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Savannah River Site Liquid Waste Planning Process

LIQUID Waste System Plan

An Integrated System at the Savannah River Site

REVISION 17

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Liquid Waste System Plan Revision 17

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1. Executive Summary

This seventeenth revision of the *Liquid Waste System Plan* recognizes challenges in funding while continuing to provide a plan to complete the Liquid Waste (LW) mission within all regulatory and legal requirements. It accomplishes this by reinventing the Savannah River Site (SRS) Liquid Waste Program in a way that integrates the smartest combination of facility operating schedules, supporting infrastructure upgrades, and workforce management actions to enable the completion of as many deliverables as possible under reduced budget projections. The overarching objective of Revision 17 of the *Plan* is to meet all Federal Facility Agreement and Site Treatment Plan regulatory commitments on or ahead of schedule while preserving as much lifecycle acceleration as possible through incorporation of numerous cost savings initiatives, elimination of non-essential scope, and deferral of other scope not on the critical path to compliance.

Preliminary funding guidance for Fiscal Year (FY) 2012 and projections for future years are significantly less than needed to execute the mission as outlined in Revision 16 of the *Plan*. These reduced funding levels drove the need for a revised approach with the objective of first ensuring regulatory commitments could be met, and then accelerating the program and reducing risks.

Purpose

The purpose of the *Liquid Waste System Plan* (hereinafter referred to as "this *Plan*") is to integrate and document the activities required to disposition the existing and future High Level Waste (HLW) and to remove from service radioactive LW tanks and facilities at the Department of Energy (DOE) SRS. It records a planning basis for waste processing in the LW System through the end of the program mission. Its development is a joint effort between DOE-Savannah River (DOE-SR) and Savannah River Remediation LLC (SRR).

This *Plan* satisfies the contract deliverable described in Contract № DE-AC09-09SR22505; Part III — List of Documents, Exhibits, and Other Attachments; Section J — List of Attachments; Appendix M — Deliverables; Item № 1 — *Liquid Waste System Plan*.[1]

This seventeenth revision (Revision 17) of the *Plan*:

- Provides one of the inputs to development of financial submissions to the complex-wide Integrated Planning, Accountability, & Budgeting System (IPABS)
- Provides one of the inputs for updating the *Savannah River Site Environmental Management Program Project Execution Plan* (PEP)[2]
- Provides a basis for LW contract and Contract Performance Baseline changes
- Forecasts compliance with the currently approved *Federal Facility Agreement* (FFA)[3] and its Waste Removal Plan and Schedule and the *Site Treatment Plan* (STP)[4].

Goals

The goals of this *Plan* are to meet the following programmatic objectives:

- Continue storing liquid radioactive wastes in a safe and environmentally sound manner
- Meet tank bulk waste removal efforts regulatory milestones in the currently-approved FFA
- Meet tank removal-from-service regulatory milestones in the currently-approved FFA
- Meet the waste treatment goals identified in the STP
- Conduct operations consistent with the *Section 3116 Determination for Salt Waste Disposal at the Savannah River Site*[5], the *Basis for Section 3116 Determination for Salt Waste Disposal at the Savannah River Site*[6], and future waste determination (WD) and Basis documents for F- and H-Areas
- Comply with applicable permits and consent orders, including the Modified Class 3 Landfill Permit for the SRS Z-Area Saltstone Disposal Facility (SDF) (permit ID 025500-1603) and State-approved area-specific General Closure Plans
- Optimize program life cycle cost and schedule
- Provide tank space to support staging of salt solution adequate to feed the Salt Waste Processing Facility (SWPF) at system capacity
- Provide tank space to support staging of salt solution adequate to feed the Small Column Ion Exchange (SCIX)at system capacity
- Sustain sludge vitrification in the Defense Waste Processing Facility (DWPF)

- Minimize the quantity of radionuclides (as measured in curies) dispositioned in the SDF, keeping the total curies at or below the amount identified in *Savannah River Site – Liquid Waste Disposition Processing Strategy*[7] (SRS LW Strategy), as amended by letter from the South Carolina Department of Health and Environmental Control (SCDHEC) to DOE-SR[8] and the *Basis for Section 3116 Determination for Salt Waste Disposal at the Savannah River Site*[6]
- Support continued nuclear material stabilization of legacy materials in H-Canyon.

To enable continuation of risk reduction initiatives encompassed by the goals above, this *Plan* follows a processing strategy to provide the tank space required to support meeting, or minimizing impacts to meeting, programmatic objectives. During the period prior to startup of SWPF in 2014, near-term retrieval, treatment, and disposal of salt waste are required. The Actinide Removal Process (ARP) and Modular Caustic Side Solvent Extraction (CSSX) Unit (MCU) facilities provide this treatment. Operation of these salt treatment processes frees up working space in the 2F, 2H, and 3H Evaporators' concentrate receipt tanks (Tanks 25, 38, and 30 and 37, respectively). This provides support for near-term handling of waste streams generated from early-year tank removals from service, DWPF sludge batch preparation, DWPF recycle handling, and H-Canyon processing.

Revisions

The significant updates from the previous version of this *Plan,* the *Liquid Waste System Plan, Revision 16* (Rev 16)[9], include:

- Modifications required due to near-term funding limitation, as described in the Cost Savings Initiative (CSI):
  - Reschedule Enhanced Chemical Cleaning (ECC) implementation
  - Elimination of Rotary Micro-Filter (RMF) for sludge washing
  - Less acceleration in tank removal from service
  - Reschedule implementation of SCIX
- **Salt Processing**:
  - **SWPF Processing:** SWPF operations initiation rescheduled to October 2014 from July 2014
  - **SCIX Processing**: reschedule of SRR's proposal of a supplemental salt treatment process
  - **Next Generation Extractant:**
    - increase SWPF processing rate to a nominal 8 million gallons per year (Mgal/yr) beginning in 2018
  - **Tank 48**: Tank 48 is no longer required to return to service to meet LW system goals

Results of the Plan

Table 1-1 — *Results of the Plan* describes the major results as compared to Revision 16 of the *Plan*:

Table 1-1 — *Results of the* Plan

Parameter	Rev 16	This *Plan*
Date last LW facility removed from service	2026	2028
All bulk waste removal currently-approved FFA commitments met	Yes	Yes
All yearly tank removal from service currently-approved FFA commitments met	Yes	Yes
Final FY2022 currently-approved FFA commitment met	Yes	Yes
Final Type I, II, and IV tanks removed from service	2018	2022
2028 STP commitment met	Yes	Yes
Date when waste removal complete from all tanks	Dec 2024	Jun 2027
SCIX for supplemental salt waste treatment	Yes	Yes
Next generation extractant for increased SWPF throughput	Yes	Yes
Cesium concentration of initial SWPF batch	<1 Ci/gal	<1 Ci/gal
DWPF processing complete	2025	2027
Salt only canisters	No	No
Maximum canister waste loading	40 wt%	43 wt%
Nominal annual canister throughput rate	400	325
Total number of canisters produced	7,557	7,580
Radionuclides (curies) dispositioned in SDF within the amended *SRS LW Strategy*	Yes	Yes
Radionuclides (curies) dispositioned in SDF within NDAA §3116	Yes	Yes
Total number of Saltstone Disposal Units (SDU)	41	12

Parameter	Rev 16	This *Plan*
SWPF facility end of operations	2025	2026
DWPF facility end of operations	2026	2028
Saltstone Production Facility (SPF) facility end of operations	2026	2028

- **SWPF Processing**: This *Plan* maintains the tank space required to provide feed for SWPF to maintain full capacity operations. The nominal processing rate for SWPF increases to 8 Mgal/yr from 7 Mgal/yr due to the incorporation of an improved cesium extractant. This increase allows SWPF to meet the 2028 STP waste removal commitment.
- **Radionuclides Dispositioned in SDF**: This *Plan* is consistent with *SRS LW Strategy* as amended by letter from the SCDHEC to DOE-SR[8] and the *Basis for Section 3116 Determination for Salt Waste Disposal at the Savannah River Site*[6] concerning the total curies dispositioned at SDF
- **Vitrification of Sludge at DWPF**: This *Plan* continues the accelerated vitrification of sludge at DWPF discussed in Rev 16. This *Plan* also reflects:
  - updated estimates of sludge mass in Tanks 4 and 12 based on sample results (see section 4.2)
  - reduced low temperature aluminum dissolution (LTAD) for some of the material in Tank 13 and Tank 15
  - lower canister loadings during the time of the reschedule of SWPF
- **Supporting Nuclear Material Stabilization**: Sufficient Tank Farm space exists to support the receipt of projected H-Canyon waste through the end of H-Canyon operations and shutdown flows. This *Plan* accommodates receipt of additional H-Canyon waste in Tank 50, or directly to sludge batches
- **Tank Closure**: This *Plan* projects meeting or exceeding all currently approved FFA commitments, however reduced funding limits the ability to mitigate outyear risks, e.g., reschedule of the start-up of SWPF (cf §5.1)
- **Waste Treatment — STP Commitment**: The increased SWPF production rate allows removal of the backlogged and currently generated waste inventory to be complete in 2027
- **Canister Storage**: This *Plan* projects completely filling Glass Waste Storage Building (GWSB) #2 in early 2017. This requires supplemental canister storage to become available in 2017. Shipment of canisters from SRS is not included in this *Plan*.
- **SDU**: In future years, larger capacity vaults may be used. Design for these SDUs is being evaluated.

2. Introduction

This revision of the *Plan* documents the current operating strategy of the LW System at SRS to receive, store, treat, and dispose of radioactive liquid waste and to close waste storage and processing facilities. The LW System is a highly integrated operation involving safely storing liquid waste in underground storage tanks; removing, treating, and dispositioning the low-level waste (LLW) fraction in concrete SDUs; vitrifying the higher activity waste at DWPF; and storing the vitrified waste in stainless steel canisters until permanent disposition. After waste removal and processing, the storage and processing facilities are cleaned and closed. This *Plan* assumes the reader has a familiarity with the systems and processes discussed. Section 7 — *System Description* is an overview of the LW System.

The Tank Farms have received over 150 million gallons of waste from 1954 to the present. Reducing the volumes of waste through evaporation and disposition of waste via vitrification and saltstone, the Tank Farms currently store approximately 38 million gallons of waste containing approximately 318 million curies of radioactivity. As of September 30, 2011, DWPF had produced 3,251 vitrified waste canisters. All volumes and total curies reported as current inventory in the Tank Farms are as of September 30, 2011 and account for any changes of volume or curies in the Tank Farms since Revision 16 of the *Plan* and the *Section 3116 Determination for Salt Waste Disposal at the Savannah River Site*.

Successful and timely salt waste removal and disposal is integral to efforts by SRS to proceed with all aspects of tank cleanup and removal from service, extending well beyond permitted disposal of the solidified low-activity salt waste streams themselves. Removal and disposal of salt waste not only enables removal of tanks from service, it is necessary for the continued removal and stabilization of the high-activity sludge fraction of the waste. This is because SRS uses the tanks to prepare the high-activity waste for processing in DWPF. Salt waste is filling up tank space needed to allow this preparation activity to continue. Processing low-activity salt waste through ARP/MCU reduces, but does not eliminate, this tank space shortage and increases the likelihood that vitrification of the high-activity fraction will be able to continue uninterrupted.

Operating ARP/MCU as described in this *Plan* will enable continued stabilization of DOE Complex legacy nuclear materials. It will also increase the likelihood of feeding SWPF at nominal capacity when it begins operation, which would not be possible without these treatment processes. Use of ARP/MCU will allow DOE to complete cleanup and removal from service of the tanks years earlier than would otherwise be the case, which, in turn, will reduce the time during which the tanks — including many that do not have full secondary containment and have a known history of leak sites — continue to store liquid radioactive waste.

2.1 *Alternative Analyses*

This *Plan* provides a qualitative analysis of several alternatives to describe the potential impacts of pursuing these alternatives:

- SWPF operations initiation rescheduled until September 30, 2015 vs. October 2014
- SWPF operations initiation rescheduled as above, but with reduced throughput in the early years
- Fissile material disposition in sludge batches at various concentration in glass including:
  - disposition of 2.5 metric tons (t) of additional fissile material at 897 g/m^3
  - disposition of additional fissile material at 2,500 g/m^3
  - disposition of additional fissile material at 5,400 g/m^3

2.2 *Goals*

The goals of this *Plan* are to meet the following programmatic objectives:

- Continue storing liquid radioactive wastes in a safe and environmentally sound manner
- Meet tank bulk waste removal efforts regulatory milestones in the currently-approved FFA
- Meet tank removal-from-service regulatory milestones in the currently-approved FFA
- Meet the waste treatment goals identified in the STP
- Conduct operations consistent with the *Section 3116 Determination for Salt Waste Disposal at the Savannah River Site*, the *Basis for Section 3116 Determination for Salt Waste Disposal at the Savannah River Site*, and future WD and Basis documents for F- and H-Areas
- Comply with applicable permits and consent orders, including the Modified Class 3 Landfill Permit for the SRS Z-Area SDF (permit ID 025500-1603) and State-approved area-specific General Closure Plans
- Optimize program life cycle cost and schedule

- Provide tank space to support staging of salt solution adequate to feed the SWPF at system capacity
- Provide tank space to support staging of salt solution adequate to feed the SCIX at system capacity
- Sustain sludge vitrification in the DWPF
- Minimize the quantity of radionuclides (as measured in curies) dispositioned in the SDF, keeping the total curies at or below the amount identified in the *SRS LW Strategy* as amended by letter from the SCDHEC to DOE-SR[8] and the *Basis for Section 3116 Determination for Salt Waste Disposal at the Savannah River Site*[6]
- Support continued nuclear material stabilization of legacy materials in H-Canyon.

The following generalized priorities guide the sequencing of waste removal and disposition from the Liquid Radioactive Waste tanks:

1. Remove waste from tanks with a leakage history, while safely managing the total waste inventory
2. Support removal from service of Type I, II, and IV tanks to meet currently approved FFA commitments
3. Ensure the curies dispositioned to the SDF are at or below the amount identified in the *SRS LW Strategy* and the *Basis for Section 3116 Determination for Salt Waste Disposal at the Savannah River Site*.
4. Provide tank space to support staging of sludge adequate to feed DWPF
5. Provide tank space to support staging of salt solution adequate to feed salt solution to SWPF and SCIX at full capacity
6. Support continued nuclear material stabilization in H-Canyon

There is currently a premium on processing and storage space in the SRS radioactive liquid waste tanks. To enable continuation of risk reduction initiatives encompassed by the goals above, this *Plan* follows a processing strategy providing the tank space required to meet, or minimizing impacts to meeting, programmatic objectives. During the period prior to startup of SWPF in 2014, near-term retrieval, treatment, and disposal of salt waste are required. The ARP/MCU facilities perform this treatment. Operation of these salt treatment processes frees up working space in the 2F, 2H, and 3H Evaporators' concentrate receipt tanks (Tanks 25, 38, and 30 and 37, respectively). This provides support for near-term handling of waste streams generated from early-year tank removals from service, DWPF sludge batch preparation, DWPF recycle handling, and H-Canyon processing.

These initiatives and the assumed SWPF startup in 2014 provide tank space to minimize impacts to the programmatic objectives.

2.3 *Risk Assessment*

The *PBS-SR-0014, Radioactive Liquid Tank Waste Stabilization and Disposition, Risk and Opportunity Management Plan*[10] (ROMP) documents the comprehensive identification and analysis of technical risks and opportunities associated with the LW program. It identifies individual technical and programmatic risks and presents the strategies for handling risks and opportunities in the near-term and outyears.

The Savannah River Site (SRS) has developed a strategic plan for the future that is called **Enterprise·SRS**. The Vision of this Plan is: "Revitalize assets and create an enduring, high-impact future for SRS." SRR plays a key role in the execution of that Vision and that is the acceleration of Liquid HLW Disposition. This includes processing of all existing and future liquid HLW, creating a "road ready" waste form for the HLW fraction, disposing of the LLW fraction in Saltstone, and closure of HLW tanks and facilities that are not needed to support the enduring mission. SRR currently has identified 11 Strategic Initiatives. Each initiative has a DOE and SRR champion. Over the next year, each of the 11 will be pursued and deployed if they provide cost effective support for the Vision. It is expected that additional initiatives will be pursued as they are identified.

3. Planning Bases

This *Plan* is based on inputs and assumptions provided by the DOE. Dates, volumes, and chemical or radiological composition information contained in this *Plan* are planning approximations only. Specific flowsheets guide actual execution of individual processing steps. The activities described are summary-level activities, some of which have yet to be fully defined. The sequence of activities reflects the best judgment of the planners. The individual activity execution strategies contain full scope, schedule, and funding development. Upon approval of scope, cost, and schedule baselines modifications of this *Plan* may be required.

3.1 *Reference Date*

The reference date for the mathematical modeling of this *Plan* is July 5, 2011. Schedules, milestones, and operational plans were current as of that date. The *Information on the Radiological and Chemical Characterization of the Savannah River Site Tank Waste As of July 5, 2011*[11] documents Waste Characterization System (WCS) tank inventory data used in this *Plan*. Actual operational performance stated in this *Plan* is current as of the end of FY11, September 20, 2011.

3.2 *Funding*

Progress toward the ultimate goal of immobilizing all the LW at SRS is highly dependent on available funding. This *Plan* was developed assuming the funding required, as specified in the *Fiscal Year (FY) 2012 Preliminary Expected Funds Letter — DE-AC09-09SR22505*[12]*,* will be available. It supports justification for requesting necessary funding profiles.

With any reduction from full funding, activities that ensure safe storage of waste claim first priority. Funding above that required for safe storage enables risk reduction activities, i.e., waste removal, treatment — including immobilization — and removal from service, as described in this *Plan*.

3.3 *Regulatory Drivers*

Numerous laws, constraints, and commitments influence LW System planning. Described below are requirements most directly affecting LW system planning. This *Plan* assumes the timely acquisition of regulatory approvals.

South Carolina Environmental Laws

Under the South Carolina Pollution Control Act, S. C. Code Ann. §§ 48-1-10 *et seq*., SCDHEC is the delegated authority for air pollution control and water pollution control. The State has empowered SCDHEC to adopt standards for protection of water and air quality, and to issue permits for pollutant discharges. Further, SCDHEC is authorized to administer both the federal Clean Water Act and the Clean Air Act. Under South Carolina's Hazardous Waste Management Act, S. C. Code Ann. §§ 44-56-10 *et seq*., SCDHEC is granted the authority to manage hazardous wastes. With minor modifications, SCDHEC has promulgated the federal Resource Conservation and Recovery Act (RCRA) requirements, including essentially the same numbering system. The South Carolina Solid Waste Policy and Management Act, S. C. Code Ann. §§ 44-96-10 *et seq*., provides standards for the management of most solid wastes in the state. For example, SCDHEC issued to DOE-SR permits such as the Class 3 Landfill Permit for SDF. This landfill permit contains conditions for the acceptable disposal of non-hazardous waste in the SDF. This permit also contains provisions for fines and penalties. Other principal permits required to operate LW facilities pursuant to the state's environmental laws include:

- SCDHEC Bureau of Water:
  - industrial wastewater treatment facility permits (e.g., Tank Farms, DWPF, ARP/MCU, Effluent Treatment Facility [ETF], and the SPF)
  - National Pollutant Discharge Elimination System (NPDES) permit (H-16 Outfall discharges from ETF)
- SCDHEC Bureau of Air Quality:
  - Part 70 Air Quality Permit (one Site-wide Air Permit including the LW facilities).

Site Treatment Plan

The STP[4] for SRS describes the development of treatment capacities and technologies for mixed wastes, and provides guidance on establishing treatment technologies for newly identified mixed wastes. The STP allows DOE, regulatory agencies, the States, and other stakeholders to efficiently plan mixed waste treatment and disposal by considering waste volumes and treatment capacities on a national scale. The STP identifies vitrification in DWPF as the preferred treatment option for appropriate SRS liquid high-level radioactive waste streams. SRS has committed that:

> *"Upon the beginning of full operations, DWPF will maintain canister production sufficient to meet the commitment for the removal of the backlogged and currently generated waste inventory by 2028."*

The commitment for the removal of the waste by 2028 encompasses the bulk waste removal efforts (BWRE) and heel removal scope of this *Plan*. Final cleaning, deactivation, and removal from service of storage and processing facilities are subsequent to the satisfaction of this commitment.

Federal Facility Agreement

The Environmental Protection Agency (EPA), DOE, and SCDHEC executed the SRS FFA[3] on January 15, 1993, which became effective August 16, 1993. It provides standards for secondary containment, requirements for responding to leaks, and provisions for the removal from service of leaking or unsuitable LW storage tanks. Tanks scheduled to be removed from service may continue to be used, but must adhere to the FFA schedule for removal from service and the applicable requirements contained in the Tank Farms' industrial wastewater treatment facility permit. An agreement between DOE, SCDHEC, and EPA (*Statement of Resolution of Dispute Concerning Extension of Closure Dates for Savannah River Site High-Level Radioactive Waste Tanks 19 and 18*[13] effective in November 2007) modified the FFA by providing for the submission of Waste Determination documentation for F- and H-Tank Farms and including end dates for BWRE and the operational closure of each old style tank. It commits SRS to operationally close the last old style tank no later than 2022.

National Environmental Policy Act

The National Environmental Policy Act (NEPA) requires federal agencies to assess the potential environmental impacts of proposed actions. Seven existing NEPA documents and their associated records of decision directly affect the LW System and support the operating scenario described in this *Plan*:

- DWPF Supplemental Environmental Impact Statement (SEIS) (DOE/EIS-0082-S)
- Final Waste Management Programmatic Environmental Impact Statement (PEIS) (DOE/EIS-0200-F)
- SRS Waste Management Final EIS (DOE/EIS-0217)
- Interim Management of Nuclear Materials EIS (DOE/EIS-0220)
- SRS High-Level Waste Tank Closure Final EIS (DOE/EIS-0303)
- Environmental Assessment (EA) for the Closure of the High Level Waste Tanks in F- and H Areas at SRS (DOE/EA-1164)
- SRS Salt Processing Alternatives Final SEIS (DOE/EIS-0082-S2).

Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005

The *Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005* (NDAA) Section 3116 (NDAA §3116) concerns determinations by the Secretary of Energy, in consultation with the Nuclear Regulatory Commission (NRC), that certain radioactive waste from reprocessing is not high-level waste and may be disposed of in South Carolina pursuant to a State-approved closure plan or State-issued permit. For salt waste, DOE contemplates removing targeted fission products and actinides using a variety of technologies and combining the removed fission products and actinides with the metals being vitrified in DWPF. NDAA §3116 governs solidifying the remaining low-activity salt stream into saltstone for the purpose of disposal in the SDF. For Type I, II, and IV tank removal from service activities, NDAA §3116 governs the Waste Determinations for the Tank Farms that demonstrate that the tanks and ancillary equipment (evaporators, diversion boxes, etc.) at the time of removal from service and stabilization can be managed as non-high level waste.

3.4 *Revisions*

The significant updates from the previous version of this *Plan,* the *Liquid Waste System Plan, Revision 16*[9], include:

- **Salt Processing**:
  - **SWPF Processing:** SWPF operations initiation rescheduled to October 2014 from July 2014
  - **SCIX Processing**: SCIX operations initiation rescheduled to October 2018 from October 2013
    Note: this increases the amount of Decontaminated Salt Solution (DSS) to SPF
  - **Next Generation Extractant:**
    - No deployment of next generation extractant at MCU

  - Deploy next generation extractant to SWPF to increase processing rate to a nominal 8 Mgal/yr from 7 Mgal/yr beginning in 2018
- **Sludge Processing**
  - Eliminate RMF for the preparation of sludge batches
- **Tank Closure**
  - Increased durations for near-term regulatory approvals
  - Reschedule implementation of ECC
- **Tank Storage Space**
  - **Tank 48**: Tank 48 is no longer planned for return-to-service

3.5 *Key Milestones*

Key Milestones are those major dates deemed necessary under this *Plan* to remove waste from storage, process it into glass or saltstone, and close the LW facilities. The *LW System Plan, Revision 16* milestones are provided for comparison.

Table 3-1 — *Key Milestones*

Key Milestone	Revision 16	this *Plan*
Date last LW facility closed	2026	2028
Date when BWRE complete for Type I, II, and IV tanks	Nov 2016	Jul 2019
Date when all Type I, II, and IV tanks are removed from service	Sep 2018	Oct 2022
DWPF processing complete	2025	Dec 2026
Total number of canisters produced	7,557	7,580
– *Salt only canisters produced*	*0*	*0*
Supplemental canister storage required	Sep 2015	Dec 2016
Initiate ARP/MCU Processing	Apr 2008 (actual)	Apr 2008 (actual)
– *Deploy next generation extractant at MCU*	*Jan 2012*	*n/a*
Initiate SCIX Processing	Oct 2013	Oct 2018
Initiate SWPF Processing	Jul 2014	Oct 2014
– *Salt Solution Processed via DDA-solely*	*2.8 Mgal (Actual)*	*2.8 Mgal (Actual)*
– *Salt Solution Processed via ARP/MCU*	*5.4 Mgal*	*5.2 Mgal*
– *Salt Solution Processed via SCIX*	*26.8 Mgal*	*16 Mgal*
– *Salt Solution Processed via SWPF*	*61 Mgal*	*78 Mgal*
Total Salt Solution Processed	***96 Mgal***	***102 Mgal***
Number of SDU *(note SDU 6–12 are high capacity SDUs)*	41	12[i]
Salt Processing Complete	2024	2026
SWPF facility end of operations	2025	2026
DWPF facility end of operations	2026	2028
SPF facility end of operations	2026	2028

[i] *In future years, larger capacity vaults may be used. Design for these SDUs is being evaluated.*

4. Planning Summary and Results

This section summarizes the key attributes of this *Plan*. Detailed discussion on risks and associated mitigation strategies are included in other documents such as the ROMP and individual implementation activity risk assessments.

In addition, this *Plan* assumes receiving adequate funding to achieve the required project and operations activities. Failure to obtain adequate funding will have a commensurate impact on the programmatic objectives.

This section summarizes the *Plan*, based on the key assumptions and bases. Tabular results of the lifecycle, on a year-by-year basis, or graphical results of the lifecycle are included in:

- Appendix A — *Bulk Waste Removal Efforts & Removal from Service*
- Appendix B — *Salt Solution Processing*
- Appendix C — *Sludge Processing*
- Appendix D — *Canister Storage*
- Appendix E — *Tank Farm Influents and Effluents*
- Appendix F — *Remaining Tank Inventory*
- Appendix G — *LW System Plan — Rev 17 Summary*

4.1 *Waste Removal and Tank Closure*

4.1.1 Waste Removal and Tank Cleaning

The first step in the disposition of sludge and salt waste is BWRE. Sludge is sent to one of two feed preparation tanks ensuring sludge waste is continuously available for treatment at DWPF. Salt is dissolved, removed, and staged for treatment at ARP/MCU, SCIX, or SWPF.

Bulk Waste Removal Efforts

This *Plan* assumes utilization of the Waste on Wheels (WOW) concept, which requires no new infrastructure. Portable and temporary equipment meet tank infrastructure needs. Additional purchased pumps and WOW equipment perform accelerated BWRE operations concurrently in both Tank Farms. The primary components of the WOW system are:

- Long-lasting reusable submersible mixer pumps (SMP)
- A portable field operating station containing pump drives and controls
- A portable substation to provide 480-, 240- and 120-volt power to the WOW equipment
- Disposable carbon steel transfer pumps.

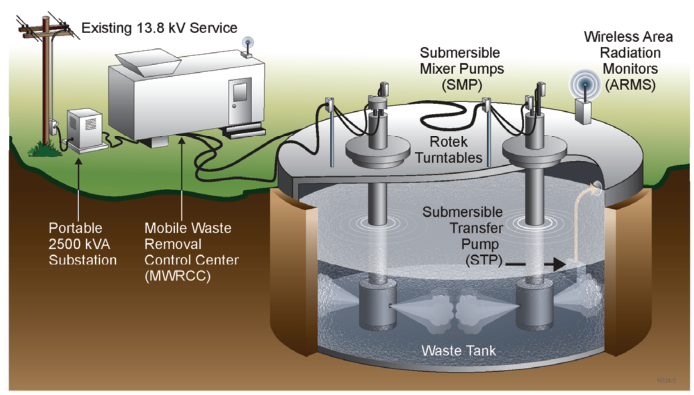


Figure 4–1 — *WOW Deployment for BWRE*

WOW equipment is deployed at the tank as a field operating station, providing temporary power and control for BWRE equipment. When BWRE is completed on one tank, the WOW equipment is reconfigured to support waste removal on the next tank. Pumps are sized to fit through 24-inch openings allowing a high degree of flexibility to locate the pumps in optimal configurations within the waste tanks. Most are supported from the bottom of the tank, minimizing steel superstructures and tank-top loading. Product lubricated bearings and motor cooling eliminate the need for bearing and seal water supply. These pumps have exterior fittings and fixtures so the pumps can be quickly decontaminated, removed, and reinstalled in the next tank with minimal radiation exposure to personnel. Disposable transfer pumps transfer the waste to a receipt or hub tank using existing underground transfer lines and diversion boxes. If the transfer system is degraded or non-existent, above-grade hose-in-hose technology is deployed, rather than investing in costly repairs. Temporary shielding is supplied as necessary to reduce exposure to personnel.

Sludge Removal

Sludge removal operations are typically conducted with three mixing pumps with provision for a fourth pump if needed. Sufficient liquid is added to the tank to suspend sludge solids; existing supernatant or DWPF recycle material is used instead of Inhibited Water (IW), when feasible, to minimize introduction of new liquids into the system. Operation of the mixing pumps suspends the solids, which are then transferred as a slurry from the tank. This operation is repeated, periodically lowering the mixer pumps, until the remaining contents of the tank can no longer be effectively removed by this method.

Sludge batches are configured to preferentially remove sludge from Type I, II, and IV tanks and to balance the sludge batch composition of Plutonium Uranium Reduction Extraction (PUREX) process and the modified PUREX process in H-Canyon (HM) sludges (see §7.1 for a description of these sludge types). Tank 13, a Type II tank in H-Tank Farm (HTF), will be used to store and transfer sludge from other tanks, as necessary, until Tank 13 heel removal is performed in 2018.

Salt Removal

Salt waste removal is accomplished using a modified density gradient process followed by mechanical agitation. A well is mined through the saltcake down to the tank bottom. An off-the-shelf, disposable transfer pump is installed at the bottom of the well, along with instruments to monitor waste density, to pump the interstitial liquid out of the tank until the well is dry. Water is added to dissolve the salt, and as the density increases, the saturated solution migrates to the bottom of the well where it is pumped out. The initial process involves no moving parts in the tank except the transfer pump. When available, DWPF recycle is used to dissolve salt, conserving Type III tank space by minimizing additions of new material and reducing the load on the evaporator system. The dissolved salt solution is prepared as

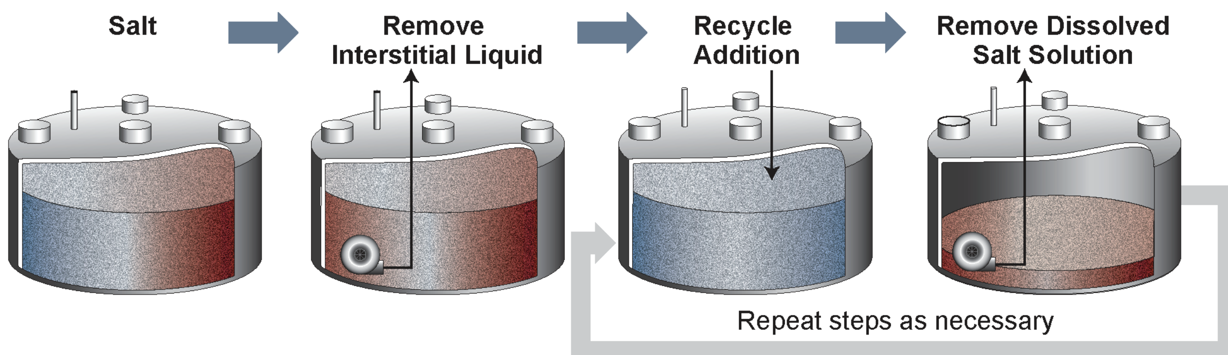


Figure 4–2 — *Modified Density Gradient Salt Removal*

close to saturation as possible prior to pumping out the tank. As salt dissolution progresses and the soluble fraction is pumped from the tank, the insoluble materials dispersed throughout the salt matrix blankets the underlying salt and the dissolution rate decreases significantly. SMPs, powered and controlled with WOW equipment, suspend and remove insoluble solids at the end of the dissolution step, similar to sludge removal.

Heel Removal

Heel removal is performed after BWRE has removed the material that can be removed with the technologies discussed above. It consists of Mechanical Heel Removal and Chemical Cleaning. In general mechanical heel removal is done prior to chemical cleaning, and is discussed below in some detail. However, depending on tank conditions, it may be more effective to perform chemical cleaning prior to mechanical heel removal or to perform some mechanical heel removal, some chemical heel removal, back and forth, to provide removal to the extent technically practicable from an engineering perspective and the highly radioactive radionuclides removed to the maximum extent practical.

Mechanical Heel Removal

For mechanical heel removal, this *Plan* assumes vigorous mixing continues, using SMPs, until less than 5,000 gallons of material remain. More aggressive methods, such as targeted hydro-lancing of sludge mounds, remotely operated robotic crawlers, etc., may be employed for difficult heels.

Chemical Cleaning

Chemical cleaning is performed when it is determined that mechanical heel removal has not removed the waste to the extent technically practicable from an engineering perspective and the highly radioactive radionuclides removed to the maximum extent practical. In bulk oxalic acid (OA) cleaning, OA is added to remaining solids in the tank to the minimum liquid level required to enable mixer pump operation. The contents of the tank are agitated for a short period and then transferred to a receipt tank for neutralization. This process is repeated three to four times, as necessary, to remain within the Tank Farm space constraints for receipt of the pH adjusted waste stream.

Enhanced Chemical Cleaning

The Enhanced Chemical Cleaning (ECC) process is an option for Type I, II, and III/IIIA tanks. This *Plan* assumes mechanical cleaning technologies are adequate for cleaning Type IV tanks, which contain no cooling coils, to acceptable levels. Using an AREVA patented technology, insoluble sludge and salt solids will be dissolved and redeposited in a Type III/IIIA waste tank resulting in a fraction of the spent liquid currently used for bulk chemical cleaning. This process employs dilute OA to dissolve residual waste, removing it along with insoluble material to clean vessels. A proprietary process using ozone destroys oxalates and spent acid, reducing liquid volume required. This process operates in small batch configuration until no more waste can be effectively removed by this process.

Bulk OA or ECC may be used depending on engineering and funding considerations on a per tank basis. ECC is planned to be available after 2018.

Tanks with Documented Leak Sites

Several Type I, II, and IV tanks have documented leak sites. All Type IV tanks having documented leak sites have been removed from service; however, waste removal operations on some of the Type I and II tanks could potentially reactivate old leak sites and potentially create new leak sites in those tanks. Contingency equipment and procedures will be utilized to contain leakage, transfer the waste to a Type III/IIIA tank, and minimize the potential for release to the environment. Specific plans will avoid liquid levels above known leak sites, when feasible, and focused monitoring will be employed where these levels cannot be avoided.

Annulus Cleaning

Some Type I and II tanks have waste in the annulus space, the majority of which is a soluble form of salt appearing as dried nodules on tank walls at leak sites and at the bottom of the annulus pan. These tanks will be inspected to determine if Annulus Cleaning is required. Before declaring the tank ready for grouting (for those tanks requiring annulus cleaning), this waste will be removed from the annulus to the extent technically practicable from an engineering perspective and the highly radioactive radionuclides removed to the maximum extent practical by dissolving the salt deposits with IW and transferring the solution out of the annulus. For Tank 16, a Type II tank, where materials are not readily dissolved or difficult to remove, remotely operated equipment may be deployed to mechanically remove the waste and transfer it out of the annulus.

4.1.2 Tank Closure

Type I, II, and IV tanks are planned for removal-from-service in accordance with a formal agreement between the DOE, Region IV of the EPA, and SCDHEC as expressed in the SRS currently approved FFA. The 24 SRS Type I, II, and IV tanks must be operationally closed per the currently approved FFA schedule. Two of these tanks in F-Tank Farm (FTF), Tank 17 and Tank 20, were operationally closed and stabilized (grouted) in 1997.

Operational closure consists of those actions following waste removal that bring liquid radioactive waste tanks and associated facilities to a state of readiness for final closure of the Tank Farms complex. The process involves:

- Developing tank-specific regulatory documents
- Isolating the tank from all operating systems in the surrounding Tank Farm (e.g., electrical, instruments, steam, air, water, waste transfer lines, and tank ventilation systems)
- Stabilizing by grouting of the primary tank, remaining equipment, annulus, and cooling coils
- Capping all tank risers.

The closure process has increased to thirty months for near-term tanks based on recent experience. This process includes sampling and characterization, initial drafting of closure documents, first-time review process, annulus and coil closure, and stabilization by grouting for Tanks 5, 6, 12, 14, and 16. The experience gained is anticipated to accelerate the tank closure process for the remaining tanks. This *Plan* assumes twenty-seven months for Tanks 3, 4, 9, 10, 11, 15, 22, and 23; twenty-four months is assumed for the rest of the tanks.

Sampling and Characterization

When cleaning using the above methods is complete, an analysis is performed to ensure that the material in the tank has been removed to the extent technically practicable from an engineering perspective and the highly radioactive radionuclides removed to the maximum extent practical. Before declaring a tank ready for grouting, however, the tank and annulus are inspected, the residual volume is determined, and the residual is sampled in accordance with a sample plan. Laboratory analysis of the samples yields concentrations of radiological and non-radiological constituents in the remaining material. Concentration and volume data are used to characterize the residual material to produce radiological and non-radiological inventories for the Closure Module (CM). Tank-specific closure documents are prepared to demonstrate compliance with State and DOE regulatory requirements as well as NDAA §3116.

Tank Isolation

Tank isolation is the physical process of isolating transfer lines and services from the tank and removing the tank from service. Tank isolation includes cutting and capping or blanking mechanical system components (transfer lines, water piping, air piping/tubing, steam piping, etc.) and disconnecting electrical power to all components on the tank. After tank isolation, flammability and inhalation dose calculations are completed to allow the tank to be placed in removed from service (RFS) Mode[14]. Temporary power skids provide services for grout placement (including ventilation, lighting, and cameras). The skids also provide a portable ventilation system to replace the permanent system so that each tank is completely isolated from the Tank Farm during grouting operations.

Closure Documentation Development

An area-specific WD approach ensures the NDAA §3116 tank closure process is implemented as efficiently as possible. Performance Assessments (PA) and NDAA §3116 Basis Documents are generated for each Tank Farm—one for FTF and one for HTF. The NDAA §3116 Basis Documents will include the waste tanks as well as ancillary structures located within the boundary of the respective Tank Farm. An area-specific General Closure Plan is developed for each of the Tank Farms for approval by SCDHEC.

DOE Radioactive Waste Management Manual 435.1-1 mandates a Tier 1 Closure Plan and associated Tier 2 Closure Plans. The Tier 1 plan is area-specific and provides the bases and process for moving forward with tank grouting. This document is approved at the DOE-Headquarters level. The Tier 2 documents are tank-specific, follow the approved criteria established in the Tier 1 document, and are locally approved by DOE-SR.

Development of a tank specific Closure Module (CM), per the State-approved area-specific General Closure Plans, follows completion of tank cleaning activities. It describes the waste removal and cleaning activities performed and documents the end state. Final characterization data supports the performance of Special Analysis, the process used to determine if final residual inventories continue to support the conclusions of the PA.

Grout Selection and Manufacture

A reducing grout provides long-term chemical durability and minimizes leaching of residual waste over time. The reducing grout fills each tank, is self-leveling, and encapsulates the equipment remaining inside the tank. A strong grout cap is applied on top for intruder prevention in tanks that do not have a thick concrete roof. The properties of the reducing grout may be such that it can serve as this strong grout cap. Grouting activities include Authorization Basis (AB) changes, field modifications, grout plant mobilization, and grout installment.

Grout Placement

Grout fill operations, including site preparation, grout procurement, pumper truck placement, grout plant set up (if required), grout delivery lines, and grout equipment placement are established around the tanks. A sequence for tanks with an annulus will be developed so that all voids are filled and the structural integrity of the tank is maintained. Generally, grouting the annulus and primary tank in alternating steps provides structural support for the tank wall.

Equipment Grouting

For tanks with installed equipment or cooling coils, internal voids are filled with a flowable grout mixture. In those tanks where the cooling coils have broken, alternative techniques will be developed to minimize voids in the grout matrix.

Riser Grouting and Capping

The final step in the tank grouting operation, after filling the tank, is encapsulating the risers. Using forms, grout encapsulates the risers thus providing a final barrier to in-leakage and intrusion. The final grouted tank configuration is an integral monolith free of voids and ensuring long-lasting protection of human health and the environment (see Figure 4–3).

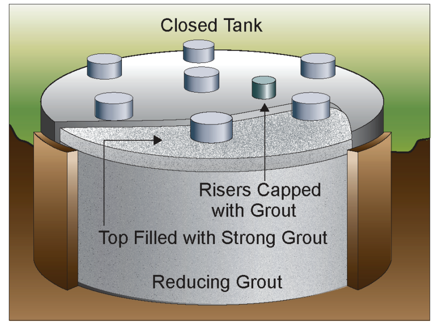


Figure 4–3 — *Grouted Tank*

4.2 *Disposition of Sludge Waste*

The basic steps for sludge processing are:

1. Sludge removal from tanks
2. Blending and washing of sludge
3. Sludge feeding to the DWPF
4. Vitrification in DWPF.

4.2.1 Sludge processing

Sludge processing is paced by the capabilities of the sludge washing and the DWPF processing facilities and by tank storage space to prepare sludge batches. Sludge batch planning uses the estimated mass and composition of sludge and known processing capabilities to optimize processing sequences. Sub-tier plans document the modeling, guide the sequence of waste removal, and support a more detailed level of planning. These sub-tier plans are revised as new information becomes available or when significant updates in the overall waste removal strategy are made. The specific input to this *Plan* from sludge batch planning is summarized in *Sludge Batch Plan 2011 in Support of System Plan R-17*[15].

Differences in sludge batch sequencing, total number canisters produced, and batch end dates between *Sludge Batch Plan 2011 in Support of System Plan R-17* and *Sludge Batch Plan – 2010 in Support of System Plan R-16* [16] are mainly driven by the following:

- This *Plan* assumes the use of low temperature aluminum dissolution for Sludge Batch (SB) 11 through 17. Most of Tank 13 is no longer targeted for aluminum dissolution due to unavailability of HM sludge
- This *Plan* assumes an 18th batch
- This *Plan* assumes the CSI strategy developed by SRR to overcome current budget constraints
- The projected canister pour rate and waste loadings are lower (@275 canisters/yr) until a second sludge preparation tank and supplemental glass waste storage capacity are available in 2017. After 2017, the projected canister pour rate will increase to 325 canisters per year
- In addition to SB7, three other sludge batches are modeled to include enough washing to remove sodium oxalate solids that originate from bulk OA chemical cleaning operations
- The Fluidized Bed Steam Reformer (FBSR) product stream, formerly proposed for the processing of Tank 48 waste, is no longer included. Tank 48 material will be dispositioned to DWPF using an alternative technology to be selected in the future
- The Sludge Processing Rotary Micro Filtration process is no longer included
- Sludge batch preparation tanks are used to support SWPF between batches.

