4, sub-section C.2.4.3).
• Develop treatment waste feed acceptance specifications consistent with the design and waste forms to be processed. The design shall incorporate solid/liquid separation and waste feed pretreatment necessary to meet the waste feed acceptance specifications (DE-AC27-08RV14800, Section C.2.4, sub-section C.2.4.3).
• Complete design and permitting, and procure and construct supplemental LAW treatment capacity. The plant(s) shall receive LAW feed from SSTs and DSTs (DE-AC27-08RV14800, Section C.2.4, sub-section C.2.4.4).

A-3.4 Process Potential Contact-Handled Transuranic Tank Waste

Process Potential Contact-Handled Transuranic Tank Waste

Process retrieved potential contact-handled transuranic tank waste by vacuum drying and transfer dried product to 55-gal drums. Potential contact-handled transuranic tank waste drums shall be stored on-site at the Central Waste Complex pending determination of a final disposal pathway.

• Design, permit, construct, and operate a supplemental transuranic treatment facility for potential contact-handled transuranic tank waste retrieved from selected SSTs14 (DE-AC27-08RV14800, Section C.2.4.5).
• Potential contact-handled transuranic tank waste shall be characterized and certified for disposal at the Waste Isolation Pilot Plant (WIPP) (DE-AC27-08RV14800, Section C.2.4.5).

Liquid effluent from the supplemental transuranic treatment facility shall be transferred to the Liquid Effluent Retention Facility (LERF) via tank truck or recycled to the retrieval project (RPP-21970, CH-TRUM WPU&SE 11-Tank Material Balance, Section 2.0 and Section 7.6, Stream 28a and 28b).

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14 The selected SSTs may include the four B-200 series tanks, the four T-200 series tanks, T-104, T-110, and T-111 (RPP-21970, CH-TRUM WPU&SE 11-Tank Material Balance, Section 3.0).
APPENDIX A-4
DISPOSE TANK WASTE

A-4.1 Dispose Immobilized High-Level Waste

Immobilized High-Level Waste Disposal

IHLW disposal is not an RPP function. Immobilized High-Level Waste disposal will be performed by the Office of Civilian Radioactive Waste Management (OCRWM). A final disposal pathway (offsite repository) for IHLW packages has yet to be identified. The HSF will receive IHLW canisters from IHS, place the canisters into shipping casks, and load the casks onto transport vehicles for offsite shipment.

- The TOC shall have the capability to prepare IHLW canisters for shipment to the final disposal pathway (offsite repository) (DE-AC27-08RV14800, Section C.1.4).
- The HSF shall have the capability receive IHLW canisters from IHS, place the canisters into casks, and load the casks onto transport vehicles for shipment offsite (DE-AC27-08RV14800, Section C.2.3.3).
- Immobilized High-Level Waste canisters shall be packaged at the HSF for shipment offsite in accordance with Office of Civilian Radioactive Waste Management procedures (DE-AC27-08RV14800, Section C.2.3.3).
- The HSF shall have the capability to ship canisters offsite at a minimum rate of 600 per year (DE-AC27-08RV14800, Section C.2.3.3).

A-4.2 Dispose Potential Contact-Handled Transuranic Tank Waste

Potential Contact-Handled Transuranic Tank Waste Disposal

Disposal of potential contact-handled transuranic tank is not an RPP function. Potential contact-handled transuranic tank waste disposal will be performed by the operator of the final disposal pathway. A final disposal pathway for potential contact-handled transuranic tank waste has yet to be identified.

- Potential contact-handled transuranic tank waste shall be prepared for shipment to the final disposal pathway (DE-AC27-08RV14800, Section C.1.4).

A-4.3 Dispose Immobilized Low-Activity Waste

Immobilized Low-Activity Waste Disposal

Receive ILAW canister transport vehicles at a permitted onsite disposal facility, off-load ILAW canisters from the transport vehicle, prepare ILAW canisters for disposal, and place the ILAW canisters in a permitted disposal cell.

- Immobilized Low-Activity Waste shall be disposed on-site in near-surface disposal facilities\(^{16}\) (DE-AC27-08RV14800, Section C.1.4).

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\(^{15}\) Includes canisters containing IHLW and canisters containing SNF for which the Department of Energy, Richland Operations Office is responsible.

\(^{16}\) A formal WIR determination, in accordance with DOE M 435.1-1, Radioactive Waste Management Manual, will be required as a prerequisite to beginning onsite disposal of ILAW.
• The ILAW waste package shall consist of a sealed stainless steel container enclosing a poured-glass waste form and an optional filler material of sand or glass (DE-AC27-01RV14136, Design, Construction, and Commissioning of the Hanford Tank Waste Treatment and Immobilization Plant, Section C 2.2.2.1).  


• Safe and compliant disposal of ILAW at the IDF shall be provided (RPP-8402, Section 1.1.1).

A-4.4 Dispose Secondary Waste

Dispose Gaseous Effluent

Gaseous effluents are treated at the respective processing facilities. Gaseous effluent quality is monitored, and gaseous effluents in compliance with Hanford air permits are released to the atmosphere.

• All process off-gas shall be treated and released to the atmosphere in accordance with Hanford air permits (AOP 00-05-006, Hanford Site Air Operating Permit).

Dispose Secondary Liquid Waste

Secondary liquid waste generated by process/treatment facilities will be disposed onsite in accordance with Hanford Site liquid waste treatment facility waste acceptance criteria and Washington State Waste Discharge Permit ST 4502 (State Waste Discharge Permit Number ST 4502) or Washington State Waste Discharge Permit ST 4500 (State Waste Discharge Permit Number ST 4500).

• Secondary liquid waste generated by RPP operations shall be treated and disposed onsite (DE-AC27-08RV14800, Section C.1.4).

17 The RPP baseline (ORP-11242) depicts supplemental treatment as a second LAW vitrification facility producing a borosilicate glass waste form. Alternatives to a second LAW vitrification facility for supplemental treatment are being evaluated. One of the potential alternatives envisions the development and deployment of an immobilization process producing a non-glass waste form (Tri-Party Agreement [TPA] Milestone M-062-45, Ecology, EPA, and DOE, 2011). The non-glass waste form would be packaged to meet the waste acceptance criteria for the selected disposal method.

18 Current plans are to include ILAW waste acceptance criteria in a future revision of HNF-EP-0063.
• Non-radioactive, non-dangerous liquid effluents shall be discharged to the Treated Effluent Disposal Facility (TEDF) (24590-WTP-ICD-MG-01-005, Interface Control Document for Nonradioactive, Nondangerous Liquid Effluents, Table 1).
• Liquid waste disposed at TEDF shall comply with State Waste Discharge Permit Number ST 4502 (HNF-3172, Liquid Waste Processing Facilities Waste Acceptance Criteria, Section 2.0).
• Low-level mixed liquid waste shall be collected at the LERF and treated at the ETF prior to disposal at the State-Approved Land Disposal Site (SALDS) (HNF-3172, Section 3.0).

Liquid waste disposed at SALDS shall comply with State Waste Discharge Permit Number ST 4500 (HNF-3172, Section 3.0).

Dispose Spent and Failed Melters

Disposal of spent and failed HLW and LAW melters shall comply with disposal facility waste acceptance criteria.

• Spent and failed HLW melters disposed at a permitted onsite disposal facility\(^{19}\) shall comply with Hanford Site Solid Waste Acceptance Criteria (HNF-EP-0063) (24590-WTP-ICD-MG-01-003, Interface Control Document for Radioactive Solid Waste, Section 4.3).
• Spent and failed LAW melters disposed at a permitted onsite disposal facility shall comply with Hanford Site Solid Waste Acceptance Criteria (HNF-EP-0063) (24590-WTP-ICD-MG-01-003, Section 4.3).