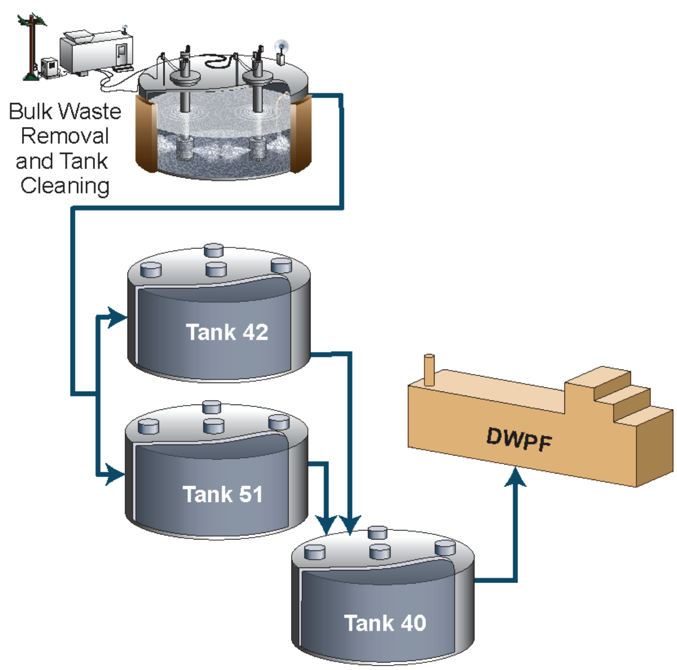


Figure 4-4 — *Sludge Feed Preparation*

Sludge Feed Preparation

This *Plan* adjusts Tank Farm operations to ensure sufficient feed availability for the retrofitted DWPF melter (described below). Use of a second sludge tank (Tank 42) as a DWPF feed preparation tank (see Figure 4-4) doubles the feed availability for the DWPF operation. This *Plan* also forecasts that DWPF feed will contain 16 weight percent (wt%) solids, reducing evaporation load on the DWPF processing systems.

Sludge Washing

Sodium and other soluble salts in DWPF feed are reduced through sludge washing. Sludge washing has historically been performed by adding water to the sludge batch, mixing with slurry pumps, securing the pumps to allow gravity settling of washed solids, and decanting the sodium-rich supernate to an evaporator system for concentration. This cycle is repeated until the desired sodium molarity, typically 1 M Na, is reached. Some types of sludge settle slowly, extending wash cycles. Sludge settling typically constitutes 60% of batch preparation time. The total number of washes performed and volume of wash water used are minimized to conserve waste tank space. Sludge batch size and wash volumes are also limited by the hydrogen generation rate associated with radiolysis of water. Tank contents are mixed on a periodic frequency to release hydrogen retained within the sludge layer, resulting in a limited window within operating constraints for gravity settling.

Accelerated Sludge Washing

To overcome washing limitations and enable accelerated DWPF vitrification, a second sludge feed preparation tank (Tank 42) begins service in 2017 to double feed preparation capacity. This includes new slurry pumps using improved bearing design to provide several thousand hours of reliable mixing. Dedicated variable frequency drives enable increased mixing in both sludge batch preparation tanks. Use of a second tank will ensure continuous, increased DWPF feed availability.

4.2.2 DWPF Operations

Washed sludge is transferred to the DWPF facility where it is combined with the high-level waste streams from salt processing (discussed below) for vitrification into glass canisters and stored on-site pending disposition.

Historically, melter performance has been the limiting factor for DWPF throughput. The DWPF melter (without bubblers) has produced an average of 215 canisters/yr for the past ten years. Bubblers installed in September 2010 enabled a rate of 315 canisters/year in FY11, resulting in a record 264 canisters poured in FY11, after accounting for unplanned outages. Tank Farm sludge waste feed preparation and DWPF feed preparation systems have been analyzed to be capable of supporting a canister production capability of 275 and 325 canisters/year, respectively.

Two-step Production Improvement Approach

To support higher glass throughput, the DWPF melter was retrofitted with four bubbler systems and the melter off-gas system was optimized. This was completed in September 2010. The second step of DWPF production capacity improvement program addresses streamlining the DWPF feed preparation system. Four process improvements are planned to streamline the DWPF feed preparation system:

- Implementation of an alternate reductant
- Processing of cesium strip effluent in the slurry mix evaporator (SME)
- Addition of dry process frit to the SME
- Minimization of water from canister decontamination frit stream to the SME.

The feed preparation modifications reduce recycle water generation by 740 thousand gallons (kgal)/yr:

- 250 kgal/yr by using dry process frit
- 1.5 kgal/canister × 325 canisters/yr = 490 kgal/yr by routing decon frit water to ETF.

Reduction of liquid addition in DWPF supports receipt of Strip Effluent (SE) from SWPF. Beneficial reuse of DWPF recycle for waste removal and tank cleaning, in lieu of water additions, supplements recycle reduction, and supports maintenance of tank farm capacity (see §4.4 below).

The DWPF production rate (over the last ten years) has averaged 215 canisters per year with 4,000 pounds of glass per canister. The production rate improvement initiatives enable a higher nominal DWPF canister production capability of 325 canisters/year. Future estimated canister production, by year is shown in Table 4-1 — *Planned DWPF Production Rates*. The canister rates assume two one-week outages every year to allow for routine planned maintenance.

Table 4-1 — *Planned DWPF Production Rates*

FY	Nominal Rate *(Canisters/yr)*	Outage *(Months)*	Total DWPF Canisters poured *(Canisters)*
FY12	275		275
FY13	275		275
FY14	275	3	206
FY15	275	1	251
FY16	275		275
FY17	325		296
FY18	325		325
FY19	325		325
FY20	325	3	245
FY21	325	1	296
FY22	325		325
FY23	325		325
FY24	325		326
FY25	325		325
FY26	325		215
FY27	(sludge heels)		44

[a] Four-Month outage in 2014 to accommodate transition to SWPF-DWPF coupled operations — assumes no canister production rate impact from coupled SWPF-DWPF operations. Outage includes DWPF production capacity improvement program and melter change out. Production capacity improvement program allows an additional increase in the nominal canister production rate.

[b] Four-month melter outage is assumed every six years during sludge processing. Actual melter change-out is determined by melter performance.

[c] Lower production rate assumed for dilute heel processing beginning in 2026.

Failed Equipment Storage Vaults and Melter Storage Boxes

Failed equipment storage vaults (FESVs) and Melter Storage Boxes (MSBs) are repetitive activities required to sustain ongoing DWPF operation by providing interim storage of failed DWPF melters. The original DWPF design has two vaults contained within one construction unit. Each FESV is designed to store one failed melter inside an MSB.

Melter 1 was placed in FESV #2 in December 2002. Melter 1 (inside MSB #1) had a relatively low radiation field. It was placed in the northernmost vault since the next vault pair to be constructed would be adjacent to FESV #2.

FESV #1 remains available for use with Melter 2. Construction of MSB #2 was completed in October 2008. MSB #2 is currently stored in FESV #1 awaiting use during the Melter 2 replacement outage currently forecast in this *Plan* to occur in 2014. Space has been reserved for construction of up to ten FESVs, if needed.

Under the current planning basis, the need date for FESV #3 and #4 will be triggered by the failure of Melter 3. Melter 3 is currently scheduled to be placed into service in October 2014. Based upon this strategy, FESVs #3 and #4 construction should be completed and available for service by April 2014 (approximately six months prior to the planned installation of Melter 3). Likewise, MSB #3 should be constructed and available to receive Melter 3 by April 2014. The need dates for FESV #3 and #4 and successive pairs of vaults will be evaluated on an ongoing basis.

Currently, the FESV 200-ton gantry crane is designed to interface only with an MSB designed primarily to contain failed melters. The placement of other large failed DWPF equipment (which do not have disposal paths) in FESVs has been considered but the complete engineered system to move large contaminated equipment from the 221-S canyon to the FESV has not been designed or constructed. Alternative methods for disposal of large contaminated equipment from DWPF (not including melters) are being evaluated.

4.3 *Disposition of Salt Wastes*

As highlighted in the Introduction, this *Plan* includes the use of a series of salt treatment processes over the life of the program, including ARP/MCU, SCIX, and SWPF. *Appendix B — Salt Solution Processing* reflects the breakdown of the volumes treated from each of the processes by year. Using the input assumptions for this *Plan*, approximately 111 Mgal of salt solution from the Tank Farms are planned for processing over the life of the program; 4.9 Mgal was processed by the end of FY11. SWPF processes the majority of this salt solution waste. As a result, the salt solution processed after the initial 12 months of SWPF is approximately 7 Mgal/yr through 2017 and reaches 8 Mgal/yr in 2018. Coupled with the SCIX throughput of 2.5Mgal/yr, 10.5 Mgal/yr is the total planned salt processing capacity. It must be noted that salt processing may be limited by SE processing in DWPF at the planned rates. At a DWPF production rate of 325 canisters/year, achieving greater than 7 Mgal/yr of SWPF processing will require reducing the strip effluent volume. Based on a preliminary trial of Next Generation Solvent, the SWPF feed rate may be increase without a corresponding increase to SE rate.

4.3.1 Actinide Removal Process / Modular CSSX Unit

The ARP/MCU process reduces the activity of the waste stream going to SDF, albeit at a lower rate than the future SWPF. The Decontaminated Salt Solution (DSS) stream, the low-level waste stream, is disposed of in the SDF as LLW grout. The higher activity monosodium titanate (MST) and strip effluent (SE) streams are eventually processed by vitrification in DWPF.

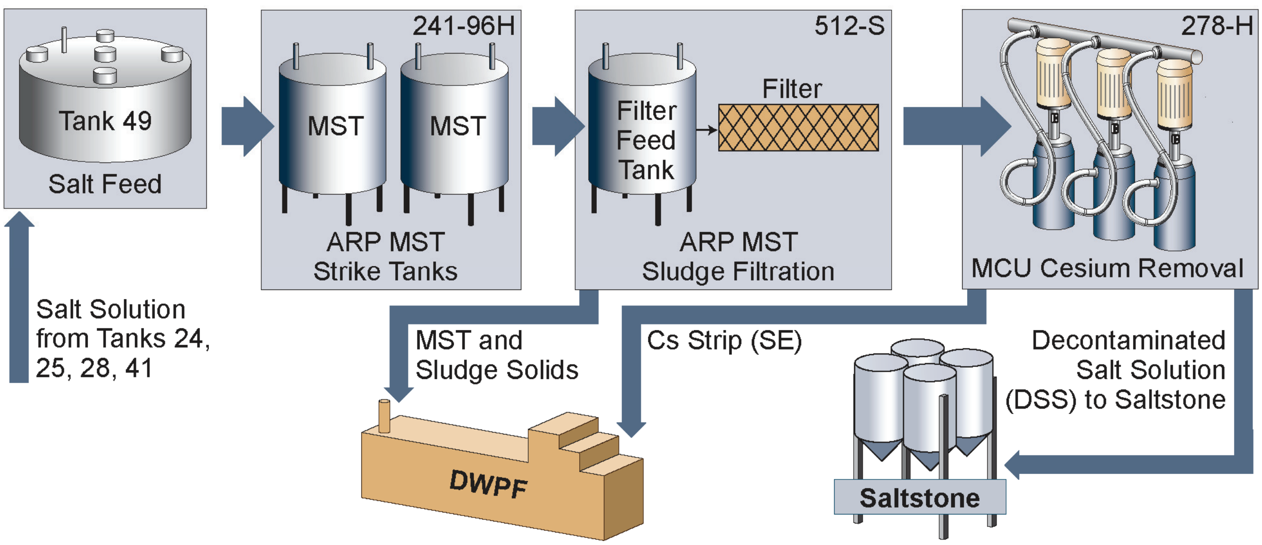


Figure 4-5 — *Actinide Removal Process / Modular Caustic Side Solvent Extraction Unit*

ARP/MCU began operation in April 2008, processing over 2 Mgal of salt waste material as of the end of September 2011. It is planned to process salt solutions until permanent shutdown for SWPF transfer line tie-ins. ARP/MCU will not operate during DWPF major outage periods (e.g., melter replacement outages) due to the close coupling of the two facilities. Table 4-2 below gives the composition of the salt batches for ARP/MCU.

Table 4-2 — *ARP/MCU Salt Batch Composition*

Batch	Source Tanks	Nominal Volume (kgal)
ARP/MCU B4	Tank 25/41 salt solution stored in Tank 23; 2H concentrated liquor; and DWPF recycle in Tank 24	1,090
ARP/MCU B5	Tank 41 salt solution stored in Tank 23; 2H concentrated liquor, SB6 LTAD leachate in Tank 8; and DWPF recycle in Tank 22	1,030
ARP/MCU B6	Tank 41 & Tank 10 salt solution stored in Tank 23; 2H concentrated liquor, SB6/SB5 LTAD leachate in Tank 8; and DWPF recycle in Tank 22	1,060
ARP/MCU B7*	Tank 41 & Tank 10 salt solution stored in Tank 23; 2H concentrated liquor, SB6/SB5 LTAD leachate in Tank 8; and DWPF recycle in Tank 22	1,050

* ARP/MCU will be shut down for SWPF tie-in when ARP/MCU B6 is completed. The qualified ARP/MCU B7 in Tank 21 would be transferred to Tank 49 to use as SWPF B1.

4.3.2 Small Column Ion Exchange

The SCIX Program will provide additional salt processing capability utilizing an Ion Exchange Column (IXC) to accelerate salt processing and tank grouting. In this *Plan* SCIX operates in parallel with SWPF, beginning in FY19. SCIX is able to increase the salt processing rate without the strip effluent limitation inherent with SWPF. It will consist of one feed pump, four rotary microfilters (RMF), two IXC units, and one Spent Resin Disposal (SRD) unit installed in risers in Tank 41. An additional 2.5 Mgal/yr salt solution treatment capacity above the SWPF capacity is planned.

The process utilizes a non-elutable ion exchange media, crystalline silicotitanate (CST), for use in the IXC to remove Cs-137 from the salt solution. CST can only be loaded with Cs-137 one time. Once loaded, the spent media must be removed and the IXC replenished with fresh resin. Spent CST will be sluiced to Spent Resin Disposal (SRD) to reduce the particle size. The ground CST, laden with Cs-137, is then transferred to a sludge batch for ultimate disposal by DWPF. The CST is assumed to require replacement once every two weeks, based on operating 24 hours a day, seven days per week. Table 4-3 below gives the composition of the salt batches for SCIX.

Table 4-3 — *SCIX Salt Batch Composition*

Batch	Source Tanks	Nominal Volume (kgal)
SCIX B1	Tank 29 salt solution and Tank 38 liquid (contained Tank 30 supernate/interstitial liquid (IL) and Tank 1, 2, and 3 supernate/IL/salt solution stored in Tank 7 and 8)	1,040
SCIX B2	Tank 37 direct salt dissolution; Tank 38 liquid (contained Tank 30 supernate/IL from Tank 37); and Tank 1, 2, and 3 supernate/IL/salt solution stored in Tank 7 and 8); and SB13 LTAD leachate	890
SCIX B3	Tank 37 direct salt dissolution and Tank 38 liquid (contained Tank 30 supernate/IL from Tank 37, Tank 1, 2, and 3 supernate/IL/salt solution stored in Tank 7 and 8, and Tank 31 supernate/IL from Tank 24)	890
SCIX B4	Tank 37 direct salt dissolution and Tank 38 liquid (contained Tank 30 supernate/IL from Tank 37, Tank 1, 2, and 3 supernate/IL/salt solution stored in Tank 7 and 8, and Tank 31 supernate/IL from Tank 24)	890
SCIX B5	Tank 37 direct salt dissolution; Tank 38 liquid (contained Tank 30 supernate/IL from Tank 37, Tank 1, 2, and 3 supernate/IL/salt solution stored in Tank 7 and 8, and Tank 31 supernate/IL from Tank 24); and SB14 LTAD leachate	890
SCIX B6	Tank 37 supernate liquid (contained Tank 37 and Tank 31 salt solution) and Tank 38 liquid (contained Tank 30 supernate/IL from Tank 37, Tank 1, 2, and 3 supernate/IL/salt solution stored in Tank 7 and 8, and Tank 31 supernate/IL from Tank 24)	890
SCIX B7	Tank 37 supernate liquid (contained Tank 31 salt solution, and Tank 28 and 47 salt solution from Tank 29) and Tank 38 liquid (contained Tank 30 supernate/IL from Tank 37, Tank 1, 2, and 3 supernate/IL/salt solution stored in Tank 7 and 8, and Tank 31 supernate/IL from Tank 24)	890
SCIX B8	Tank 37 supernate liquid (contained Tank 31 salt solution, and Tank 28 and 47 salt solution from Tank 29); SB15 LTAD leachate; and Tank 38 liquid (contained Tank 30 supernate/IL from Tank 37, Tank 1, 2, and 3 supernate/IL/salt solution stored in Tank 7 and 8, and Tank 31 supernate/IL from Tank 24)	890
SCIX B9	Tank 37 supernate liquid (contained Tank 31 salt solution, and Tank 28 and 47 salt solution from Tank 29) and Tank 43 supernate (contained Tank 31 and 47 supernate/IL from Tank 24 and Tank 33)	890
SCIX B10	Tank 37 supernate liquid (contained Tank 31 and 45 salt solution from Tank 29) and Tank 43 supernate (contained Tank 31 and 47 supernate/IL from Tank 24 and Tank 33, Tank 36 and 38 supernate/IL)	890
SCIX B11	Tank 37 supernate liquid (contained Tank 31 and 45 salt solution from Tank 29); Tank 43 supernate (contained Tank 31 and 47 supernate/IL from Tank 24 and Tank 33, Tank 36 and 38 supernate/IL); and SB16 LTAD leachate	890
SCIX B12	Tank 37 supernate liquid (contained Tank 38 salt solution) and Tank 43 supernate (contained Tank 31 and 47 supernate/IL from Tank 24 and Tank 33, Tank 36 and 38 supernate/IL)	890
SCIX B13	Tank 37 supernate liquid (contained Tank 36 and 38 salt solution) and Tank 43 supernate (contained Tank 31 and 47 supernate/IL from Tank 24 and Tank 33, Tank 36 and 38 supernate/IL)	890
SCIX B14	Tank 37 supernate liquid (contained Tank 36 and 38 salt solution) and Tank 43 supernate (contained Tank 31 and 47 supernate/IL from Tank 24 and Tank 33, Tank 36 and 38 supernate/IL)	890
SCIX B15	Tank 37 supernate liquid (contained Tank 36 and 38 salt solution); Tank 43 supernate (contained Tank 31 and 47 supernate/IL from Tank 24 and Tank 33, Tank 36 and 38 supernate/IL); and SB17 LTAD leachate	890
SCIX B16	Tank 37 supernate liquid (contained Tank 36 and 38 salt solution) and Tank 43 supernate (contained Tank 31 and 47 supernate/IL from Tank 24 and Tank 33, Tank 36 and 38 supernate/IL)	890
SCIX B17	Tank 37 supernate liquid (contained Tank 36 and 38 salt solution, and Tank 46 salt solution from Tank 29) and Tank 43 supernate (contained Tank 31 and 47 supernate/IL from Tank 24 and Tank 33, Tank 36 and 38 supernate/IL)	890
SCIX B18	Tank 37 supernate liquid (contained Tank 36 and 38 salt solution, and Tank 46 salt solution from Tank 29) and Tank 43 supernate (contained Tank 31 and 47 supernate/IL from Tank 24 and Tank 33, Tank 36 and 38 supernate/IL)	890
SCIX B19	Tank 37 supernate liquid (contained Tank 36 and 38 salt solution, and Tank 46 salt solution from Tank 29) and Tank 43 supernate (contained Tank 31 and 47 supernate/IL from Tank 24 and Tank 33, Tank 36 and 38 supernate/IL)	890

4.3.3 Salt Waste Processing Facility

SWPF is assumed to begin operation in October 2014 and is critical to the success of the *Plan*. For the first 12 months, the SWPF processing rate is assumed to be 4.6 Mgal/yr of salt solution. After 12 months, this *Plan* assumes the nominal processing rate to increase to 7 Mgal/yr. Beginning in 2018 process improvements will increase the nominal processing rate to 8 Mgal/yr.

The 7.2 Mgal/yr nominal processing rate is based on:

- 9.4 Mgal/yr maximum hydraulic rate adjusted
- 75% availability

$$[9.4 \text{ Mgal/yr}] \times [0.75] = 7 \text{ Mgal/yr}$$

However, because of the close coupling between SWPF and DWPF, SWPF must shut down for each DWPF melter replacement outage, with assumed four-month outages approximately every six years. DWPF is also limited in the amount of Strip Effluent (SE) from SWPF that can be processed. At the forecast SWPF rates, DWPF is limited to 325 canisters/year.

The SWPF processing rate is based on an assumed 100% availability for the Tank Farm feed as well as DWPF and Saltstone receipt of the SWPF discharge streams. Availability of tank space to prepare salt solution batches may impact the ability to achieve full capacity SWPF operations, especially in the first few years of operation.

Table 4-4 below gives the composition of the salt batches for SWPF.