Dispose Secondary Solid Waste

Solid secondary waste generated by process/treatment facilities will be disposed onsite in compliance with Hanford Site solid waste acceptance criteria. Solid waste will be disposed in the Integrated Disposal Facility (IDF), Environmental Restoration Disposal Facility (ERDF), or the Mixed Waste Trench as appropriate.

• Secondary solid waste generated by RPP operations shall be treated and disposed onsite (DE-AC27-08RV14800, Section C.1.4).
• Secondary solid waste shall be disposed in compliance with Hanford Site solid waste acceptance criteria (HNF-EP-0063, Section 1.1).
• Only LLW, MLLW, TRU, or TRU mixed wastes may be accepted for disposal or storage on the Hanford Site (24590-WTP-ICD-MG-01-003, Section 3.2.3.1).

\(^{19}\) A WIR determination, in accordance with DOE M 435.1-1, Radioactive Waste Management Manual, will be needed to confirm this disposal path; otherwise, an alternate disposal path must be identified.
APPENDIX A-5
MANAGE SYSTEM-GENERATED WASTE AND EXCESS FACILITIES

A-5.1 Manage Immobilized High-Level Waste

Immobilized High-Level Waste Interim Storage and Shipping Requirements

Interim Hanford Storage will receive and temporarily store canisters of IHLW. Immobilized High-Level Waste will be stored and monitored at IHS pending determination of a final disposal pathway. The IHLW canisters will eventually be retrieved and transferred to the HSF.

• The design life of IHS shall consider the uncertainty related to availability of a final disposal alternative (DOE-ORP letter 11-TF-082, August 22, 2011, page 7).
• Interim Hanford Storage shall accommodate a minimum of 4,000 canisters (DOE-ORP letter 11-TF-082, August 22, 2011, page 2).
• Interim Hanford Storage design shall accommodate the need for additional storage capacity based on actual WTP production rates, projected total IHLW canister count, and the availability of a final disposal alternative (DOE-ORP letter 11-TF-082, August 22, 2011, page 6).
• Interim Hanford Storage shall be capable of maintaining IHLW canisters in safe and compliant storage (DOE O 435.1-1, Radioactive Waste Management Manual, Chapter II, Sections F and T).

A-5.2 Manage Potential Contact-Handled Transuranic Tank Waste

Potential Contact-Handled Transuranic Tank Waste Interim Storage

Potential contact-handled transuranic tank waste containers will be transported from the supplemental transuranic treatment facility to the Central Waste Complex. Potential contact-handled transuranic tank waste containers will be stored and monitored at the Central Waste Complex pending determination of a final disposal pathway. The potential contact-handled transuranic tank waste containers will eventually be retrieved from storage and disposed via the final disposal pathway.

• The TOC shall transport potential contact-handled transuranic tank waste containers from the supplemental transuranic treatment facility to the Central Waste Complex (DE-AC27-08RV14800, Section C.2.4.5).

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20 Operation of the Central Waste Complex is the responsibility of the PRC.
• Potential contact-handled transuranic tank waste containers shall be held in onsite interim storage pending determination of a final disposal pathway (DE-AC27-08RV14800, Section C.1.4).

A-5.3 Manage Immobilized Low-Activity Waste

Immobilized Low-Activity Waste Management

The TOC shall provide transportation for ILAW canisters from a LAW immobilization facility to an onsite near-surface disposal facility (DE-AC27-08RV14800, Section C.2.3.3).

• Physical transfer of the ILAW product from the WTP to the disposal facility shall be conducted in accordance with ICD-15 (24590-WTP-ICD-MG-01-015, Interface Control Document for Immobilized Low-Activity Waste).

A-5.4 Manage Secondary Waste

Manage Secondary Liquid Waste

Prepare secondary liquid wastes to meet waste acceptance criteria for release to an onsite disposal facility. Non-radioactive and non-dangerous secondary liquid waste shall be transferred to the TEDF. Radioactive and dangerous liquid effluent (e.g. 242-A Evaporator condensate, WTP evaporator condensate, caustic scrubber effluent, and decontamination fluids) shall be transferred to the LERF in preparation for treatment in the ETF.

• The LERF/ETF shall be upgraded to accommodate the quantity and compositions of secondary liquid waste generated by the PROCESS WASTE function (DE-AC27-08RV14800, Section C.2.3.4).
• ETF upgrades shall include the capability to produce a solidified waste form that can be disposed at a permitted onsite disposal facility (Justification of Mission Need for the Secondary Liquid Waste Treatment Project, December 2010).

Manage Spent and Failed Melters

The TOC shall design and procure the necessary equipment and arrange for transportation of unique waste forms from WTP to their respective on-site disposition or storage locations$^{21}$ (DE-AC27-08RV14800, Section C.2.3.3).

Manage Secondary Solid Waste

Prepare secondary solid wastes to meet onsite disposal facility waste acceptance criteria.


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$^{21}$ This requirement is interpreted to include transportation of spent and failed IHLW and ILAW melters from the WTP to a permitted onsite disposal facility for disposal.
• Solid wastes for onsite disposal shall be characterized for acceptance under Hanford solid waste acceptance criteria (HNF-EP-0063 Section 1.1; RPP-8402, *Waste Acceptance Criteria for the Immobilized Low-Activity Waste Disposal Facility*, Section 1.1.2).

**Manage Sanitary Waste and Refuse**

Management of sanitary waste and refuse is the responsibility of the Mission Support Alliance (MSA) under contract to the U.S. Department of Energy (DOE), Richland Operations Office (RL).

**A-5.5 Close Tanks and Waste Management Areas**

**Close SSTs and Ancillary Storage Systems**

Close all Hanford SST Farms and ancillary storage systems. Close and stabilize facilities preparatory to transition for deactivation and decommissioning. Close SSTs, SST farms, ancillary storage systems and ancillary facilities in accordance with approved closure plans and the TC&WM EIS Record of Decision (DE-AC27-08RV14800, Section C.2.2.2). If necessary, due to waste residues remaining after closure, prepare for post-closure monitoring and care.

- All SSTs, SST farms, ancillary storage systems and ancillary facilities shall be closed by January 31, 2043 (TPA Milestone M-045-00, Ecology, EPA and DOE, 1989).

**Close DSTs**

Close all Hanford DST farms. Close and stabilize facilities preparatory to transition for deactivation and decommissioning. Close DSTs, DST farms, and ancillary facilities when they are no longer required to conduct the RPP mission in accordance with approved closure plans and the TC&WM EIS Record of Decision (DE-AC27-08RV14800, Section C.1.4). If necessary, because waste residues remain after closure, prepare for post-closure monitoring and care.

- All DSTs, DST farms, and ancillary facilities shall be closed no later than September 30, 2052 (TPA Milestone M-042-00A, Ecology, EPA and DOE, 1989).

**Perform Waste Management Area Remediation**

As required, perform Waste Management Area remediation.

- The TOC shall characterize vadose zone contamination, perform barrier installations, and perform soils remediation in coordination with the Hanford Site groundwater program (DE-AC27-08RV14800, Section C.1.4).

**A-5.6 Close Facilities**

**Close WTP**

Safely and efficiently deactivate, decommission, and close the WTP when it is no longer needed for the RPP mission. Close the WTP and associated facilities in accordance with approved
closure plans and the TC&WM EIS Record of Decision (DE-AC27-08RV14800, Section C.1.4). If necessary, because waste residues remain after closure, prepare the WTP and associated facilities for post-closure monitoring and care.

- The TOC shall decommission the WTP after RPP mission completion (DE-AC27-08RV14800, Section C.1.4).

**Close Supplemental Waste Treatment Facilities**

Safely and efficiently deactivate, decommission, and close the supplemental waste treatment facilities when they are no longer needed for the RPP mission. Close the supplemental waste treatment facilities in accordance with approved closure plans (DE-AC27-08RV14800, Section C.1.4). If necessary, because waste residues remain after closure, prepare the supplemental waste treatment facilities for post-closure monitoring and care.