Table 4-4 — *SWPF Batch Composition*

Batch	Source Tanks	Nominal Volume (kgal)
SWPF B1	Tank 41 & Tank 10 salt solution stored in Tank 23; 2H concentrated liquor, SB6/SB5 LTAD leachate in Tank 8 and DWPF recycle in Tank 22	1,050
SWPF B2	Tank 24 supernate (contained 3H concentrated liquor and Tank 13 supernate) and Tank 13 supernate (contained Tank 14 & 15 salt dissolution).	1,000
SWPF B3	Tank 23 supernate (contained Tank 9 and 10 salt solution and Tank 13 supernate) Tank 33 supernate stored in Tank 8	1,000
SWPF B4	Tank 13 supernate (contained Tank 38 salt solution and Tank 25 supernate/IL/salt solution) and Tank 33 supernate stored in Tank 8	1,000
SWPF B5	Tank 33 supernate stored in Tank 8 and Tank 9 salt solution stored in Tank 23	1,000
SWPF B6	Tank 13 supernate (contained Tank 25 salt solution and Tank 14 BWR liquid) and Tank 8 supernate (contained Tank 3 and 33 supernate/IL)	1,000
SWPF B7	Tank 8 supernate (contained Tank 3 and 33 supernate /IL) and Tank 9 salt solution stored in Tank 23	1,000
SWPF B8	Tank 33 salt solution stored in Tank 13 and Tank 8 supernate (contained Tank 24 supernate transfer from Tank 4 and 7)	1,000
SWPF B9	Tank 23 supernate (contained Tank 33 salt solution and Tank 9 heel removal liquid) and Tank 30 supernate (contained Tank 9 supernate /IL and Tank 14, 15 salt solution from Tank 13)	1,000
SWPF B10	Tank 30 supernate (contained Tank 9 supernate /IL and Tank 14, 15 salt solution from Tank 13) and Tank 35 supernate	1,000
SWPF B11	Tank 23 supernate (contained Tank 41 salt solution); Tank 30 supernate (contained Tank 9 supernate /IL, Tank 14, 15 salt solution from Tank 13 and Tank 29 supernate/IL); and SB11 LTAD leachate	1,000
SWPF B12	Tank 23 supernate (contained Tank 41 salt solution); Tank 30 supernate (contained Tank 9 supernate /IL, Tank 14, 15 salt solution from Tank 13 and Tank 29 supernate/IL); and SB11 LTAD leachate	1,000
SWPF B13	Tank 30 supernate (contained Tank 9 supernate /IL, Tank 14, 15 salt solution from Tank 13 and Tank 29 supernate/IL); Tank 35 supernate (contained Tank 35 supernate and Tank 41 salt solution); and SB11 LTAD leachate	1,000
SWPF B14	Tank 30 supernate (contained Tank 9 supernate /IL, Tank 14, 15 salt solution from Tank 13 and Tank 29 supernate/IL); Tank 4 supernate (contained Tank 3 salt solution); and SB11 LTAD leachate	1,000
SWPF B15	Tank 30 supernate (contained Tank 9 supernate /IL, Tank 14, 15 salt solution from Tank 13 and Tank 29 supernate/IL) and Tank 35 supernate (contained Tank 35 supernate and Tank 41 salt solution).	1,000
SWPF B16	Tank 8 supernate (contained Tank 1 and 2 supernate /IL) and Tank 7 supernate (contained Tank 1 and 2 salt solution)	1,000
SWPF B17	Tank 30 supernate (contained Tank 9 supernate /IL, Tank 14, 15 salt solution from Tank 13 and Tank 29 supernate/IL); Tank 35 supernate (contained Tank 35 supernate and Tank 41 salt solution); and Tank 22 (contained Tank 29 salt solution and Tank 35 supernate)	1,000

Batch	Source Tanks	Nominal Volume (kgal)
SWPF B18	Tank 30 supernate (contained Tank 9 supernate /IL, Tank 14, 15 salt solution from Tank 13 and Tank 29 supernate/IL) and Tank 4 supernate (contained Tank 3 salt solution)	1,000
SWPF B19	Tank 8 supernate (contained Tank 1 and 2 supernate /IL); Tank 7 supernate (contained Tank 1 and 2 salt solution); and SB12 LTAD leachate	1,000
SWPF B20	Tank 22 (contained Tank 29 salt solution and Tank 35 supernate/Tank 34 salt solution); Tank 37 supernate; and SB12 LTAD leachate	1,000
SWPF B21	Tank 22 (contained Tank 29 salt solution and Tank 35 supernate/ Tank 34 salt solution); Tank 37 supernate; and SB12 LTAD leachate	1,000
SWPF B22	Tank 4 supernate (contained Tank 3 salt solution); Tank 37 supernate; and SB12 LTAD leachate	1,000
SWPF B23	Tank 7 supernate (contained Tank 1 and 2 salt solution, and Tank 3 salt solution stored in Tank 4) and Tank 8 supernate (contained Tank 1, 2 supernate/ IL and Tank 34 supernate /IL stored in Tank 33)	1,000
SWPF B24	Tank 30 supernate (contained Tank 30 supernate/ salt solution and Tank 41 salt solution) and Tank 37 supernate (contained Tank 37 supernate and Tank 30 supernate /IL)	1,000
SWPF B25	Tank 30 supernate (contained Tank 30 supernate/ salt solution and Tank 41 salt solution) and Tank 37 supernate (contained Tank 37 supernate and Tank 30 supernate /IL)	1,000
SWPF B26	Tank 8 supernate (contained Tank 1, 2 supernate/ IL and Tank 34 supernate /IL stored in Tank 33) and Tank 7 supernate (contained Tank 1 and 2 salt solution)	1,000
SWPF B27	Tank 38 supernate (contained transfers from Tank 7, 8, 30, and 37); Tank 30 salt solution; and SB13 LTAD leachate	1,000
SWPF B28	Tank 8 supernate (contained Tank 1, 2 supernate/ IL and Tank 34 supernate /IL stored in Tank 33); Tank 22 (contained Tank 29 salt solution and Tank 35 supernate/ Tank 34 salt solution); and SB13 LTAD leachate	1,000
SWPF B29	Tank 7 supernate (contained Tank 1 and 2 salt solution, and Tank 3 salt solution stored in Tank 4) and Tank 8 supernate (contained Tank 1, 2 supernate/ IL and Tank 34 supernate /IL stored in Tank 33)	1,000
SWPF B30	Tank 38 supernate (contained transfers from Tank 7, 8, 30, and 37); Tank 29 supernate (contained Tank 30 salt solution); Tank 29 direct salt dissolution into Tank 42; and SB13 LTAD leachate	1,000
SWPF B31	Tank 29 supernate (contained Tank 37 supernate/IL and Tank 29 salt solution) and Tank 43 supernate (contained Tank 37 supernate/ IL and Tank 39 supernate)	1,000
SWPF B32	Tank 7 supernate (contained Tank 1 and 2 salt solution, and Tank 3 salt solution stored in Tank 4) and Tank 8 supernate (contained Tank 1, 2 supernate/ IL and Tank 34 supernate /IL stored in Tank 33)	1,000
SWPF B33	Tank 38 supernate (Tank 31 supernate/IL stored in Tank 24) and Tank 29 supernate (Tank 37 Supernate/ Il/ salt solution, Tank 7 supernate from Tank 21, and Tank 28 salt solution)	1,000
SWPF B34	Tank 29 supernate (Tank 37 Supernate/ Il/ salt solution, Tank 7 supernate from Tank 21, and Tank 28 salt solution) and Tank 43 supernate (included Tank 31 supernate/IL from Tank 24)	1,000
SWPF B35	Tank 28 direct salt dissolution into Tank 34 and Tank 25 supernate (contained Tank 25 salt solution and Tank 13 original supernate)	1,000
SWPF B36	Tank 38 supernate (Tank 31 supernate/IL stored in Tank 24) and Tank 37 direct salt dissolution into Tank 51	1,000
SWPF B37	Tank 29 supernate (contained Tank 47 salt solution); Tank 43 supernate (included Tank 44 supernate/IL); and SB14 LTAD leachate	1,000
SWPF B38	Tank 28 direct salt dissolution into Tank 34 and Tank 25 supernate (included Tank 44 supernate/IL)	1,000
SWPF B39	Tank 38 supernate (contained Tank 31 supernate/IL stored in Tank 24); Tank 37 (contained Tank 37 and Tank 31 salt solution); and SB14 LTAD leachate	1,000
SWPF B40	Tank 43 supernate (included Tank 44 supernate/IL); Tank 29 (contained Tank 28 and 47 salt solution); and SB14 LTAD leachate	1,000
SWPF B41	Tank 44 supernate (contained Tank 44 and 28 salt solution) and Tank 25 supernate (contained Tank 44 and 45 supernate/IL)	1,000
SWPF B42	Tank 31 (contained Tank 28 salt solution) and Tank 38 (contained Tank 44 and 45 supernate/IL from Tank 25/35)	1,000
SWPF B43	Tank 25 supernate (contained Tank 45 supernate/IL) and Tank 44 direct salt dissolution into Tank 25	1,000
SWPF B44	Tank 38 (contained Tank 44 and 45 supernate/IL from Tank 25/35); Tank 37 (contained Tank 31 salt solution, and Tank 28 & 47 salt solution from Tank 29); and SB15 LTAD leachate	1,000
SWPF B45	Tank 31 supernate (contained Tank 45 and 47 salt solution); Tank 38 (contained Tank 44 and 45 supernate/IL from Tank 25/35); and SB15 LTAD leachate	1,000
SWPF B46	Tank 44 direct salt dissolution to Tank 28; Tank 25 supernate (contained Tank 27 supernate/IL); and SB15 LTAD leachate	1,000
SWPF B47	Tank 44 direct salt dissolution to Tank 28 and Tank 25 supernate (contained Tank 27 supernate/IL)	1,000
SWPF B48	Tank 43 supernate (contained Tank 47 supernate/IL from Tank 33) and Tank 37 supernate (contained Tank 31 salt solution)	1,000

Batch	Source Tanks	Nominal Volume (kgal)
SWPF B49	Tank 43 supernate (contained Tank 47 supernate/IL from Tank 33 and Tank 36 supernate/IL) and Tank 31 direct salt dissolution into Tank 30	1,000
SWPF B50	Tank 44 direct salt dissolution into Tank 34 and Tank 25 supernate (contained Tank 46 supernate/IL)	1,000
SWPF B51	Tank 27 direct salt dissolution into Tank 28 and Tank 25 supernate (contained Tank 46 supernate/IL)	1,000
SWPF B52	Tank 31 salt solution; Tank 43 supernate (contained Tank 36 and 38 supernate/IL); and SB16 LTAD leachate	1,000
SWPF B53	Tank 43 supernate (contained Tank 36 and 38 supernate/IL); Tank 37 supernate (contained Tank 45 salt solution and Tank 31 salt solution from Tank 29); and SB16 LTAD leachate	1,000
SWPF B54	Tank 44 supernate (contained Tank 44 and 46 salt solution) and Tank 25 liquid (contained Tank 46 supernate/IL).	1,000
SWPF B55	Tank 27 direct salt dissolution into Tank 28 and Tank 25 supernate (contained Tank 46 supernate/IL)	1,000
SWPF B56	Tank 31 direct salt dissolution; Tank 43 supernate (contained Tank 36 and 38 supernate/IL); and SB16 LTAD leachate	1,000
SWPF B57	Tank 45 direct salt dissolution into Tank 34 and Tank 25 supernate (contained Tank 44 and 46 supernate/IL from Tank 26)	1,000
SWPF B58	Tank 27 direct salt dissolution into Tank 28 and Tank 25 supernate (contained Tank 44 and 46 supernate/IL from Tank 26)	1,000
SWPF B59	Tank 31 supernate (contained Tank 31 and Tank 38 salt solution) and Tank 43 supernate (contained 36, 38 supernate/IL and Tank 47 supernate/IL from Tank 33).	1,000
SWPF B60	Tank 45 direct salt dissolution into Tank 34 and Tank 25 supernate (contained Tank 44 and 46 supernate/IL from Tank 26)	1,000
SWPF B61	Tank 27 direct salt dissolution into Tank 28 and Tank 25 supernate (contained Tank 44 and 46 supernate/IL from Tank 26)	1,000
SWPF B62	Tank 31 direct salt dissolution; Tank 43 supernate (contained Tank 36 and 47 supernate/IL from 35); and SB17 LTAD leachate	1,000
SWPF B63	Tank 45 direct salt dissolution into Tank 34; Tank 25 supernate (contained Tank 44, 46 and 45supernate/IL from Tank 26); and SB17 LTAD leachate	1,000
SWPF B64	Tank 27 direct salt dissolution into Tank 28 and Tank 25 supernate (included Tank 44, 45 and 46 supernate/IL from Tank 26)	1,000
SWPF B65	Tank 43 supernate (contained supernate/IL from Tank 33, 38, 36, 44, and 24) and Tank 31 liquid (contained Tank 46 salt solution stored in Tank 29)	1,000
SWPF B66	Tank 45 direct salt dissolution into Tank 34 and Tank 25 supernate (contained Tank 44, 45 and 46 supernate/IL from Tank 26)	1,000
SWPF B67	Tank 27 direct salt dissolution into Tank 28 and Tank 25 supernate (included Tank 28, 44, 45 and 46 supernate/IL from Tank 26)	1,000
SWPF B68	Tank 31 liquid (contained Tank 36 salt solution and Tank 46 salt solution stored in Tank 29) and Tank 43 supernate (contained supernate/IL from Tank 33, 38, 36, 44, and 24)	1,000
SWPF B69	Tank 45 liquid (contained Tank 46 salt solution) and Tank 25 supernate (included Tank 28, 44, 45 and 46 supernate/IL from Tank 26)	1,000
SWPF B70	Tank 27 direct salt dissolution into Tank 28 and Tank 25 supernate (included Tank 28, 44, 45 and 46 supernate/IL from Tank 26)	1,000
SWPF B71	Tank 36 direct salt dissolution into Tank 51 and Tank 43 supernate (contained supernate/IL from Tank 33, 38, 36, 44, and 24)	1,000
SWPF B72	Tank 31 liquid (contained Tank 36 salt solution and Tank 46 salt solution stored in Tank 29) and Tank 43 supernate (contained supernate/IL from Tank 33, 38, 36, 44, and 24)	1,000
SWPF B73	Tank 27 liquid (contained Tank 46 salt solution) and Tank 25 supernate (included Tank 28, 44, 45 and 46 supernate/IL from Tank 26)	1,000
SWPF B74	Tank 45 liquid (contained Tank 46 salt solution) and Tank 25 supernate (included Tank 28, 44, 45 and 46 supernate/IL from Tank 26)	1,000
SWPF B75	Tank 31 liquid (contained Tank 36 salt solution) and Tank 43 supernate (contained supernate/IL from Tank 27, 36, 44, 45)	1,000
SWPF B76	Tank 36 salt solution (included Tank 27 and 46 salt solution from Tank 29) and Tank 43 supernate (contained supernate/IL from Tank 27, 36, 44, 45)	1,000
SWPF B77	Tank 45 liquid (contained Tank 46 salt solution) and Tank 25 supernate (included Tank 28, 44, 45 and 46 supernate/IL from Tank 26)	1,000
SWPF B78	Tank 31 liquid (contained Tank 27 and 46 salt solution from Tank 29) and Tank 43 supernate (contained supernate/IL from Tank 27, 36, 44, 45)	1,000

4.3.4 Saltstone Operations

The current active SDU (Vault 4) is approximately 200 feet wide, by 600 feet in length, by 26 feet in height. The next three SDUs (2, 3, and 5) will consist of two cells nominally 150 feet diameter by 22 feet high. After accounting for interior obstructions (support columns, drainwater collection systems, etc.) and the requirement for a 2-foot cold cap, the nominal useable volume of a cell is 2,600 kgal. Recent operating experience has resulted in approximately 1.76 gallons of grout being produced for each gallon of DSS feed, thus yielding a nominal cell capacity of approximately 1,500 kgal of DSS. In future years, larger capacity vaults may be used. Design for these SDUs is being evaluated.

Operations using ARP/MCU waste can be processed at rates as high at 120 kgal/week into an individual cell. This is based on experience in the facility with Isopar® concentrations low enough that ventilation and temperature controls are not required. With higher Isopar® concentrations, two cells are required to process at this rate.

This plan assumes that DSS resulting from the SWPF treatment process will meet the SPF WAC limit.

4.4 *Base Operations*

4.4.1 Supporting Nuclear Material Stabilization

A continuing portion of the mission of the Tank Farms, especially HTF, is safe receipt, storage, and disposition of waste yet to be received from H-Canyon and HB-Line. This *Plan* supports nuclear material stabilization in H-Canyon through 2019 (with shutdown flows through 2022) per the *H-Area Liquid Waste Forecast Through 2019*[17]. The evolving mission of H-Canyon may require operation through 2022 with flushing through 2025. Full impact of this change will be evaluated in future revisions of the *Plan*.

Tank 39 will continue to be used for H-Canyon receipt until required for SCIX. Receipt capability will be available through at least 2022 to support shutdown flows from H-Canyon. The 3H and 2F Evaporator systems will continue to operate. Salt must be removed from the Evaporator concentrate receipt tanks to allow continued evaporator operation. Thus, this *Plan* relies on Tank Farm evaporators to operate at reasonable attainment. An unanticipated extended outage of either the 2F or 3H Evaporator Systems could delay the preparation of a DWPF sludge batch, delay tank removals from service, and impact H-Canyon operation.

This *Plan* assumes waste volumes from H-Canyon are transferred to Tank 39 per the *H-Area Liquid Waste Forecast Through 2019*[17]. Some plutonium bearing waste by-passes Tank 39 and is inserted into a DWPF sludge batch "just-in-time" via receipt into the sludge processing tanks (Tank 51 or Tank 42) or the DWPF feed tank (Tank 40) as the alternative disposition path. Plutonium discards from H-Canyon will be supported to the extent allowable without negatively impacting planned canister waste loadings or failing to comply with canister fissile material concentration limits. Additionally, LLW is transferred from H-Canyon into Tank 50 for direct disposal in SPF.

It is recognized that the H-Canyon mission may be changed in the coming years such that new waste streams may be received into the LW system. As new streams are identified, they will be evaluated and impacts to LW processing will be reviewed.

4.4.2 DWPF Recycle Handling

DWPF recycle is the largest influent stream received by the Tank Farm. In this *Plan*, disposition of the recycle stream is handled through evaporation in the 2H Evaporator System and through the beneficial reuse of the low sodium molarity (less than 1.0 molar sodium) recycle stream. The DWPF recycle rate will remain between 1.5 and 1.9 Mgal/yr prior to SWPF operations. The rate depends on canister production rate and Steam Atomized Scrubbers (SAS) operation as well as DWPF recycles reduction initiatives. The rate could increase to as high as 3.2 Mgal/yr after the startup of SWPF because of extra water in the strip effluent stream and MST slurry and because the higher Cs-137 concentrations will require the operation of two SAS stages in the DWPF melter offgas system. Currently, only one SAS stage is operated. This higher rate, however, could be mitigated by the DWPF recycle reduction initiatives discussed in §4.2.2, above. DWPF recycle is evaporated in the 2H Evaporator System due to chemical incompatibility with other waste streams. It may, however, be beneficially reused for salt solution molarity adjustment, salt dissolution, heel removal, etc. Beneficial reuse minimizes the utilization of the 2H Evaporator. LW system modeling forecasts that the life cycle processing outlined herein can adequately handle the DWPF recycle stream through the end of the *Plan*. DWPF recycle will be supplemented by IW, as required, for salt dissolution and adjustment.

4.4.3 Transfer Line Infrastructure

Although efforts will continue to be made to keep transfers between tanks to a minimum, executing this *Plan* requires more frequent transfers than have historically occurred in the Tank Farm, especially after the startup of SWPF, when large volumes of salt solution will be delivered to the facility. Because of the greatly increased pace of transfers after the startup of SWPF, short downtimes due to unexpected conditions requiring repair will be more difficult to accommodate without impact because the idle time of transfer lines will be reduced.

New infrastructure is required to accomplish transfers to support SWPF, while also continuing activities that have been historically performed, such as waste removal and evaporation. Discoveries of unexpected conditions in existing transfer systems could impact the installation of new transfer lines and equipment.

The transfers in this *Plan* are generally based on the known current infrastructure and modifications planned in the SWPF transfer line tie-ins and in projects for new facilities. The actions described can be executed as long as the planned modifications are made and significant failures of key transfer equipment do not occur or can be mitigated quickly enough to allow activities to proceed as planned. The American Recovery and Reinvestment Act (ARRA) supported completion of several of the needed infrastructure upgrades, which reduced the risk of failure of the infrastructure required to achieve the goals of this *Plan*. This *Plan*, however, does not attempt to explain all the modifications needed or the failure of specific pieces of transfer equipment.

4.4.4 Tank 48 Waste Treatment

Previous *Plans* assumed dispositioning the TPB bearing waste in Tank 48 via FBSR. The FBSR design, however, was suspended pending evaluation of a cost-effective alternate technology that has become viable due to liquid waste program process and system planning enhancements. A tabletop engineering evaluation concluded that maturation of the chemical destruction method was warranted given the significant potential cost savings over FBSR.

A technology maturation plan[18] will guide a phased approach, allowing for interim decisions along the technology maturation pathway:

- Phase 1 (FY12) — feasibility and demonstration testing on waste simulant testing and establish notional flowsheets
- Phase 2 (FY12/FY13) — real waste demonstration testing and establish flowsheets
- Phase 3 (FY13/FY14) — necessary flowsheet integration studies that will define the necessary modifications.

Co-incident with Phase 3, the *Plan* will integrate this treatment of Tank 48 waste. The technology maturation should be complete in line with the 96-H facility availability after ARP/MCU shutdown.

4.4.5 Tank 50 Equipping for HLW Service

Tank 50 was modified to enable it to enter HLW service, if needed. This *Plan* projects the continued use of Tank 50 as the SPF feed tank throughout the life cycle. Final conversion, however, is an option if future modeling indicates it is required.

4.4.6 Effluent Treatment Facility

The Effluent Treatment Facility (ETF), located in H-Area, collects and treats process wastewater that may be contaminated with small quantities of radionuclides and process chemicals. The primary sources of wastewater include the 2F, 2H, and 3H Evaporator overheads, and F- and H-Canyons. The wastewater is processed through the treatment plant and pumped to Upper Three Runs Creek for discharge at an NPDES permitted outfall. Tank 50 receives ETF residual waste for storage prior to treatment at SPF and final disposal at SDF. A new 35-kgal Waste Concentrate Hold Tank (WCHT) was installed and it received an operating permit from SCDHEC in September 2011. It provides storage capacity at ETF to minimize transfer impacts directly to Tank 50 or SPF during SWPF operations.

4.4.7 Managing Type III Tank Space

Type III tank space is essential to all the processes described in this *Plan*: evaporation, DWPF sludge batch preparation, salt processing, tank removal from service, etc. Limited waste storage space exists in Type III/IIIA tanks in both FTF and HTF. There is a risk that a leak in a primary tank or other adverse event could occur that might impair execution of this *Plan.*

In the 2F and 3H Evaporator Systems, space is needed for evaporator concentrate receipt to support periodic salt dissolutions and storage of high-hydroxide waste that does not precipitate into salt. This “boiled-down” liquid is commonly referred to as liquor and removing the liquor from an evaporator system is referred to as deliquoring. Evaporator effectiveness is diminished when the concentrate receipt tank salt level is 330″ or greater — at this point, the evaporator system is said to be “salt bound.” Salt removal from the 3H Evaporator concentrate receipt tank, Tank 37, occurred in early FY11 to reduce the salt level. Tank 25 replaced Tank 47 as the 2F Evaporator concentrate receipt tank in early 2010.

In addition, this *Plan* was structured in such a way as to provide contingency when allowable in order to provide the best opportunity for success. Even so, risk exists pertaining to availability of Type III tank space, specifically tied to the start-up of the SWPF. If the start-up of SWPF is rescheduled, the 2F Evaporator System will have to be employed to evaporate decants from Sludge Batch 10. This would consume the remaining available salt space in the 2F Evaporator concentrate receipt tank and space could not be reclaimed until start-up of SWPF. Thus, lack of evaporator working space would hinder acceleration of tank removals from service, canister production rate at the DWPF, or H-Canyon support.

This *Plan*, as did Revision 16 of the *Plan*, utilizes Type I, II, and IV tanks to store supernate generated by sludge preparation. Tanks 8 and 11 store aluminum-laden supernate from the aluminum dissolution of Sludge Batches 5 and 6. Tank 24 is planned for storage of Tank 13 supernate to enable sludge removal from Tank 13.

4.5 *Glass Waste Canister Storage*

The canisters of vitrified HLW glass produced by DWPF are currently stored on-site in dedicated interim storage buildings called Glass Waste Storage Buildings (GWSB). A Shielded Canister Transporter moves one canister at a time from the Vitrification Building to a GWSB. The schedule for filling the GWSBs is found in *Appendix D — Canister Storage.*

GWSB #1 consists of a below-grade seismically qualified concrete vault containing support frames for vertical storage of 2,262 standard canisters. Eight of these positions have been abandoned due to construction defects and three contain archived non-radioactive glass filled canisters. As of September 30, 2011, 2,244 standard positions are in use storing radioactive canisters, the remaining 7 being contingency positions for placement of canisters if GWSB #2 is temporarily unavailable.

GWSB #2, with a similar design to GWSB #1, has 2,340 standard storage locations. The first radioactive canister was placed in GWSB #2 on July 10, 2006. One archived non-radioactive canister has been placed in GWSB #2. As of September 30, 2011, GWSB #2 stored 997 canisters. The total storage capacity of GWSB #1 and #2 for standard radioactive storage is 4,590.

Supplemental glass waste storage must be ready to store canisters in 2017. Scoping studies are being conducted to determine the configuration of the supplemental storage.

The schedule for shipment of the canisters from SRS is not included in this *Plan*.

4.6 *Closure Sequence for the Liquid Waste System*

This *Plan* describes a sequence of events to facilitate an orderly and reasonable shutdown and closure of the various facilities used to treat and disposition the waste. A previous section described activities required for removal from service of tanks and associated equipment in the Tank Farms. The Liquid Waste facilities outside the Tank Farm — DWPF, SWPF, ARP/MCU, SPF, SDF, and associated ancillary equipment — will be available for beneficial reuse under **Enterprise•SRS Vision**. (cf §2.3) If necessary these facility will be available for removal from service. Projection of shutdown and cleaning of the facilities to the point where they will generate no more liquid effluents is required for modeling the end of this *Plan*.

To the extent practical, removal from service of tanks and facilities occurs in groups to minimize operating and removal from service costs for each group. The priority (but not necessarily the sequence) for shutdowns as modeled is:

1. Type I, II, and IV tanks
2. F-Area waste tanks, the 2F Evaporator, and ancillary equipment (including 1F Evaporator and the concentrate transfer system)
3. H-Area West Hill waste tanks, the 3H Evaporator, and ancillary equipment (including 1H Evaporator)

4. H-Area East Hill waste tanks, the 2H Evaporator, and ancillary equipment (including any remaining ARP/MCU equipment)
5. Major remaining processing facilities (e.g., DWPF, SWPF, SDF/SPF, etc.).
6. ETF is not addressed in this plan as it processes streams from facilities outside the scope of this plan (e.g. Mixed Oxide Facility, etc.)

The key elements of the systematic closure sequence for shutting down and closing the LW System are summarized in Table 4-5.

Table 4-5 — *Closure Activities*

FY19	- Waste removal is complete from all Type I, II, and IV tanks - H-Canyon processing influents cease
FY20–25	- All Type I, II, and IV tanks are operationally closed in compliance with the currently approved FFA removal from service commitments - 2F Evaporator available for **Enterprise•SRS** reuse - 3H Evaporator available for **Enterprise•SRS** reuse - H-Canyon shutdown flow influents cease - 2H Evaporator available for **Enterprise•SRS** reuse
FY26–28	- FTF waste removal is completed and the FTF becomes available for **Enterprise•SRS** reuse - HTF waste removal is complete and the HTF becomes available for **Enterprise•SRS** reuse - SWPF available for **Enterprise•SRS** reuse - DWPF available for **Enterprise•SRS** reuse - SPF available for **Enterprise•SRS** reuse

Once the **Enterprise•SRS** activities are complete, the facilities may be chemically cleaned and flushed as necessary.

The schedule for shipment of the canisters from SRS is not included in this *Plan*.

5. Alternative Analyses

5.1 *2015 SWPF Startup*

Summary

In this Alternative Analysis, SWPF operations are rescheduled to October 2015 from October 2014.

Discussion

A twelve-month reschedule out of the start-up of SWPF operations would directly impact those processes that depend on expeditious treatment and disposal of salt waste:

- The immediate results would be a delay in the salt removal campaign for Tank 3 and the removal of waste stored in Tanks 4 and 8, all in FTF. This results in a day-for-day slip in waste removal and removal from service of these tanks. The tanks would miss the FFA commitments for removal from service.
- Less DWPF recycle is used for salt dissolution or molarity adjustment. The salt feed to SWPF (4.6 Mgal/yr) for this duration is over twice the nominal salt feed to ARP/MCU (2 Mgal/yr). As less salt feed is produced, less DWPF recycle can be beneficially reused. Tanks 21, 22, and 24 removals from service would be delayed to support receipt of the recycle until the start-up of SWPF.
- The reschedule would limit sludge processing capability. This would delay sludge removal from Tank 15 and the H-Area sludge hub tank, Tank 13.
- Delay in salt removal also delays waste removal on Type III tanks, specifically, evaporator concentrate receipt tanks. This decreases the functionality of the evaporators impacting future sludge batch preparation capability. The result would potentially be decreased canister production.

This Plan assumes continued use of ARP/MCU until shutdown for SWPF tie-ins. The total curies disposed at Saltstone during interim salt processing, using the ARP/MCU process, would remain at or below the amount identified in the *SRS LW Strategy* as amended by letter from the SCDHEC to DOE-SR[8] and the *Basis for Section 3116 Determination for Salt Waste Disposal at the Savannah River Site*[6]. Mitigation of the impact of the SWPF reschedule, however, would be limited. The additional million gallons of tank space, made available by operating ARP/MCU for an additional year, could allow salt removal from one of the FFA removal from service tanks or could be used to increase sludge preparation, somewhat mitigating the DWPF production impact. A priority decision on the type of material to be processed through ARP/MCU would dictate which of the impacts would be diminished.

The net result, in tank closures, would be a 69 tank-month delay, under the current assumptions, past the FFA dates for removal from service. These include:

	Months Past FFA
One Tank	3
Three Tanks	6
Four Tanks	12

Were the SWPF start-up rescheduled as described herein, the sequence of salt and sludge removal and tank removals from service should be reconfigured to minimize the impacts as much as possible. Since the sequence of activities described in this *Plan* are progressing apace, the earlier the notification of a reschedule in SWPF, the greater the potential for mitigation of the impacts.

5.2 *2015 SWPF Startup at Minimal Capacity*

Summary

In this Alternative Analysis, SWPF operations are rescheduled to October 2015 from October 2014. Additionally, the rates for SWPF operations would be limited to 3.75 Mgal for the first 12 months of operations, 6 Mgal for the next 12 months, and a 7 Mgal/yr rate until September 2018, upon which the nominal rate would rise to 8 Mgal/yr for the balance of the program.

Discussion

This analysis would encompass the effects of the previous twelve-month reschedule alternative analysis. The additional reduction in initial rates would further exacerbate the impact to those processes that depend on expeditious treatment and disposal of salt waste. No additional tanks, however, would be expected to exceed the FFA removal from service dates.

The net result, in operational tank closures, would be an additional 18 tank-month delay resulting in an overall 87 tank-month delay, under the current assumptions, past the FFA dates for removal from service:

	Months Past FFA	Additional months	**Total months past FFA**
One Tank	3		**3**
Three Tanks	6	6	**12**
Four Tanks	12		**12**

5.3 *Maximum Salt Processing Rate of 8 Mgal per Year*

Summary

In this Alternative Analysis, SWPF operations begin October 2014 and SCIX operations begin October 2018, however, the combined production rate is limited to 8 Mgal of salt feed per year.

Discussion

While it is possible to feed SWPF and SCIX with 10.5 Mgal of salt per year, it is very complex to manage the preparation of the salt, requiring use of sludge processing tanks and evaporator tanks to serve double duty as salt preparation tanks between sludge processing and evaporator runs. Limiting total salt feed to the salt processing facilities reduces the number of transfers and the risk and complexity of salt preparation.

The result of this limitation is that completion of salt processing is rescheduled to the point that it finishes close to the end of sludge processing. This reduces or eliminates the number of sludge-only DWPF canisters at the end of the program.

5.4 *Additional Fissile Material Disposition*

Summary

This *Plan* includes the following sensitivity cases for fissile material disposition in sludge batches at various concentrations in glass:

- disposition of 2.5 metric tons (t) at 897 g/m^3
- disposition of additional fissile material at 2,500 g/m^3
- disposition of additional fissile material at 5,400 g/m^3.

Discussion

This *Plan* allows receipt of additional fissile materials from H-Canyon to the extent allowable without negatively impacting the planned Sludge Oxide Loading (SOL). Table 5-1 below provides the quantity of additional fissile material that can be added to each batch without impacting the planned waste loading or exceeding the fissile material concentration limit of 897 g/m^3.

Table 5-1 — *Additional Fissile Mass*

Sludge Batch	SOL (wt%)	Additional fissile mass which could be added to a sludge batch and maintain the canister fissile concentration below 897 g/m^3 (kg)*
SB7B	36	0
SB8	36	27
SB9	40	141
SB10	40	157
SB11	40	125
SB12	40	92
SB13	40	69
SB14	40	44
SB15	40	58
SB16	40	79
SB17	40	106
SB18	40	116
Total Additional Fissile Material Added		**1,014**

*The amount shown only takes into account the concentration limit; DWPF nuclear criticality constraints are not factored in.

Case 1 (Table 5-2) displays a scenario where 2.5 t of additional fissile material from H-Canyon supplements the ~1.3 t of fissile material currently in the waste tanks, bringing the total fissile material mass to be vitrified to ~3.8 t. The volume of a DWPF canister is 0.6745 m^3. At a concentration of 897 g/m^3, this equates to 605 grams of fissile material per canister or over 6,500 canisters remaining to be poured (almost 2,500 more than the Revision 17 Base Case). In this case, 2.5 t of additional fissile is distributed equally among the future batches. It reduces the 40 wt% SOL, as the additional fissile material is evenly distributed and must remain less than 897 g/m^3.

The addition of 2,500 canisters extends the operation of DWPF, and the feed tanks associated with feeding sludge, through the end of 2028 with a total in excess of 10,000 canisters. The planned storage capacity could be exceeded by almost 2,500 canisters — the equivalent of an additional GWSB.

This case extends DWPF operations, varying only in impacts to Tank Farm and H-Canyon operations. Table 5-2 assumes that discards from H Canyon begin with 51 kg in Sludge Batch 7 and are increased in subsequent batches until a maximum of 227 kg per batch is reached. This alternative impacts the removal from service dates for all compliant tanks that contain sludge and would likely reschedule removal from service of the last old-style tank past 2022.

Please note that Sludge Batch 8, presently being prepared, is only forecast to receive 27 kg of fissile material from H-Canyon. At 605 grams per canister, for 344 canisters, the total fissile mass could be 208 kg. Sludge Batch 8 could accommodate an additional 103 kg for a total of 130 kg from H-Canyon within the 897 g/m^3 limit.

Table 5-2 — *Case 1: 2.5 t of additional fissile material @ 897 g/m^3*

	SOL wt%	No. of Cans	Canisters /year	Fissile Mass per Batch in HLW Tanks	Additional Fissile Mass From H-Canyon (kg)*	Total Fissile Mass per Sludge Batch	Total Canisters @ 897 g/m^3	Sludge Batch End Date	Waste Loading to meet 897 g/m^3
SB7B	36	344	275	151	0	151	347	Apr 2013	36
SB8	36	344	275	78	27 **	105	342	Jun 2014	36
	Melter#2 Replacement + SWPF Tie-in + Process Improvements							Oct 2014	
SB9	40	344	275	67	300	367	606	Jan 2016	23
SB10	40	342	275	50	300	350	579	Jul 2017	24
SB11	40	353	325	89	300	389	643	Mar 2019	22
SB12	40	352	325	121	300	421	695	Dec 2020	20
	Melter#3 Replacement							Apr 2021	
SB13	40	326	325	128	200	328	541	Aug 2022	24
SB14	40	351	325	168	200	368	609	Mar 2024	23
SB15	40	353	325	154	200	354	586	Sep 2025	24
SB16	40	352	325	134	200	334	552	Feb 2027	26
	Melter#4 Replacement							Jun 2027	
SB17	40	351	325	106	200	306	506	Oct 2028	28
SB18	40	269	325	48	273	321	531	Feb 2030	20
Total for SB 7B-18		**4,081**		**1,294**	**2,500**	**3,794**	**6,537**		
						Canisters in SB 1A-7A	*3,319*		
						Canisters in heel	*180*		
						Total Canisters Lifecycle	**10,036**		

* Additional Fissile mass shown here is what could be brought in from the canyon at Pu concentration of 897 g/m^3 in glass. The amount shown only takes into account the concentration limit; DWPF nuclear criticality constraints are not factored in.

** For SB8, 27 kg is planned to be brought in from the canyon. The batch, however, could accommodate up to 130 kg of fissile.

Case 2 (Table 5-3) displays a scenario that assumes fissile material at a concentration of 2,500 g/m^3 in the glass and no change in the SOL wt% for the future batches. The canister capacity would be ~1,700 g of fissile material. This option allows addition of 2.5 t of fissile material, maintains the canister count, and does not change the waste loading. It shortens the life cycle by over 6 years when compared to Case 1. One advantage of this option is that it allows 2.5 t of additional fissile material for processing into glass and still maintains the same life cycle duration as suggested in this *Plan*.

Please note that Sludge Batch 8, presently being prepared, is only forecast to receive 27 kg of fissile material from H-Canyon. At ~1,700 grams per canister, for 344 canisters, the total fissile mass could be 580 kg. Sludge Batch 8 could accommodate an additional 475 kg for a total of 502 kg from H-Canyon within the 2,500 g/m^3 limit.

Table 5-3 — *Case 2: 2.5 t of additional fissile material @ 2,500 g/m³*

	SOL wt%	No. of Cans	Canisters /year	Fissile Mass per Batch in HLW Tanks	Additional Fissile Mass From H-Canyon (kg)*	Total Fissile Mass per Sludge Batch	Total Canisters @ 2,500 g/m^3	Sludge Batch End Date	Waste Loading to meet 2,500 g/m^3
SB7B	36	344	275	151	0	151	347	Apr 2013	36
SB8	36	344	275	78	27 **	105	342	Jun 2014	36
	Melter#2 Replacement + SWPF Tie-in + Process Improvements							Oct 2014	
SB9	40	344	275	67	510	577	342	May 2015	40
SB10	40	342	275	50	521	571	339	Apr 2016	40
SB11	40	353	325	89	504	593	352	Mar 2017	40
SB12	40	352	325	121	474	595	353	Jan 2018	40
	Melter#3 Replacement							May 2018	
SB13	40	326	325	128	422	550	326	Apr 2019	40
SB14	40	351	325	168	42	210	351	Mar 2020	40
SB15	40	353	325	154	0	154	352	Feb 2021	40
SB16	40	352	325	134	0	134	352	Jan 2022	40
SB17	40	351	325	106	0	106	351	Dec 2022	40
SB18	40	269	325	48	0	48	269	Aug 2023	40
Total for SB 7B-18		**4,081**		**1,294**	**2,500**	**3,794**	**4,076**		
					Canisters in SB 1A-7A		*3,319*		
						Canisters in heel	*180*		
				Total Canisters Lifecycle			**7,575**		

* Additional Fissile mass shown here is what could be brought in from the canyon at Pu concentration of 2,500 g/m^3 in glass. The amount shown only takes into account the concentration limit; DWPF nuclear criticality constraints are not factored in.

** For SB8, 27 kg is planned to be brought in from the canyon. The batch, however, could accommodate up to 502 kg of fissile.

Case 3 (Table 5-4) displays a scenario that assumes fissile material at a concentration of 5,400 g/m³ in the glass and no change in the SOL wt% for the future batches. The canister capacity would be ~3,600 g of fissile material. This option allows addition of 6 t of fissile material, maintains the canister count, and does not change the waste loading. It also shortens the life cycle by over 6 years when compared to Case 1. One advantage of this option is that it allows almost 6 t of additional fissile material for processing into glass and still maintains the same life cycle duration as suggested in this *Plan*.

Please note that Sludge Batch 8, presently being prepared, is only forecast to receive 27 kg of fissile material from H-Canyon. At ~3,600 grams per canister, for 344 canisters, the total fissile mass could be 1,253 kg. Sludge Batch 8 could accommodate an additional 1,148 kg for a total of 1,175 kg from H-Canyon within the 5,400 g/m³ limit.

Table 5-4 — *Case 3: 6 t of additional fissile material @ 5,400 g/m³*

	SOL wt%	No. of Cans	Canisters /year	Fissile Mass per Batch in HLW Tanks	Additional Fissile Mass From H-Canyon (kg)*	Total Fissile Mass per Sludge Batch	Total Canisters @ 5,400 g/m³	Sludge Batch End Date	Waste Loading to meet 5,400 g/m³
SB7B	36	344	275	151	0	151	344	Apr 2013	36
SB8	36	344	275	78	27 **	105	344	Jun 2014	36
	Melter#2 Replacement + SWPF Tie-in + Process Improvements							Oct 2014	
SB9	40	344	275	67	1,182	1249	344	May 2015	40
SB10	40	342	275	50	1,183	1233	342	Apr 2016	40
SB11	40	353	325	89	1,180	1269	353	Mar 2017	40
SB12	40	352	325	121	1,159	1280	352	Jan 2018	40
	Melter#3 Replacement							May 2018	
SB13	40	326	325	128	1,055	1183	326	Apr 2019	40
SB14	40	351	325	168	214	382	351	Mar 2020	40
SB15	40	353	325	154	0	154	353	Feb 2021	40
SB16	40	352	325	134	0	134	352	Jan 2022	40
SB17	40	351	325	106	0	106	351	Dec 2022	40
SB18	40	269	325	48	0	48	269	Aug 2023	40
Total for SB 7B-18		**4,081**		**1,294**	**6,000**	**7,294**	**4,080**		
					Canisters in SB 1A-7A		*3,319*		
					Canisters in heel		*180*		
					Total Canisters Lifecycle		**7,579**		

* Additional Fissile mass shown here is what could be brought in from the canyon at Pu concentration of 5,400 g/m³ in glass. The amount shown only takes into account the concentration limit; DWPF nuclear criticality constraints are not factored in.

** For SB8, 27 kg is planned to be brought in from the canyon. The batch, however, could accommodate up to 1,175 kg of fissile.

6. Description of Assumptions and Bases

The major assumptions and planning bases are the results of an agreement between SRR[19] and DOE[20]. These assumptions address the planning period to the end of the program.

6.1 *Funding*

This *Plan* was developed assuming the funding required to achieve the planned project and operations activities will be available, within the following restrictions

- Revision 17 of the LW System Plan is based on the "Cost Savings Initiative," undertaken to recognize funding restraints in the near term
- It assumes receipt of the funding targets received (*Fiscal Year (FY) 2012 Preliminary Expected Funds Letter — DE-AC09-09SR22505*[12]) and outyear funding as discussed
- No "re-pricing" for site services is realized
- No additional increase in pension, legacy, etc. costs is realized

6.2 *Regulatory Drivers*

The following regulatory requirements drive the development of the System Plan through the end of the program.

- **Federal Facility Agreement (FFA)** – Commits the Department of Energy to operationally close the Type I, II, and IV tanks (Tanks 1–24) no later than 2022. The specific schedule for the Type I, II, and IV tanks is per the *Statement of Resolution of Dispute Concerning Extension of Closure Dates for Savannah River Site High-Level Radioactive Waste Tanks 19 and 18*[13], which is the schedule for the currently approved FFA.
- **Site Treatment Plan (STP)** – "Upon the beginning of full operations, DWPF will maintain canister production sufficient to meet the commitment for the removal of the backlogged and currently generated waste inventory by 2028." This is satisfied by removing waste (including heels) from all Type III tanks by 2028; Types I, II, and IV having had the waste removed in compliance with the FFA above.

Timely regulatory approvals are necessary to support this Plan. Recent increases in regulatory expectations have not been finalized and are not included.

6.3 *Waste Removal and Tank Removal from Service Program*

The following technical assumptions were used as input to the modeling of this *Plan*:

Waste Removal

- Types I, II, and IV tanks (Tanks 1–24):
  - Waste Removal and Tank Removal from Service commitments are per the FFA
    - After completion of bulk waste removal efforts in a specific tank, sufficient liquid may be added to facilitate heel cleaning and removal. Any further addition of contaminated liquids after completion of bulk waste removal efforts may be introduced only upon approval by SCDHEC and EPA
- Type III and IIIA (Tanks 25–51)
  - Commitment for completion of waste removal (bulk waste and heel) from all Type III/IIIA tanks is per the STP

  Note: Tanks are not required to be isolated and grouted to meet the STP
- Waste removal and cleaning activities could include mechanical, chemical, and water washing operations
- After the initial BWRE campaign in a sludge tank, a ~3 to 6 inch heel (10–20 kgal) of waste remains
- After the initial BWRE campaign in a salt tank, ~ 2 to 3 feet (90–130 kgal depending on the type of tank) of insoluble/low solubility material waste (heel) remains
- Two Phases of Waste Heel Removal are available for use:
  - Mechanical Cleaning uses mechanical agitation
    - Assumed to take 12 months of operation unless otherwise stated
      - Heel solids volume reduced to less than 5 kgal
  - Chemical Cleaning uses OA or advanced/specialized mechanical or chemical technology
    - Assumed to take 6 months of operation unless otherwise stated
  - For some tanks with high waste turnover, e.g. Tank 8, mechanical cleaning may not be required; however, flushing could be required prior to chemical cleaning

- For some tanks mechanical cleaning may remove waste to the extent technically practicable from an engineering perspective and the highly radioactive radionuclides removed to the maximum extent practical (e.g. Tanks 21, 22, 23, and 24). For those tanks chemical cleaning will not be performed.
- Monitoring during the heel removal phase will inform the decision to do mechanical or chemical cleaning.
- Tank cleaning is complete for Tanks 5 and 6.

Annulus Cleaning

- All tanks that have experienced leaks will undergo inspection and, potentially, sampling and analysis to determine the necessity for annulus cleaning. The amount of material used for annulus cleaning depends on the extent of waste present.

Tank Removal from Service

- A 30-month closure process is assumed for near-term tanks. This *Plan* assumes this process will become more streamlined in the future
- Overall tank closure priority will support area closure in the following order, as feasible:
  1. F-Tank Farm
  2. H-Tank Farm West Hill
  3. H-Tank Farm East Hill

Regulatory Approvals

- Two Secretarial Waste Determinations (F-Tank Farm and H-Tank Farm) will be issued pursuant to NDAA §3116 to determine whether the provisions of NDAA §3116(a) are met such that the tank and ancillary equipment residuals are not high level waste. The F-Tank Farm Waste Determination is needed by April 2012
- SCDHEC reviews and approves operational closure using a process that will be documented in the respective General Closure Plan. The tank 18/19 approvals are needed by April 2012 to ensure FFA compliance
- DOE will approve any necessary waste determination documents (e.g. amendments) to support this *Plan*
- DOE will maintain NEPA documentation necessary to support this *Plan*.

6.4 ***DWPF Production***

Canister production and sludge batch need dates are projected by the *Sludge Batch Plan*[15]

- DWPF will produce canisters at maximum throughput for the duration of the program (based on Chemical Process Cell processing [mercury stripping], achievable melt rate, planned outages, and waste loading for sludge being processed). DWPF near-term canister production is based on revised sludge mass values.
- In general, assumes 4-month melter replacement outage approximately every 72 months of melter operation (i.e., DWPF operates 68 months out of every 72 months). The next DWPF melter outage to replace Melter 2 is planned concurrent with the SWPF tie-in outage (June 2014–October 2014)
- A 4-month DWPF outage includes:
  - Melter #3 will replace Melter #2
  - DWPF feed preparation modifications
    - yields greater than 300 canister/year production rate
    - enables a SOL of 40 wt%
  - Recycle reduction modifications
    - Reduces the recycle amount by ~1.25 Mgal/yr from the forecast of ~3.2 Mgal/yr after SWPF startup (as predicted by the algorithm used in versions of the LW System Plan prior to Rev. 15)
  - SWPF tie-ins
- Discrete Canister Production Rate[ii]:
  - Sludge batch planning is performed to recommend the sequencing and timing of future sludge batches. Based on modeling of sludge batches, *Appendix C — Sludge Processing* sums the canister production expectations, assuming the following nominal canister production rates:
    - 275 Discrete canisters/yr at 36 wt% SOL for Sludge Batches 7–10 due to improvements in melter technology with the addition of bubblers

[ii] *"Discrete canisters" refers to actual physical canisters (sometimes referred to as cans)*

    - 325 Discrete canister/yr at 40 wt% SOL upon implementation of feed preparation modifications except where SOL is limited by fissile material concentration (planned during the SWPF tie-in outage).
- DWPF recycle is beneficially reused
- Supplemental glass waste storage will be required with the need date determined by modeling
- Shipment of canisters off-site for final disposition is not in the scope of this Plan.
- DWPF canisters will maintain a concentration limit of 897 g/m^3 of fissile material in the glass[21]. Sludge batch preparation will supply feed for the DWPF to ensure the canisters remain within this requirement
- Pu discards from H-Canyon will be supported to the extent allowable without negatively impacting planned canister waste loadings while continuing to comply with the canister fissile material concentration limits.

6.5 *Salt Program*

ARP/MCU

- ARP/MCU processing rates:
  - For modeling purposes, ARP/MCU processes salt feed at a nominal rate of 2 Mgal/yr
    - ARP/MCU will not operate during any DWPF melter replacement outages
    - ARP/MCU will cease operations six months prior to SWPF start-up to allow for SWPF tie-ins
    - ARP/MCU will not return to operation after SWPF startup
  - MCU decontamination factor for Cs-137 is 200
- For each gallon processed, ~1.3 gallons of DSS is sent to SPF
- DOE and SCDHEC will approve operation of ARP/MCU facilities to align with the SCDHEC previously approved date for SWPF startup
  - the total volume of waste may be increased from the present NDAA §3116 Basis
  - ARP/MCU facilities operate within the curie estimates of the *SRS LW Strategy* as amended[8] and the NDAA §3116 Basis
- Any ARP/MCU facility upgrades required to maintain the ARP/MCU operating rate for its extended life will be provided

SCIX

- DOE approval will be required prior to the use of SCIX
- SCIX Processing of salt waste begins October 2018 at 2.5 Mgal/yr (nominal rate)
- The average DSS stream resulting from the SCIX process will be equivalent to the DSS stream produced from the SWPF process and consistent with the NDAA §3116 Basis Determination for Salt Waste Disposal at SRS.
- Annual processing throughput:
  - 2.5 Mgal/yr processing rate
  - The 2.5 Mgal/yr is based on 100% availability for the Tank Farm feed as well as DWPF and SPF/DSS Tank receipt of SWPF discharge streams. The yearly throughput varies when adjusted for the assumed 4-month duration melter replacement outage every six years and other planned outages
    - ~40 kgal will be sent to DWPF per year
    - ~2,500 kgal of DSS will be sent to SPF per year
- Tank Farm feed preparation infrastructure modifications are completed to support SCIX processing rates. Major modifications include:
  - H-Tank Farm blend tanks readiness for salt solution preparation
  - Tank 41 readiness as SCIX processing tank
  - Mixing capabilities
  - Enhanced transfer capabilities
  - Transfer routes provided to feed tank.

SWPF

- SWPF becomes operational October 31, 2014
  - SWPF tie-ins will require a 4-month outage of DWPF operations and a 2-month outage of SPF operations
- Annual processing throughput (*Long Term Processing Capacity at SWPF – Inputs to System Plan*[22])
  - Initial year: 4.625 Mgal/yr processing rate
  - Subsequent years: 7.2 Mgal/yr nominal processing rate

  - Processing rate determined as follows:

$$\left[9.4\,\text{Mgal/yr}\right]\times\left[0.75\right]=7\,\text{Mgal/yr}$$

    9.4 Mgal/yr based on maximum hydraulic rate
    0.75 – availability
  - The 7 Mgal/yr is based on 100% availability for the Tank Farm feed as well as DWPF and SPF/DSS Tank receipt of SWPF discharge streams. The yearly throughput varies when adjusted for the assumed 4-month duration melter replacement outage every six years and other planned outages
  - ~9.2 Mgal (nominal rate) of DSS will be sent to SPF per year
  - ~580 kgal (nominal rate) of SE will be sent to DWPF per year
  - ~130 kgal (nominal rate) of MST solids/sludge will be sent to DWPF per year
  - Next generation extractant has minimal impact on DWPF operations
  - Next generation extractant has minimal impact on SPF operations
- Final years—after September 2018: 8.0 Mgal/yr nominal processing rate
  (Note: these rates are based on the use of next generation solvent)
  - ~10.2 Mgal (nominal rate) of DSS will be sent to SPF per year
  - ~580 kgal (nominal rate) of SE will be sent to DWPF per year
  - ~130 kgal (nominal rate) of MST solids/sludge will be sent to DWPF per year
- The SWPF feed chemistry is per SWPF Feed Specification Radionuclide Limits of the SWPF *Waste Acceptance Criteria*[23] including:
  - the initial one million gallons of feed to SWPF will be (at 6.44 M Na):
    - ≤ 1.0 Curies per gallon (Ci/gal)
  - all batches are planned to be at 6.44 M Na
  - additional blending may be required to meet other feed criteria, such as:
    - OH > 2 M
      - Caustic (50% NaOH) additions are planned during salt dissolution and batch preparation, as needed to meet the minimum 2 M OH requirements
    - Al < 0.25 M
    - Si < 842 mg/L

- Tank Farm feed preparation infrastructure modifications required to support SWPF processing rates. Major modifications include:
  - H-Tank Farm Blend tanks readiness for salt solution preparation
  - F-Tank Farm Blend tanks readiness for salt solution preparation
  - Tank 49 readiness as SWPF feed tank
  - Mixing capabilities
  - Enhanced transfer capabilities
  - Transfer routes provided to feed tank

6.6 ***Saltstone Production***

SPF is capable of processing at a rate that supports other waste treatment operations as follows:

- During ARP/MCU operations:
  - May require operation of more than one cell and the use of "cold caps" to meet radiological control requirements
- During SWPF and SCIX operation:
  - SPF and SDF will support SWPF and SCIX processing rates
  - Additional operational time (i.e., multiple shifts, additional operating days each week, etc.) and adequate SDU receipt space to match production streams from SWPF and SCIX are planned
  - Modifications will provide sufficient contingency storage capacity to minimize impacts to SWPF, SCIX, or ETF due to SPF or SDF outages
- SPF will be in a 2-month outage just prior to SWPF operations for SWPF tie-ins
- Since neither ARP/MCU nor SWPF process during melter replacement outages, SPF is not planned to operate other than to run off any backlog material that may be in the feed tanks
- Two SDUs, Vault 1 and Vault 4, are in service. Vault 1 will receive no additional saltstone grout;
  - Each gallon of (DSS) feed, when added to the cement, flyash, and slag, makes 1.76 gallons of grout
  - Vault 4 has one partially filled cell available to receive grout, approximately 1.3 Mgal remaining Tank 50-material feed solution capacity as of September 30, 2011

— The next three SDUs will have two 150-foot diameter by 20-foot tall disposal cells. Each cell will contain ~2,600 kgal of grout. Therefore, each cell holds ~1,500 kgal of Tank 50-material feed solution; each SDU holds ~ 3,000 kgal of Tank 50-material feed solution.
— In future years, larger capacity vaults may be used. Design for these SDUs is being evaluated.

6.7 *Base Operations*

Evaporation

The primary influents into the Tank Farms are DWPF recycle and H-Canyon waste receipts. In addition, sludge batch preparation produces a large internal stream of spent washwater. In order to continue to maintain space in the Tank Farms to support these missions, these streams must be evaporated. There is one evaporator in F-Area and two in H-Area.

DWPF recycle has a high concentration of silica due to the vitrification process. When this stream is mixed with high aluminum streams from PUREX and HM canyon processing, there is a potential for forming sodium aluminosilicate. Experience has shown that sodium aluminosilicate can co-precipitate sodium diuranate in the evaporator, causing a potential criticality concern. In order to prevent the potential for criticality, a feed qualification program is in place to minimize the formation of a sodium aluminosilicate scale in the 2F and 3H Evaporators and to prevent accumulation of enriched uranium in the 2H Evaporator. It is assumed that scale may accumulate in the 2H Evaporator, but uranium enrichments and masses will be well below criticality concerns.

- The 2H Evaporator System is used to evaporate DWPF recycle. The 2F and 3H Evaporators are used to process streams that will not produce scale, i.e., canyon wastes and sludge batch decants. The evaporator system feed and concentrate receipt tanks configuration is:
  — 3H: Feed – Tank 32; Receipt – Tanks 30 and Tank 37
  — 2H: Feed – Tank 43; Receipt – Tank 38
  — 2F: Feed – Tank 26; Receipt – Tank 25
- Evaporator Capacity – The following evaporator utilities and capacity were assumed based on historical experience.

Table 6-1 — *Evaporator Utilities*

Evaporator	Utility	Space Gain Capacity
2F	50%	150 kgal/mo
2H	50%	150 kgal/mo
3H	50% [a]	200 kgal/mo

[a] 50% utility is assumed when operating. Due to periodic salt dissolutions and feed availability, average percentage of operating time is lower (<30%).

General Assumptions

- A minor influent is the 299-H Maintenance Facility. The influents mainly consist of a dilute nitric acid stream, decontamination solutions, and steam condensate. These waste streams are collected from decontaminating equipment and collected in the 299-H pump tank, neutralized and sent to Tank 39. Beginning in 2018, these receipts are assumed to be redirected to allow Tank 39 to be the SCIX blend tank.
- Tank Farm infrastructure maintained to support SWPF, DWPF, and SPF processing rates and tank operational closure schedules.

Separations Canyon Operations

- Sufficient tank space volume is available to support the projected receipt of HLW into Tank 39 from H-Canyon operations through 2018. In 2019, these receipts will be redirected to allow Tank 39 to be the SCIX blend tank. H-Canyon will only transfer shutdown flows from 2020 through 2022. These dates are subject to change based on the evolving mission of H-Canyon. Full evaluation of the proposed mission changes will be evaluated in future revisions of the *Plan*. The Unirradiated Uranium Materials (UUM) dispositioned in SPF are received into Tank 50 and direct discards of Pu and neptunium materials to the DWPF feed system are received into Tank 40, Tank 42, or Tank 51, for which sufficient tank space volume is available.
- Source of streams is based on *H-Area Liquid Waste Forecast Through 2019*[17]
- Shutdown flows for H-Canyon are assumed from FY20–FY22 and are as outlined in *H-Canyon Liquid Waste Generation Forecast for H-Tank Farm Transfer*[24].

- Additional material sent directly to sludge batches increases total DWPF canister count by as much as 100 canisters (these additional canisters are included in the 7,580 forecast canisters of this *Plan*):
  - — Fissile isotope concentration of SRS HLW canisters will be maintained at or below 897 g/m^3
  - — Pu discards from H-Canyon will be supported to the extent allowable without negatively impacting planned canister waste loadings while continuing to comply with canister fissile material concentration limits.

Effluent Treatment Facility

- ETF is assumed to receive an average of 11 Mgal/yr:
  - — LW Evaporators: 5 Mgal/yr
  - — Savannah River Nuclear Solutions (SRNS) Facilities: 6 Mgal/yr
    Note: the Agreement between SRNS and SRR for LW Receipt Services provides that the total maximum allocation for waste generated from SRNS facilities including H-Canyon, F-Canyon, the Waste Solidification Building, Mixed Oxide Facility, and miscellaneous smaller contributors is 15 Mgal/yr.

Dismantlement and Decommissioning

- — LW Areas transferred to D&D on an Area-by-Area basis upon closure of their included facilities.

7. System Description

7.1 *History*

The LW System is the integrated series of facilities at SRS that safely manage the existing waste inventory and disposition waste stored in the tanks into a final glass or grout form. This system includes facilities for storage, evaporation, waste removal, pre-treatment, vitrification, and disposal.

Since it became operational in 1951, SRS, a 300-square-mile DOE Complex located in the State of South Carolina, has produced nuclear material for national defense, research, medical, and space programs. The separation of fissionable nuclear material from irradiated targets and fuels resulted in the generation of large quantities of radioactive waste that are currently stored onsite in large underground waste storage tanks. As of September 2011, approximately 38 Mgal[25] of radioactive waste are stored at SRS. Most of the tank waste inventory is a complex mixture of chemical and radioactive waste generated during the acid-side separation of special nuclear materials and enriched uranium from irradiated targets and spent fuel using the Plutonium Uranium Reduction Extraction (PUREX) process in F-Canyon and the modified PUREX process in H-Canyon (HM process). Waste generated from the recovery of Pu-238 in H-Canyon for the production of heat sources for space missions is also included. The waste was converted to an alkaline solution; metal oxides settled as sludge, and supernate was evaporated to form saltcake.

The variability in both nuclide and chemical content is because waste streams from the 1st cycle (high heat) and 2nd cycle (low heat) extractions from each Canyon were stored in separate tanks to better manage waste heat generation. When these streams were neutralized with caustic, the resulting precipitate settled into four characteristic sludges presently found in the tanks where they were originally deposited. The soluble portions of the 1st and 2nd cycle waste were similarly partitioned but have and continue to undergo blending in the course of waste transfer and staging of salt waste for evaporative concentration to supernate and saltcake. Historically, fresh waste receipts were segregated into four general categories in the SRS Tank Farms: PUREX high activity waste, PUREX low activity waste, HM high activity wastes and HM low activity wastes. Because of this segregation, settled sludge solids contained in tanks that received fresh waste are readily identified as one of these four categories. Fission product concentrations are about three orders of magnitude higher in both PUREX and HM high-activity waste sludges than the corresponding low-activity waste sludges.

Because of differences in the material processed by PUREX and HM processes, the chemical compositions of principal sludge components (iron, aluminum, uranium, manganese, nickel, and mercury) also vary over a broad range between these sludges. Combining and blending salt solutions has tended to reduce soluble waste into blended salt and concentrate, rather than maintaining four distinct salt compositions. Continued blending and evaporation of the salt solution deposits crystallized salts with overlying and interstitial concentrated salt solution in salt tanks located in both Tank Farms. More recently, with transfers of sludge slurries to sludge washing tanks, removal of saltcake for tank removal from service, receipts of DWPF recycle, and space limitations restricting full evaporator operations, salt solutions have been transferred between the two Tank Farms. Intermingling of PUREX and HM salt waste will continue until processing in the SWPF can begin.

Continued long-term storage of these radioactive wastes poses a potential environmental risk. Therefore, since 1996, DOE and its contractor have been removing waste from tanks, pre-treating it, vitrifying it, and pouring the vitrified waste into canisters for long-term disposal in a permanent canister storage location (see *Figure 7-2 — Process Flowsheet*). As of September 30, 2011, DWPF had produced 3,251 vitrified waste canisters.

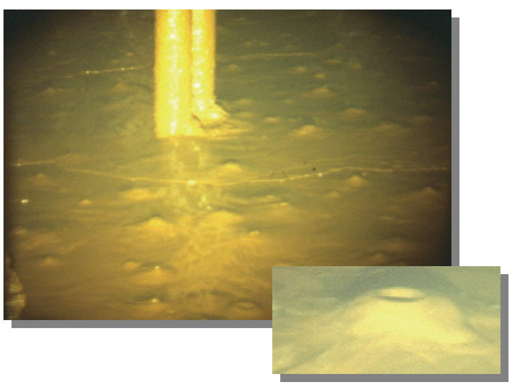
7.2 *Tank Storage*

SRS has 51 underground waste storage tanks, all of which were placed into operation between 1954 and 1986. There are four types of waste tanks — Types I through IV. Type III tanks are the newest tanks, placed into operation between 1969 and 1986. There are 27 Type III tanks. Type I tanks are the oldest tanks, constructed in 1952 through 1953. Type II waste tanks were constructed in 1955 through 1956. There are eight Type IV tanks, constructed in 1958 through 1962. Two of these Type IV tanks, Tanks 17 and 20 in F-Tank Farm, have been isolated, removed from service, and grouted. Twelve tanks without full secondary containment have a history of leakage[26]. Sufficient waste has been removed from these tanks such that there are currently no active leak sites. The first tank, Tank 1F, lacking full secondary containment, began receiving waste in 1954. This tank is still in service.

Approximately 38 Mgal of radioactive waste, containing 318 million curies (MCi)[25] of radioactivity, are currently stored in 49 active waste storage tanks located in two separate locations, H-Tank Farm (29 tanks) and F-Tank Farm (20 tanks). This waste is a complex mixture of insoluble metal hydroxide solids, commonly referred to as sludge, and soluble salt supernate. The supernate volume is reduced by evaporation, which also concentrates the soluble salts to their solubility limit. The resultant solution crystallizes as salts. The resulting crystalline solids are commonly referred to as saltcake. The saltcake and supernate combined are referred to as salt waste.

Tanks under construction. Note tank size relative to construction workers. Later, dirt is backfilled around the tanks to provide shielding.

The sludge component of the radioactive waste represents approximately 2.9 Mgal (8% of total) of waste but contains approximately 155 MCi (49% of total). The salt waste makes up the remaining 35.1 Mgal (92% of total) of waste and contains approximately 163 MCi (51% of total). Of that salt waste, the supernate accounts for 19.3 Mgal and 151 MCi and saltcake accounts for the remaining 15.8 Mgal and 12 MCi[25]. The sludge contains the majority of the long-lived (half-life > 30 years) radionuclides (e.g., actinides) and strontium. The sludge is currently being stabilized in DWPF through a vitrification process that immobilizes the waste in a borosilicate glass matrix.



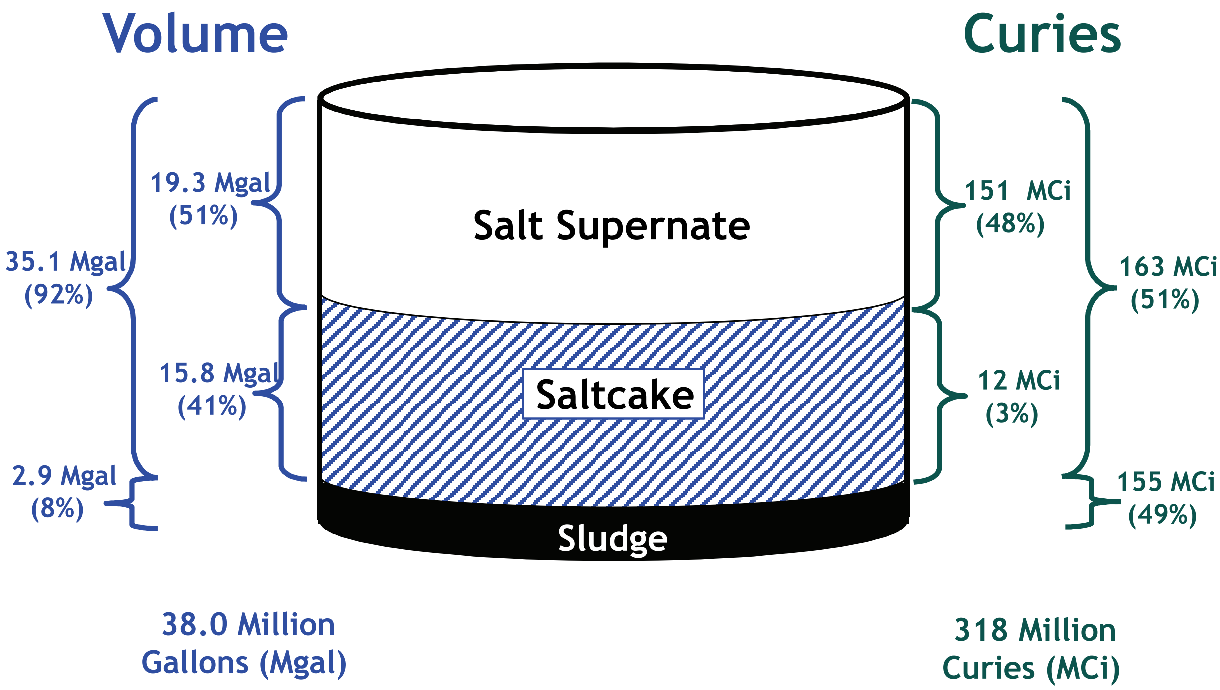
Sludge consists of insoluble solids that settle to the bottom of a tank. Note the offgas bubbles, including hydrogen generated from radiolysis.

Radioactive waste volumes and radioactivity inventories reported herein are based on the Waste Characterization System (WCS) database, which includes the chemical and radionuclide inventories on a tank-by-tank basis. WCS is a dynamic database frequently updated with new data from ongoing operations such as decanting and concentrating of free supernate via evaporators, preparation of sludge batches for DWPF feed, waste transfers between tanks, waste sample analyses, and influent receipts such as H-Canyon waste and DWPF recycle.

Salt waste is dissolved in the liquid portion of the waste. It can be in normal solution as Supernate (top picture) or, after evaporation, as salt cake (bottom picture) or concentrated supernate. The pipes in all the pictures are cooling coils.

Well over 95%[25] of the salt waste radioactivity is short-lived (half-life ≤ 30 years) Cs-137 and its daughter product, Ba-137m, along with lower levels of actinide contamination. Depending on the particular waste stream (e.g., canyon waste, DWPF recycle waste), the cesium concentration may vary. The precipitation of salts following evaporation can also change the cesium concentration. The concentration of cesium is significantly lower than non-radioactive salts in the waste, such as sodium nitrate and nitrite, therefore, the cesium does not reach its solubility limit and only a small fraction precipitates[27]. As a result, the cesium concentration in the saltcake is much lower than that in the liquid supernate and interstitial liquid fraction of the salt waste.

Figure 7-1 — *Waste Tank Composite Inventory (As of September 30, 2011)* [25]



7.3 *Waste Tank Space Management*

To make better use of available tank storage capacity, incoming liquid waste is evaporated to reduce its volume. This is important because most of the SRS Type III waste storage tanks are already near full capacity. Since 1951, the Tank Farms have received over 150 Mgal of liquid waste, of which over 110 Mgal have been evaporated, leaving approximately 38 Mgal in the storage tanks. Projected available tank space is carefully tracked to ensure that the Tank Farms do not become "water logged," a term meaning that so much of the usable Type III tank space has been filled that normal operations and waste removal and processing operations cannot continue. A portion of tank space must be reserved as contingency space should a new tank leak occur. Waste receipts and transfers are normal Tank Farm activities as the Tank Farms receive new or "fresh" waste from the H-Canyon stabilization program, liquid waste from DWPF processing (typically referred to as "DWPF recycle"), and wash water from sludge washing. The Tank Farms also make routine transfers to and from waste tanks and evaporators. Since initiation of interim salt waste treatment (DAA and ARP/MCU), the working capacity of the Tank Farms has been maintained. Three evaporator systems are currently operating at SRS — the 2H, 3H, and 2F systems.

7.4 *Waste Removal from Tanks*

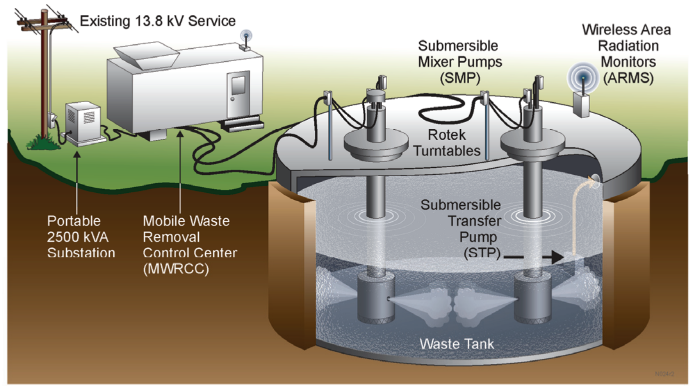
The first step in the disposition of sludge and salt waste is bulk waste removal efforts (BWRE). Sludge is sent to one of two feed preparation tanks ensuring sludge waste is continuously available for treatment at DWPF. Salt is dissolved, removed, and staged for treatment at ARP/MCU, SCIX, or SWPF.

To reduce the two-to-four year period required for installation of substantial structural steel and large mixing and transfer pumps — with their attendant infrastructure — required for BWRE, a Waste on Wheels (WOW) innovation was developed. The WOW concept requires no new infrastructure. Portable and temporary equipment meet tank infrastructure needs. Additional purchased pumps and WOW equipment perform accelerated BWRE operations concurrently in both Tank Farms. The primary components of the WOW system are:

- Long-lasting reusable SMPs
- A portable field operating station containing pump drives and controls

- A portable substation to provide 480-, 240- and 120-volt power to the WOW equipment
- Disposable commercial transfer pumps.

WOW equipment is deployed at the tank as a field operating station, providing temporary power and control for BWRE equipment. When BWRE is completed on one tank, the WOW equipment is reconfigured to support waste removal on the next tank. Pumps are sized to fit through 24-inch openings allowing a high degree of flexibility to locate the pumps in optimal configurations within the waste tanks. Most are supported from the bottom of the tank, minimizing steel superstructures and tank-top loading. Product lubricated bearings and motor cooling eliminate the need for bearing and seal water supply. These pumps have exterior fittings and fixtures so that the pumps can be quickly decontaminated, removed, and reinstalled in the next tank with minimal radiation exposure to personnel. Disposable transfer pumps are used to transfer the waste to a receipt or hub tank using existing underground transfer lines and diversion boxes. If the transfer system is degraded or non-existent, above-grade hose-in-hose technology is deployed, rather than investing in costly repairs. Temporary shielding is supplied as necessary to reduce exposure to personnel.



WOW Deployment for BWRE

7.5 Safe Disposal of the Waste

The goal is to convert all of the waste into one of two final waste forms: Glass, which will contain 99% of the radioactivity, and Saltstone Grout, which will contain most of the volume. Each of the waste types at SRS needs to be treated to accomplish disposal in these two waste forms. The sludge must be washed to remove non-radioactive salts that would interfere with glass production. The washed sludge can then be sent to DWPF for vitrification. The salt must be treated to separate the bulk of the radionuclides from the non-radioactive salts in the waste. Starting in 2014, this separation will be accomplished in SWPF with SCIX supplementing this separation in 2018. However, until the startup of SWPF and SCIX, ARP/MCU accomplishes this separation.

7.6 Salt Processing

Five different processes treat salt:

- **Deliquification, Dissolution, and Adjustment** (DDA) –**D**eliquification (i.e., extracting the interstitial liquid) is an effective decontamination process because the primary radionuclide in salt is Cs-137, which is highly soluble. To accomplish the process, the salt was first deliquified by draining and pumping. The deliquified salt was then **D**issolved by adding water and pumping out the salt solution. The resulting salt solution was aggregated with other Tank Farm waste to **A**djust batch chemistry for processing at SPF. For salt in Tank 41 as of June 9, 2003, which was relatively low in radioactive content, treatment using DDA-solely was sufficient to meet the SPF WAC. Tank 41 has since received additional salt dissolution from Tank 25 and there is no longer any qualified feed for the DDA-solely process. No further use of DDA-solely is planned.
- **Actinide Removal Process** (ARP) – For salt in selected tanks (e.g., Tank 25), even though extraction of the interstitial liquid reduces Cs-137 and soluble actinide concentrations, the Cs-137 or actinide concentrations of the resulting salt are too high to meet the SPF WAC. Salt from these tanks first will be sent to ARP. In ARP, MST is added to the waste as a finely divided solid. Actinides are sorbed on the MST and then filtered out of the liquid to produce a low-level waste stream that is sent to MCU. The MST, containing the actinides, is sent to DWPF.
- **Modular CSSX Unit** (MCU) – The ARP low-level waste stream requires reduction in the concentration of Cs-137 using the CSSX process. MCU is a solvent extraction process for removal of Cs-137 from caustic salt solutions. The solvent used is a four-part solvent with the key ingredient being the cesium extractant (presently BoB Calix). This solvent is fed to a bank of centrifugal contactors while the waste is fed to the other end in a counter-current flow. The solvent extracts the cesium with each successive contactor stage extracting more, resulting in a DSS stream and a cesium-laden solvent stream. The solvent stream is stripped of its cesium, washed, and the solvent is reused. The cesium-laden strip effluent is transferred to DWPF. MCU has a dual purpose:

 - — demonstrating the CSSX flowsheet
 - — treating salt waste to enable accelerated closure of Type I, II, and IV tanks and uninterrupted vitrification of HLW at DWPF.

- **Small Column Ion Exchange** (SCIX) – This process utilizes a non-elutable ion exchange media, crystalline silicotitanate (CST), for use in an ion exchange column (IXC) to remove Cs-137 from the salt solution. Ground CST, laden with Cs-137, is then transferred to a sludge batch for ultimate disposal at DWPF. The DSS stream is dispositioned at SPF. The MST solids are transferred to a sludge batch preparation tank for ultimate disposal at DWPF.
- **Salt Waste Processing Facility** (SWPF) – This is the full-scale CSSX process. The facility incorporates both the ARP and CSSX processes in a full-scale shielded facility capable of handling salt with high levels of radioactivity. Facility startup of SWPF is assumed to be in 2014.

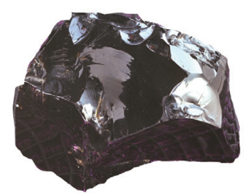
7.7 *Sludge Processing*

Sludge is washed to reduce the amount of non-radioactive soluble salts remaining in the sludge slurry. During sludge processing, large volumes of wash water are generated and must be volume-reduced by evaporation or beneficially reused. Over the life of the waste removal program, the sludge currently stored in tanks at SRS will be blended into separate sludge batches to be processed and fed to DWPF for vitrification.

7.8 *DWPF Vitrification*

Canisters being received (prior to being filled with radioactive glass)

Final processing for the washed sludge and salt waste occurs at DWPF. This waste includes MST/sludge from ARP or SWPF, the cesium strip effluent from MCU or SWPF, and the washed sludge slurry. In a complex sequence of carefully controlled chemical reactions, this waste is blended with glass frit and melted to vitrify it into a borosilicate glass form. The resulting molten glass is poured into stainless steel canisters. As the filled canisters cool, the molten glass solidifies, immobilizing the radioactive waste within the glass structure. After the canisters have cooled, they are first sealed with a temporary plug, the external surfaces are decontaminated to meet United States Department of Transportation requirements, and the canister is then permanently sealed. The canisters are then ready to be stored on an interim basis on-site. A low-level recycle waste stream from DWPF is returned to the Tank Farms. DWPF has been operational since 1996.



Sample of Vitrified Radioactive Glass

7.9 *Saltstone Disposition*

The Saltstone Facility, located in Z-Area, consists of two facility segments: the Saltstone Production Facility (SPF) and the Saltstone Disposal Facility (SDF). SPF is permitted as a wastewater treatment facility per SCDHEC regulations. SPF receives and treats the salt solution to produce grout by mixing the LLW liquid stream with cementitious materials (cement, flyash, and slag). A slurry of the components is pumped into the SDUs, located in SDF, where the Saltstone grout solidifies into a monolithic, non-hazardous, solid LLW form. SDF is permitted as an Industrial Solid Waste Landfill site.

View of the Saltstone Facility

The facility will contain many large concrete SDUs. Each of the SDUs will be filled with solid Saltstone grout. The grout itself provides primary containment of the waste, and the walls, floor, and roof of the SDUs provide secondary containment.

Approximately 15 feet of overburden were removed to prepare and level the site for SDU construction. All SDUs will be built at or slightly below the grade level that exists after the overburden and leveling operations are complete. The bottom of the Saltstone grout monoliths will be at least five feet above the historic high water table beneath the Z-Area site, thus avoiding disposal of waste in a zone of water table fluctuation. Run-on and runoff controls are installed to minimize site erosion during the operational period.

The current active SDU (Vault 4) is approximately 200 feet wide, by 600 feet in length, by 26 feet in height, divided into twelve cells. The other current SDU (Vault 1) is approximately 100 feet wide, by 600 feet in length, by 25 feet in height, divided into six cells.

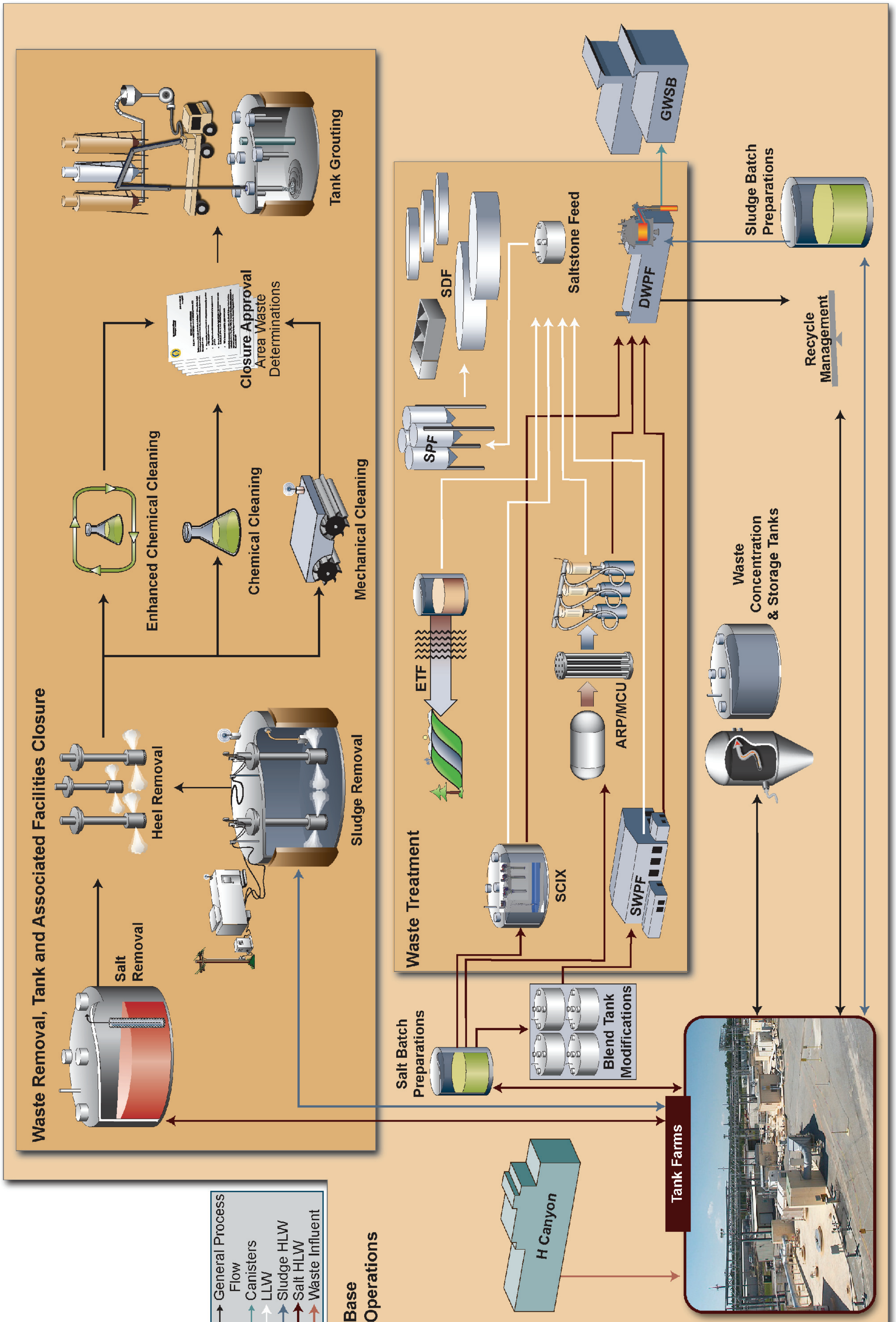
The next three SDUs are two cells, nominally 150 feet diameter by 22 feet high each, and were designed in compliance with provisions contained in the Consent Order of Dismissal in Natural Resources Defense Council, et al. v. South Carolina Department of Health and Environmental Controls, et al. (South Carolina Administrative Law Court, August 7, 2007). This design is used commercially for storage of water. After accounting for interior obstructions (support columns, drainwater collection systems, etc.) and the requirement for a 2-foot cold cap, the nominal useable volume of a cell is 2,600 kgal. Recent operating experience has resulted in approximately 1.76 gallons of grout being produced for each gallon of DSS feed, yielding a nominal cell capacity of approximately 1,500 kgal of DSS.

In future years, larger capacity vaults may be used. Design for these SDUs is being evaluated.

Closure operations will begin near the end of the active disposal period in the SDF, i.e., after most or all of the SDUs have been constructed and filled. Backfill of native soil will be placed around the SDUs. The present closure concept includes two moisture barriers consisting of clay/gravel drainage systems along with backfill layers and a shallow-rooted bamboo vegetative cover.

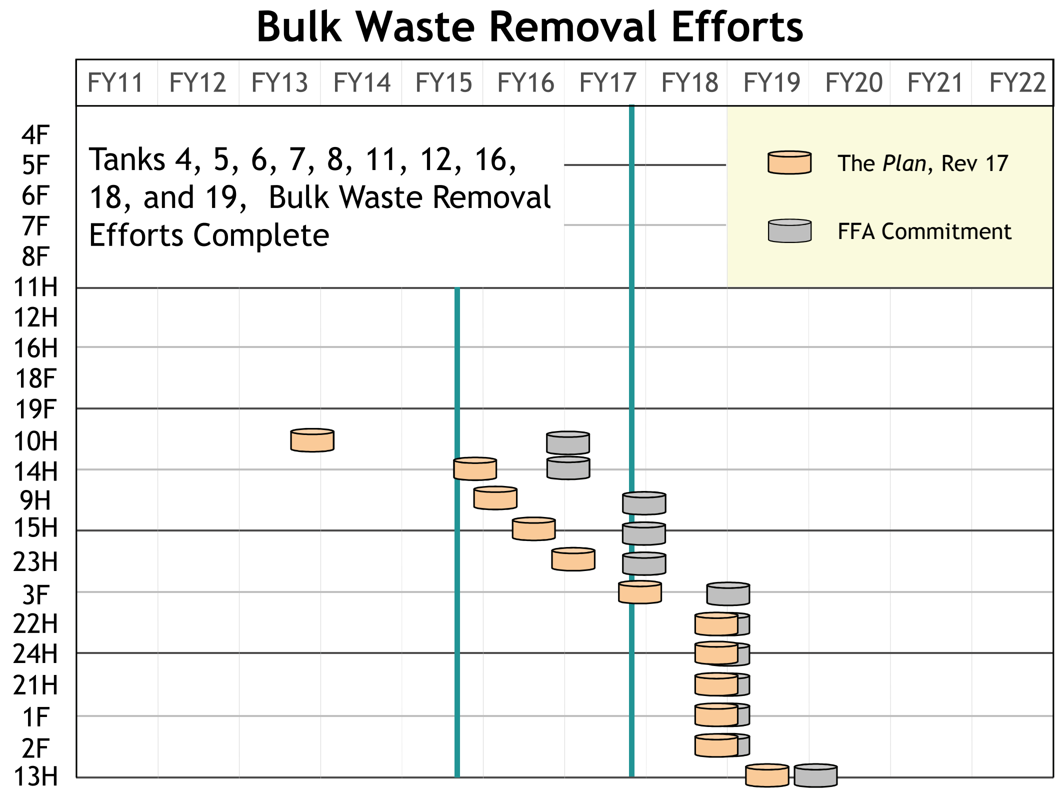
Construction of the SDF and the first two SDUs was completed between February 1986 and July 1988. The SDF started radioactive operations June 12, 1990. Future SDUs will be constructed on a "just-in-time" basis in coordination with salt processing production rates.

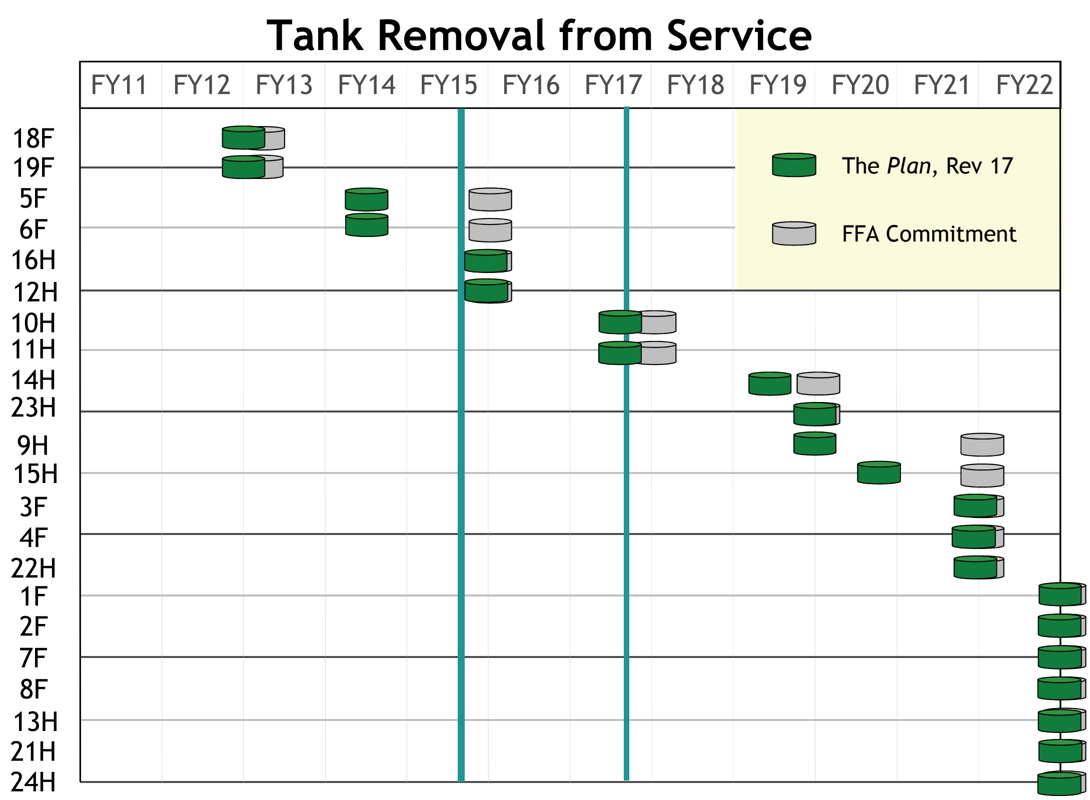
Figure 7-2 — *Process Flowsheet*



Appendices

Appendix A — *Bulk Waste Removal Efforts & Removal from Service*





Appendix B — *Salt Solution Processing*

End of Fiscal Year	Salt Solution via DDA-solely (kgal)	Salt Solution via ARP/MCU (kgal)	Salt Solution via SCIX (kgal)	Salt Solution via SWPF (kgal) [a]	Total Salt Solution from Tank Farms (kgal) [b]	DSS Stream to Tk50 (kgal)	UUM Stream to Tk50 (kgal) [c]	ETF Stream to Tk50 (kgal)	Total Feed Stream to SPF (kgal)	SDU Numbers [d]
Total as of end of FY10	2,800	990			3,790	3,151	682	3,019	6,492	4
FY11		1,063			1,063	1,487	200	64	1,751	4
FY12		926			926	1,175	18	120	1,313	4
FY13		1,111			1,111	1,410	18	120	1,548	2- 5
FY14		1,060			1,060	1,345	18	120	1,483	3 & 5
FY15				4,239	4,239	5,380	18	120	5,518	3 -6
FY16				6,848	6,848	8,690	18	120	8,828	6
FY17				7,050	7,050	8,946	18	120	9,084	6-7
FY18				7,129	7,129	9,047	18	120	9,185	7
FY19			2,520	8,000	10,520	12,672	18	120	12,810	7-8
FY20			1,960	6,000	7,960	9,574	18	120	9,712	8-9
FY21			2,240	7,333	9,573	11,546	18	120	11,684	9
FY22			2,520	8,000	10,520	12,672	18	120	12,810	9-10
FY23			2,520	8,000	10,520	12,672		92	12,764	10-11
FY24			2,520	8,000	10,520	12,672		92	12,764	11
FY25			1,680	7,650	9,330	11,388		92	11,481	11-12
FY26								92	92	12
FY27								18	18	12
FY28										12
Total	**2,800**	**5,150**	**15,960**	**78,250**	**102,160**	**123,827**	**1,080**	**4,790**	**129,337**	

[a] SWPF throughput is lower in the year of the DWPF melter replacement

[b] *Total Salt Solution from Tank Farms* is a total of all LLW sent directly from the Tank Farm and all salt solution treated via the DDA-solely, ARP/MCU, SCIX, and SWPF processes. Each gallon of salt solution treated via ARP/MCU and SWPF yields ~1.3 gallons of DSS; SCIX yields 1 gallon.

[c] Low Level Waste receipts to Tank 50 are assumed as outlined in *H-Area Liquid Waste Forecast Through 2019*[17].

[d]
- SDUs 1 and 4 are in service. SDU 1 will not receive additional grout; SDU 4 has one cell remaining to receive grout
- SDUs 2, 3, and 5 will have two cylindrical cells, each with 1.4-Mgal Tank 50-material feed capacity (2.6 Mgal of grout). SDU 3 and 5 will be installed and filled together to allow filling multiple cells
- In future years, larger capacity vaults may be used. Design for these SDUs is being evaluated.
- Each gallon of Tank 50 feed, when added to the cement, flyash, and slag, generates approximately 1.76 gallons of grout
- Bleed water recycling consumes 5% of the vault space, reducing the available space for feed solution.

Note: Dates, volumes, and chemical or radiological composition information are planning approximations only.

Appendix C — *Sludge Processing*

Sludge Batch	Prep Tank	Source Tanks [a]	Projected SOL (weight %)	Canister Production Rates (Cans/Year)	Actual Cans @ Projected SOL	Date Batch Finished @ Projected SOL[b]
		Current through September 30, 2011:			3,251	
SB7A	51	4,7,12	36	325	177	Dec 2011
SB7B	51	4,7,12	36-38	275	344	Apr 2013
SB8	51	13, 4, 7	36-37	275	344	Jun 2014
DWPF melter Replacement+DWPF Process Modifications+SWPF Tie-in Outage						Oct 2014
SB9	51	13,4,7	40-41	275	344	Jan 2016
SB10	51	13,14	40-41	275	342	Apr 2017
SB11 (LTAD)	51	13,15,33	39-40	325	353	May 2018
SB12 (LTAD and SCIX Start up)	42	13,33,35, MST,CST in TK 40	40-42	325	352	Jul 2019
SB13 (LTAD)	51	33,35,21,22,MST, CST in TK 40	40-43	325	326	Jun 2020
DWPF melter Replacement						Oct 2020
SB14 (LTAD)	42	26, 33, 39, MST, CST in TK 40	40-43	325	351	Nov 2021
SB15 (LTAD)	51	26,34,33,32,35,39,MST, CST in TK40	40-43	325	353	Dec 2022
SB16 (LTAD)	42	26,34,33,47,32,35,39,MST,CST in TK40	40-43	325	352	Jan 2024
SB17 (LTAD)	51	26,47,34,33,32,35,39,43,MST, CST in TK40	40-43	325	351	Feb 2025
SB18	42	43,26,47,34,33,32,39,35,MST,CST in TK 40	39-41	325	269	Dec 2025
Accounting for the Heels	[c]		30	180	180	Dec 2026
Total Canisters					**7,580**	

[a] The indicated tanks are the sources of the major components of each sludge batch, not necessarily the sludge location just prior to receipt for sludge washing. Tanks 7 and 13, for example, are also used to stage sludge that is removed from other tanks.

[b] Dates are approximate and represent when Tank 40 gets to a 40″ heel. Actual dates depend on canister production rates.

[c] Lower production rate assumed for dilute heel processing

Note: Dates, volumes, and chemical or radiological composition information are planning approximations only.

Appendix D — *Canister Storage*

End of Fiscal Year	SRS Cans Produced		SRS Cans in GWSB #1 (2,251 capacity)[a]		SRS Cans in GWSB #2 (2,339 capacity)[b]		SRS Cans in Supplemental Storage [c]	
	Yearly	Cum.	Added	Cum.	Added	Cum.	Added	Cum.
FY96	*64*	*64*	*64*	*64*				
FY97	*169*	*233*	*169*	*233*				
FY98	*250*	*483*	*250*	*483*				
FY99	*236*	*719*	*236*	*719*				
FY00	*231*	*950*	*231*	*950*				
FY01	*227*	*1,177*	*227*	*1,177*				
FY02	*160*	*1,337*	*160*	*1,337*				
FY03	*115*	*1,452*	*115*	*1,452*				
FY04	*260*	*1,712*	*260*	*1,712*				
FY05	*257*	*1,969*	*257*	*1,969*				
FY06	*245*	*2,214*	*244*	*2,213*	*1*	*1*		
FY07	*160*	*2,374*	*28*	*2,241*	*132*	*133*		
FY08	*225*	*2,599*		*2,241*	*225*	*358*		
FY09	*196*	*2,795*		*2,241*	*196*	*554*		
FY10	*192*	*2,987*	*3*	*2,244*	*183*	*737*		
FY11	*264*	*3,251*		*2,244*	*264*	*997*		
FY12	275	3,526		2,244	275	1,272		
FY13	275	3,801		2,244	275	1,547		
FY14	206	4,007		2,244	206	1,753		
FY15	251	4,258		2,244	251	2,004		
FY16	*275*	*4,533*		*2,244*	*275*	*2,279*		
FY17	296	4,829		2,244	60	2,339	236	236
FY18	325	5,154		2,244		2,339	325	561
FY19	325	5,479		2,244		2,339	325	886
FY20	245	5,724		2,244		2,339	245	1,131
FY21	296	6,020		2,244		2,339	296	1,427
FY22	325	6,345		2,244		2,339	325	1,752
FY23	325	6,670		2,244		2,339	325	2,077
FY24	326	6,996		2,244		2,339	326	2,403
FY25	325	7,321		2,244		2,339	325	2,728
FY26	215	7,536		2,244		2,339	215	2,943
FY27	44	7,580		2,244		2,339	54	2,997
FY28							[d]	

Numbers in italics are actuals — through FY11. FY12 and on are forecast based on modeling assumptions

[a] GWSB #1 filling began in May 1996. Of 2,262 standard canister storage locations, 8 are unusable and 3 store non-radioactive archive canisters yielding a usable storage capacity of 2,251 standard canisters; 7 are contingency positions for placement of canisters if GWSB #2 is temporarily unavailable. It reached its maximum capacity in FY07.

[b] GWSB #2 was built with 2,340 standard storage locations. One archived non-radioactive canister is stored in GWSB #2 yielding a usable storage capacity of 2,339 standard canisters. GWSB #2 received its first radioactive canister in June 2006. It is expected to reach maximum capacity in FY17.

[c] This *Plan* assumes supplemental canister storage is available in early FY17.

[d] Typically, five to ten canisters are in the vitirification building pending transfer to canister storage. All cans will be transferred to canister storage before the DWPF is cleaned and flushed.

Note: Dates, volumes, and chemical or radiological composition information are planning approximations only.

Appendix E — *Tank Farm Influents and Effluents*

End of	Influents (kgal)						Effluents (kgal)		Total
	H-Canyon[a]			DWPF			Salt	Sludge to	
Fiscal Year	HLW	UUM	Pu[b]	Recycle[c]	299-H	ETF	Solution	DWPF	Inventory[e]
FY12	348	18	27	2,433	6	120	1,313	296	**37,560**
FY13	364	18	33	2,809	12	120	1,548	282	**36,814**
FY14	348	18	33	932	12	120	1,483	206	**36,284**
FY15	348	18	34	2,029	12	120	5,518	251	**34,740**
FY16	364	18	51	2,432	12	120	8,828	267	**32,197**
FY17	348	18	16	2,377	12	120	9,084	306	**29,491**
FY18	364	18	-	2,337	12	120	9,185	365	**26,536**
FY19	348	18	2	2,348	12	120	12,810	371	**22,558**
FY20	399	-	-	1,990	12	120	9,712	293	**19,314**
FY21	321			2,174	12	120	11,684	362	**15,924**
FY22	165			2,264	12	120	12,810	396	**11,942**
FY23	-			2,256	d	92	12,764	395	**7,958**
FY24				1,243		92	12,764	383	**3,973**
FY25						92	11,481	739	**265**
FY26						92	92	318	**32**
FY27						18	18	78	**0**
FY28						-	-		**0**

a H-Canyon receipts are based on *H-Area Liquid Waste Forecast Through 2019*[17]. Shutdown flows for H-Canyon are assumed from FY20–FY22 and are as outlined in *H-Canyon Liquid Waste Generation Forecast For H-Tank Farm Transfer*[24]. HLW is the main component of H-Canyon waste and is received into Tank 39. UUM consists of unirradiated uranium material and concentrate from the General Purpose H-Canyon (GP) Evaporator that is received in Tank 50. Pu consist of Pu-bearing waste that is received directly into a sludge batch, either in the sludge preparation tanks (Tanks 51 and 42) or the DWPF feed tank (Tank 40).

b Pu discards from H-Canyon will be supported to the extent allowable without negatively impacting planned canister waste loadings while continuing to comply with the canister fissile material concentration limits.

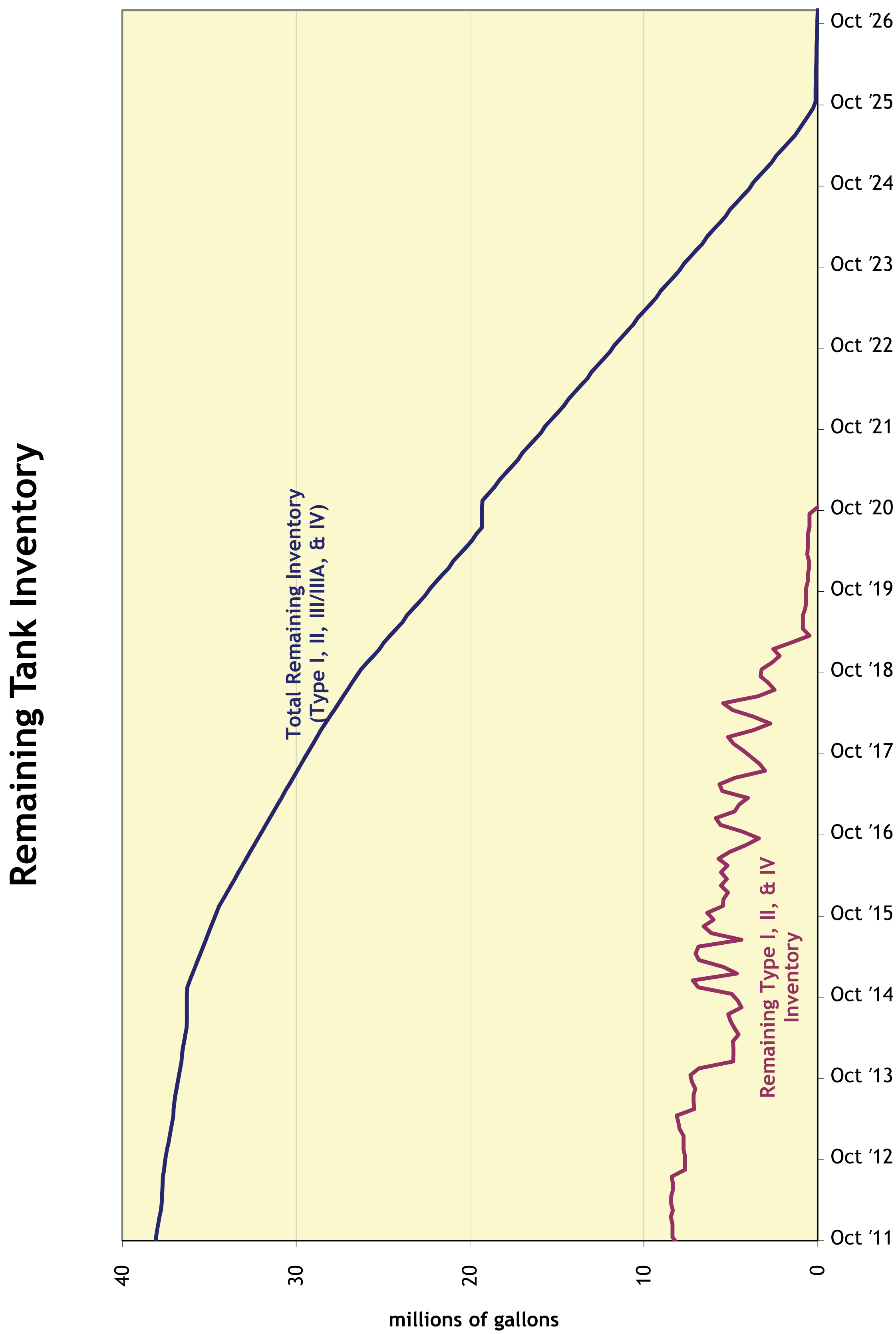
c DWPF Recycle receipts reflect modifications made in the DWPF to reduce recycle. Additionally, DWPF recycle is used to minimize inhibited water addition required for salt dissolution and molarity adjustments within the Tank Farms.

d Maintenance Facility (299-H) receipts mainly consists of a dilute Nitric Acid Stream, decon solutions, and steam condensate. These waste streams are collected from decontaminating equipment and collected in their pump tank, neutralized, and sent to Tank 39. They are assumed to be redirected when necessary to complete Tank 39 heel removal.

e Volumes are not additive after accounting for jet dilution, expansion of sludge during sludge slurrying operations (sludge becomes less dense), and other volume changes during the processing of waste. During a transfer, steam eductor jets are used to transfer liquid waste from tank to tank. Volume from the transfer steam accounts for 4% of the volume being transferred for intra-area transfers and 6% for inter-area lines. Mixing waste forms of different compositions are not mathematically additive. For example, noticeable space recovery can be achieved when a light solution (such as DWPF recycle water) is mixed with concentrated supernate. Also, the dissolution of "dry salt" (i.e. salt with interstitial liquid removed) tends to recover space. Years with large amounts of salt dissolution reflect this anomaly.

Note Dates, volumes, and chemical or radiological composition information are planning approximations only.

Appendix F — *Remaining Tank Inventory*



Appendix G — *LW System Plan — Rev 17 Summary*

(see attached foldout chart)

Appendix H — *Acronyms*

AB Tank Farm **Authorization Basis**
ARRA **American Recovery and Reinvestment Act**
ARP **Actinide Removal Process** – planned process that will remove actinides and Strontium-90 (Sr-90), both soluble and insoluble, from Tank Farm salt solution using MST and filtration
BWRE **Bulk Waste Removal Efforts**
Ci/gal Curies per gallon
CM **Closure Module**
CSI **Cost Savings Initiative**
CSSX **Caustic Side Solvent Extraction** – process for removing cesium from a caustic (alkaline) solution. The process is a liquid-liquid extraction process using a crown ether. SRS plans to use this process to remove Cesium-137 (Cs-137) from salt wastes.
CST **crystalline silicotitanate**
D&D **Dismantlement and Decommissioning**
DDA **Deliquification, Dissolution, and Adjustment**
DOE **Department of Energy**
DOE-SR The **DOE Savannah River** Operations Office
DSS **Decontaminated Salt Solution** – the decontaminated stream from any of the salt processes – DDA, ARP/MCU, or SWPF
DWPF **Defense Waste Processing Facility** – SRS facility in which LW is vitrified (turned into glass)
EA **Environmental Assessment**
ECC **Enhanced Chemical Cleaning**
EIS **Environmental Impact Statement**
EPA **Environmental Protection Agency**
ETF **Effluent Treatment Facility –** SRS facility for treating contaminated wastewaters from F & H Areas
FFA **Federal Facility Agreement** – tri-party agreement between DOE, SCDHEC, and EPA concerning closure of waste sites. The currently-approved FFA contains commitment dates for closing specific LW tanks
FBSR **Fluidized Bed Steam Reformer**
FESV **Failed Equipment Storage Vault**
FTF **F-Tank Farm**
FY **Fiscal Year**
GP **General Purpose** Evaporator – an H-Canyon process that transfers waste to HTF
GWSB **Glass Waste Storage Building** – SRS facilities with a below-ground concrete vault for storing glass-filled HLW canisters
HLW **High Level Waste**
HM **H Modified** – the modified PUREX process in H-Canyon for separation of special nuclear materials and enriched uranium
HTF **H-Tank Farm**
IL **Interstitial Liquid**
IPABS **Integrated Planning, Accountability, & Budgeting System**
ITR **Independent Technical Review**
IW **Inhibited Water** – well water to which small quantities of sodium hydroxide and sodium nitrite have been added to prevent corrosion of carbon steel waste tanks
IXC **Ion Exchange Column**
kgal **thousand gallons**
LTAD **Low Temperature Aluminum Dissolution**
LLW **Low Level Waste**
LW **Liquid** (Radioactive) **Waste** – broad term that includes the liquid wastes from the canyons, HLW for vitrification in DWPF, LLW for disposition at SDF, and LLW wastes for treatment at ETF
MCi **Million Curies**
MCU **Modular CSSX Unit** – small-scale modular unit that removes cesium from supernate using a CSSX process similar to SWPF
Mgal **million gallons**
MSB **Melter Storage Box**
MST **monosodium titanate**
NDAA Ronald W. Reagan **National Defense Authorization Act** for Fiscal Year 2005, Public Law 108-375
NDAA §3116 **Section 3116** – Defense Site Acceleration Completion — of the **NDAA**
NEPA **National Environmental Policy Act**
NPDES **National Pollution Discharge Elimination Systems**
NRC **Nuclear Regulatory Commission**
OA **Oxalic Acid**
PA **Performance Assessment**
PEP **Project Execution Plan**
PEIS **Programmatic Environmental Impact Statement**
PUREX **Plutonium Uranium Reduction Extraction**
RCRA **Resource Conservation and Recovery Act**
RFS **Removed from Service**
RMF **Rotary Microfilter**
ROMP **Risk** and **Opportunity Management Plan**

SAS	**Steam Atomized Scrubber**
SB	**Sludge Batch**
SCDHEC	**South Carolina Department of Health and Environmental Control** – state agency that regulates hazardous wastes at SRS
SCIX	**Small Column Ion Exchange**
SDF	**Saltstone Disposal Facility** – SRS facility containing Saltstone Disposal Units
SDU	**Saltstone Disposal Units** – Disposal Units that receive wet grout from SPF, where it cures into a solid, non-hazardous Saltstone
SE	**Strip Effluent**
SEIS	**Supplemental Environmental Impact Statement**
SME	**Slurry Mix Evaporator**
SMP	**Submersible Mixer Pump**
SOL	**Sludge Oxide Loading**
SPF	**Saltstone Production Facility** – SRS facility that mixes decontaminated salt solution and other low-level wastes with dry materials to form a grout that is pumped to SDF
SRD	**Spent Resin Disposal**
SRNS	**Savannah River Nuclear Solutions**
SRR	**Savannah River Remediation** LLC
SRS	**Savannah River Site**
STP	**Site Treatment Plan**
SWPF	**Salt Waste Processing Facility** – planned facility that will remove Cs-137 from Tank Farm salt solutions by the CSSX process and Sr-90 and actinides by treatment with MST and filtration
TPB	**t**etra**p**henyl**b**orate
UUM	**Unirradiated Uranium Material**
WAC	**Waste Acceptance Criteria**
WCHT	**Waste Concentrate Hold Tank**
WCS	**Waste Characterization System** – system for estimating the inventories of radionuclides and chemicals in SRS Tank Farm tanks using a combination of process knowledge and samples
WD	**Waste Determination**
WOW	**Waste on Wheels**
wt%	**weight percent**

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