- The TOC shall decommission supplemental waste treatment facilities after RPP mission completion (DE-AC27-08RV14800, Section C.1.4).

**Close RPP Support Facilities**

Safely and efficiently deactivate, decommission, and close RPP support facilities when they are no longer needed for the RPP mission. Close the RPP support facilities in accordance with approved closure plans (DE-AC27-08RV14800, Section C.1.4).
APPENDIX A-6 REFERENCES


AOP 00-05-006, Hanford Site Air Operating Permit.


APPENDIX B. GLOSSARY
## Glossary

<table>
<thead>
<tr>
<th>Term or Abbreviation</th>
<th>Definition or Expansion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architecture</td>
<td>A necessary and sufficient set of systems, structures and components (SSCs), design details and performance parameters required to execute the RPP mission and successfully achieve mission goals.</td>
</tr>
<tr>
<td>Assumed Leaker</td>
<td>The integrity classification of a waste storage tank for which surveillance data indicates a loss of liquid attributed to a breach of integrity in the past. No tanks are known to be leaking today.</td>
</tr>
<tr>
<td>Constraint</td>
<td>External restriction on how the mission may be executed (Federal law, Federal regulation, DOE Order, State administrative code, TC &amp; WM EIS ROD¹, Tri-Party Agreement milestone², Consent Decree milestone³, DOE Hanford Site standard, DOE Hanford Site directive, ORP directive, offsite waste disposal facility waste acceptance criteria, national consensus standard).</td>
</tr>
<tr>
<td>Closure</td>
<td>“Closure” is defined as the deactivation and stabilization of a radioactive waste facility intended for long-term confinement of waste (per DOE M 435.1-1⁴). “Final closure” of the operable units (tank farms) is defined as regulatory approval of completion of closure actions and commencement of post-closure actions. For the purpose of this document, all units located within the boundary of each tank farm will be closed in accordance with WAC 173-303-610⁵.</td>
</tr>
<tr>
<td>Function</td>
<td>Action that must be performed to transform the mission initial state (current situation) into the mission end state (desired outcome).</td>
</tr>
<tr>
<td>Derived Requirement</td>
<td>Requirement not directly traceable to a single source, but derivable as a logical corollary of two or more constraints, direct requirements or a combination thereof.</td>
</tr>
<tr>
<td>Direct Requirement</td>
<td>Requirement directly traceable to a constraint (as defined above), WTP or TOC contractual commitment⁶, WTP/TOC interface control document⁷, onsite waste disposal facility waste acceptance criteria, requirement in selected top-level WTP technical baseline documents, and requirement in selected top-level TOC technical baseline documents.</td>
</tr>
<tr>
<td>Disposal</td>
<td>Emplacement of waste in such a manner that ensures protection of the public, workers, and the environment with no intention of retrieval and that requires deliberate action to regain access to the waste (per DOE M 435.1-1⁴).</td>
</tr>
<tr>
<td>Enabling Assumption</td>
<td>A logical deduction regarding mission architecture in the absence of an applicable direct or derived requirement; an enabling assumption permits mission architecture to be defined in the absence of a necessary and sufficient set of mission requirements.</td>
</tr>
<tr>
<td>Hard-to-Remove Heel</td>
<td>A large solid mass or group of large solids not easily removed from the bottom of some large tanks.</td>
</tr>
<tr>
<td>High-Level Waste (HLW)</td>
<td>The term HLW refers to the fraction of the tank waste containing most of the radioactivity that will be immobilized into glass and disposed at an off-site repository. This includes the solids remaining after pretreatment plus certain separated radionuclides.</td>
</tr>
<tr>
<td>Low-Activity Waste (LAW)</td>
<td>Waste that remains following the process of separating as much of the radioactivity as is practicable from HLW. When solidified, LAW may</td>
</tr>
</tbody>
</table>
be disposed of as low-level waste in a near-surface facility.

<table>
<thead>
<tr>
<th><strong>Low-Level Waste (LLW)</strong></th>
<th>Radioactive waste not classified as high-level radioactive waste, transuranic waste, spent nuclear fuel, or byproduct material, as defined in section 11e.(2) of the Atomic Energy Act of 1954. $^9$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mixed Waste</strong></td>
<td>Mixed waste contains both radioactive and chemically hazardous components.</td>
</tr>
<tr>
<td><strong>Pretreatment</strong></td>
<td>Separation of waste into a high-level and a low-activity waste fraction.</td>
</tr>
<tr>
<td><strong>Ready-to-Serve</strong></td>
<td>Immediately available to discharge a function; in this particular application, immediately available to sample tank waste and transport the samples to an analytical laboratory.</td>
</tr>
<tr>
<td><strong>Requirement</strong></td>
<td>Qualitative or quantitative need that a mission function must fulfill to ensure mission success.</td>
</tr>
<tr>
<td><strong>Retrieval</strong></td>
<td>The process of removing, to the maximum extent practical, all the waste from a given underground storage tank. The retrieval process is selected specific to each tank and accounts for the waste type stored and the access and support systems available. A tank is in “retrieval status” if one of two conditions is met: (1) waste has been physically removed from the tank by retrieval operations, or (2) preparations for retrieval operations are directly responsible for rendering the leak or intrusion monitoring instrument “out of service.”</td>
</tr>
<tr>
<td><strong>Saltcake</strong></td>
<td>Saltcake is a mixture of crystalline sodium salts that originally precipitated when alkaline liquid waste from the various processing facilities was evaporated to reduce waste volume. Saltcakes are comprised primarily of the sodium salts of nitrate, nitrite, carbonate, phosphate, and sulfate. Concentrations of transition metals such as iron, manganese, and lanthanum and heavy metals (e.g., uranium and lead) are generally small. Saltcake typically contains a small amount of interstitial liquid. The bulk of the saltcake will dissolve if contacted with sufficient water.</td>
</tr>
<tr>
<td><strong>Sludge</strong></td>
<td>Sludge is a mixture of metal hydroxides and oxyhydroxides that originally precipitated when acid liquid waste from the various reprocessing facilities was made alkaline with sodium hydroxide. Sludge is comprised primary of the hydroxides and oxyhydroxides of aluminum, iron, chromium, silicon, zirconium, and uranium, plus the majority of the insoluble radionuclides such as $^{90}$Sr and the plutonium isotopes. Sludge typically contains a significant amount of interstitial liquid (up to nominal 40-wt% water). Sludge is mostly insoluble in water; however, a significant amount of aluminum and chromium will dissolve if leached with sufficient quantities of sodium hydroxide.</td>
</tr>
<tr>
<td><strong>Supernate</strong></td>
<td>Supernate is technically the liquid floating above a settled solids layer. At Hanford, it is typically used to refer to any non-interstitial liquid in the tanks, even if no solids are present. Supernate is similar to saltcake in composition and contains many of the soluble radionuclides such as $^{137}$Cs and $^{99}$Tc.</td>
</tr>
<tr>
<td><strong>Supplemental Pretreatment</strong></td>
<td>Pretreatment capacity beyond that provided by WTP Pretreatment Facility design capacity.</td>
</tr>
<tr>
<td><strong>Supplemental Treatment</strong></td>
<td>Treatment capacity beyond that provided by WTP Low-Activity Waste Vitrification Facility design capacity (e.g. Second Low-Activity Waste Facility).</td>
</tr>
<tr>
<td><strong>Treatment</strong></td>
<td>Conversion of a high-level or low-activity waste fraction into a waste</td>
</tr>
</tbody>
</table>
form that complies with the waste disposal facility’s waste acceptance criteria, regulatory permit and safety authorization basis.

| Waste Group A Tanks | Tanks, that due to their waste composition and quantities, have the potential for a spontaneous buoyant displacement gas release event and are conservatively estimated to contain enough flammable gas within the waste that if all were released into the tank headspace, the concentration of the flammable gas would be a flammable mixture. |

References:


