# Status of F/H Area Radioactive Liquid Waste Tanks Being Removed from Service

# CY2022 Annual Report

## March 2023

SRMC SAVANNAH RIVER MISSION COMPLETION

# Approvals

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## Executive Summary

Per Section IX.B.2 of the Federal Facility Agreement (FFA) for the Savannah River Site (SRS), the United States Department of Energy (DOE) is required to submit a report to the United States Environmental Protection Agency (EPA) – Region 4 and the South Carolina Department of Health and Environmental Control (SCDHEC) containing new or replacement waste tank system component assessments annually on or before March 9th of each year. Further, Section IX.E.3 of the SRS FFA requires that DOE submit to EPA and SCDHEC the status of the radioactive liquid waste tanks being removed from service. To fulfill these requirements, Calendar Year (CY) 2022 individual tank status reports and a list of FFA assessment reports are included in this report in Appendix A and Appendix B, respectively. Appendix L of the SRS FFA stipulates that, with respect to the F-Area and H-Area waste tanks, in connection with the annual report, DOE shall report on the status of bulk waste and heel removal activities, Performance Assessments (PA), General Closure Plans, operational closure of tanks, and implementation of Section 3116(a) of the *Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005* (NDAA). The information required by Appendix L is provided in Section 2 of this report.

In 2022, DOE continued to make progress regarding waste removal and closure. After Tank Closure Cesium Removal (TCCR) Unit 1 enclosure upgrades and enhancements (TCCR-1A) required to process higher curie Tank 9H waste was completed in CY2021, TCCR Unit 1 processed the first batch of material, approximately 77,000 gallons, from Tank 9 saltcake dissolution activities between January 13, 2022, and February 18, 2022. The feed material had previously been transferred from Tank 9H to Tank 10H in CY2021 and was qualified in early January 2022. While attempting to start building the next batch of TCCR feed in Tank 10H, from the continued dissolution of Tank 9H saltcake, the Tank 9H Submersible Transfer Pump (STP) failed in January 2022 causing salt dissolutions activities to stop until replacement of the STP. Removal of the failed Tank 9H STP and installation of a new pump was completed in Mid-April 2022. Saltcake dissolution activities were resumed in Tank 9H and approximately 154,000 gallons of Tank 9H dissolved salt solution was sent into Tank 10H. The Tank 9H STP faulted again in July 2022. In July 2022, the decision was made to suspend TCCR operations and lay up TCCR Unit 1 to accelerate overall risk reduction (i.e., removal of waste) for Tanks 9H, 10H, and 11H which are submerged in the water table. The TCCR columns were disconnected from the process and removed in September 2022 and placed on the Interim Safe Storage (ISS) Pad 2. The TCCR supplemental ventilation was removed in September 2022. Above ground transfer lines lead shielding and transfer lines were also removed in CY2022.

Extensive balance of plant modifications and procurements were made, as well as assembly/installation of new equipment for Tanks 2F, 3F, 9H, 10H, 15H, 27F, 28F, 31H, 33F, 35H, and 39H, in preparation for waste removal and treatment. Additional waste removal preparation work in CY2022 included initiation of project activities for future waste removal in Tanks 14H, 32H, 34F, 36F, 46F, and 47F as well as initiation of long lead engineering procurements to support most of these projects.

Tank Farm Operations were in place to support full operations of Salt Waste Processing Facility (SWPF). SWPF continued operations in CY2022. Seven one-million-gallon salt batches have been qualified for SWPF waste feed and five of those batches have completed processing. Tank 21H

and Tank 41H continued to serve as blend tanks for SWPF feed preparation. Tank 42H physical modifications in support of converting the tank into the third SWPF salt batch feed blend tank were completed in CY2021, including the installation of a jumper in the 242-16H Evaporator Cell that allows the transfer from Tank 41H or Tank 42H directly to Tank 49H, the SWPF feed tank. Tank 42 began operation as a salt batch feed blend tank in CY2022. SWPF treated over 2,400,000 gallons of salt solution during CY2022.

In April 2019, the *2019 Suspension Agreement Federal Facility Agreement (FFA) High Level Waste (HLW) Tank Milestones* was incorporated into the FFA via an approved minor modification. The agreement suspended the remaining Appendix L milestones for completion of Bulk Waste Removal Efforts (BWRE) and operational closure of waste tanks, except the BWRE milestone to complete Tank 10H BWRE, which was completed in CY2019. The Agreement added, among other milestones, a new FFA milestone for completion of operational closure of F-Area Diversion Box-5 (FDB-5) and FDB-6. Internal grouting of FDB-5 was completed in November 2021 and FDB-6 in January 2022. The Project Team completed the design for the electrical and mechanical Disassembly and Removal (D&R) of FDB-5 and FDB-6 and the design for the entombment of the ancillary structures in June 2022. D&R activities prior to the entombment of the diversion boxes included: removal of process lines from the diversion boxes to the leak detection boxes, removal of the diversion boxes' instrument power conduit and piping from Building 241-18F, and removal of rain covers and stairs. Entombment of the diversion boxes included excavations for the installation of mud-mats, installation of rebar, and installation of formwork for the pouring of the entombment concrete. Concrete was poured on October 4, 2022, for FDB-5 followed by curing of the concrete and formwork removal on October 17, 2022. Concrete pour for FDB-6 occurred on October 25, 2022, with formwork removal completed on November 8, 2022. Entombment completed the stabilization of the diversion boxes as authorized by their respective Closure Module. DOE notified SCDHEC and EPA that operational closure of FDB-5 and FDB-6 was complete in November 2022 ahead of the December 31, 2022, FFA milestone.

In December 2022, DOE, SCDHEC and EPA signed the *2022 High Level Waste Tank Milestones Agreement* which has since been added to the FFA, Appendix L, Statements of Dispute Resolution, to document that the purpose and requirements of the *2019 Suspension Agreement Federal Facility Agreement (FFA) High Level Waste (HLW) Tank Milestones* have been satisfied and the actions to be taken to reduce the risk to the environment by removing waste and closing tanks with a goal of completion of the liquid waste program by 2037. The milestones listed in the *2022 High Level Waste Tank Milestones Agreement* are associated with (1) submittal and issuance of the F-Area Diversion Boxes FDB-5 and -6 Explanation of Significant Difference to the Interim Record of Decision, F-Area Tank Farm, Tanks 17 and 20, (2) Preliminary Cease Waste Removal dates for a specified number of tanks, and (3) Operational Closure dates for a specified number of tanks. The Preliminary Cease Waste Removal dates and new operational closure dates replace the previously suspended BWRE and operational closure dates.

The United States Nuclear Regulatory Commission (NRC) did not perform any on-site monitoring visits in CY2022 related to the Tank Farms. DOE continued to provide documentation/information as requested by the NRC to support NRC and SCDHEC monitoring responsibilities under Section 3116(b) of the NDAA.

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# Acronyms

| | |
|---|---|
| APR | Air Pathway Release |
| ARM | Area Radiation Monitor |
| BSL | Bulk Saltcake Layer |
| BWRE | Bulk Waste Removal Efforts |
| CGCP | Consolidated General Closure Plan |
| CSMP | Commercial Submersible Mixer Pump |
| CTS | Contingency Transfer System |
| CY | Calendar Year |
| D&R | Disassembly and Removal |
| DCP | Design Change Package |
| DOE | Department of Energy |
| DSS | Decontaminated Salt Solution |
| DWPF: | Defense Waste Processing Facility |
| ECR | Electrical Control Room |
| ECSMP | Enhanced Commercial Submersible Mixer Pump |
| EOY | End of Year (2022-12-31 T 24:00) |
| EPA | Environmental Protection Agency |
| FEPs | Features, Events, and Processes |
| FDB | F-Area Diversion Box |
| FFA | Federal Facility Agreement |
| FSR | Free Supernate Removal |
| FTF | F-Area Tank Farm |
| GRM | Gas Release Mode |
| HDB | H-Area Diversion Box |
| HLLCP | High Liquid Level Conductivity Probe |
| HIH | Hose-in-Hose |
| H&V | Heating and Ventilation |
| HR | Heel Removal |
| HTF | H-Area Tank Farm |
| ISS | Interim Safe Storage |
| IW | Inhibited Water |
| LTAD | Low Temperature Aluminum Dissolution |
| LVMJ | Low Volume Mixing Jet |
| MCC | Motor Control Center |
| NDAA | National Defense Authorization Act |
| NEA | Nuclear Energy Agency |
| NRC | Nuclear Regulatory Commission |
| PA | Performance Assessment |
| RadFLEx | Radionuclide Field Lysimeter Experiment Facility |
| SA | Special Analysis |
| SCDHEC | South Carolina Department of Health and Environmental Control |
| SOW | Statement of Work |
| SMP | Submersible Mixer Pump |
| SRMC | Savannah River Mission Completion |
| SRS | Savannah River Site |
| STP | Submersible Transfer Pump |
| SWPF | Salt Waste Processing Facility |
| TCCR | Tank Closure Cesium Removal |
| TR&C | Task Requirements and Criteria |
| TRR | Technical Review Report |
| UWMQE | Unreviewed Waste Management Question Evaluation |
| VFD | Variable Frequency Drive |

# 1.0 Introduction

Section IX.B.2 of the Federal Facility Agreement (FFA) for the Savannah River Site (SRS) requires the United States Department of Energy (DOE) to annually submit a report to the United States Environmental Protection Agency (EPA) – Region 4 and the South Carolina Department of Health and Environmental Control (SCDHEC):

> "…for each F and H Area high-level waste tank system or component installed after the effective date of this Agreement, the DOE shall prepare a written assessment, certified by a registered professional engineer, that the waste tank system or component has sufficient structural integrity and is acceptable for the storing or treating of hazardous and/or radioactive substances."

Section IX.B.3 further states:

> "The assessment(s) shall demonstrate that the foundation, structural support, seams, connections, and pressure controls (if applicable) are adequately designed and that the waste tank system(s) have sufficient structural strength, compatibility with the hazardous/ radioactive substances to be stored or treated, and corrosion protection to ensure that the waste tank system(s) or component(s) will not collapse, rupture, or fail. At a minimum, the assessment(s) shall include the information contained in Subsection B of Appendix B herein, entitled, *Design/Installation Standards for New and Replacement Tank System(s) and Components*."

These waste tank system component assessments are to be "submitted annually on or before March 9th of each year for all components installed during the previous year."

In addition, Section IX.E.3 of the SRS FFA states:

> "The DOE will submit to EPA and SCDHEC an annual report on the status of tanks being removed from service under Subsection E.1 herein. This report will include any requests, subject to review and approval, for changes to the existing plan(s) and schedule(s) approved under Subsection E.1. This annual report shall be submitted in conjunction with the assessments submitted under Subsection B.3 herein."

With respect to the waste tanks in F-Area Tank Farm (FTF) and H-Area Tank Farm (HTF), Appendix L, Item 18, of the SRS FFA states:

> "In connection with the annual report on the status of tanks being removed from service due by March 9th of each year in accordance with Section IX.E.3 of the FFA, DOE shall report on the status of bulk waste and heel removal activities for F Area and H Area tanks, F Area and H Area Tank Farm Performance Assessments, F Area and H Area Tank Farm General Closure Plans, operational closure of groups of tanks in F and H Areas, and implementation of Section 3116(a) of the Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005 with respect to F Area and H Area tanks."

The required assessments under Section IX.B are found in Appendix B of this report. The status of the old-style tanks being removed from service, as required in Section IX.E, are found in

Appendix A of this report. Section 2 of this report contains the additional information required by Appendix L of the SRS FFA.

# 2.0 Overview of CY2022 Activities and Accomplishments

As of the end of Calendar Year (CY) 2022, of the 24 old-style tanks, eight tanks have been operationally closed (also referred to as removed from service): Tanks 5F, 6F, 17F, 18F, 19F, and 20F in FTF and Tanks 12H and 16H in HTF. Bulk Waste Removal Efforts (BWRE) were previously declared complete on six additional old-style tanks: Tanks 4F, 7F, 8F, 10H, 11H and 15H, and Heel Removal (HR) activities were initiated in Tank 15H. The first ancillary structures, F-Area Diversion Box 5 (FDB-5) and FDB-6, were operationally closed. Salt Waste Processing Facility (SWPF) Operations continued in CY2022. Through CY2022 seven approximately one-million-gallon salt batches have been qualified for SWPF waste feed. SWPF treated over 2,400,000 gallons of salt solution during CY2022.

## 2.1 Highlights of Waste Removal Efforts, Operational Closure, and Post Closure Activities for the F- and H-Area Tanks

An FFA milestone was completed in CY2022 with the operational closure of the first SRS ancillary structures in November 2022 with the DOE transmittal to SCDHEC and EPA of WDPD-23-03, "Completion of Federal Facility Agreement Milestone "Demonstration of Ancillary Structure Closure (FDB-5 and FDB-6) - Operational Closure" located in the *2019 Suspension Agreement Federal Facility Agreement (FFA) High Level Waste (HLW) Tank Milestones*, (SEMS Number:23)". The milestone was completed ahead of the milestone completion date of December 31, 2022.

Internal grouting of FDB-5 was completed in November 2021 and FDB-6 in January 2022. The Project Team completed the design for the electrical and mechanical Disassembly and Removal (D&R) of FDB-5 and FDB-6 and the design for the entombment of the ancillary structures in June 2022. D&R activities prior to the entombment of the diversion boxes included: removal of power and instrumentation associated with the leak detection boxes, removal of the diversion boxes' instrument power conduit and piping from Building 241-18F, and removal of rain covers and stairs. Entombment of the diversion boxes included excavations for the installation of mud-mats, installation of rebar, and installation of formwork for the pouring of the entombment concrete. Concrete was poured on October 4, 2022, for FDB-5 followed by curing of the concrete and formwork removal on October 17, 2022. Concrete pour for FDB-6 occurred on October 25, 2022, with formwork removal completed on November 8, 2022. Entombment completed the stabilization of the diversion boxes as authorized by their respective Closure Module. Figures 1 through 4 provide photographs of FDB-5 and FDB-6 before and after entombment.

*Figure 1: FDB-5 Prior to Entombment*


*Figure 2: Entombment of FDB-5*

*Figure 3: FDB-6 Prior to Entombment*

*Figure 4: Entombment of FDB-6*

The Tank 2F Project Team completed the development of the tank top modification D&R of Risers 1 and 6 spray chambers and Inhibited Water (IW) piping, Commercial Submersible Mixer Pumps (CSMPs), and Submersible Transfer Pump (STP) Design Change Packages (DCPs). These designs support mixing and transfer capabilities for waste removal.

The Tank 3F Project Team continued making progress toward the execution of saltcake dissolution activities with the aid of CSMPs. The Project Team completed D&R of the Risers 1, 3, and 6 Low Volume Mixing Jets (LVMJs) and spray chambers (Figure 5). A shielded riser cover with inspection ports was installed in Riser 3. Two CSMPs to be installed in Risers 1 and 6 were received and assembled. The Team also fabricated the Gas Release Mode (GRM) Skid and the CSMP Contactor Skid which were transferred to Tank 28F and Tank 33F, respectively, to support saltcake waste dissolution activities in those tanks.

*Figure 5: Tank 3F Riser Spray Chamber Disassembly & Removal*

Tank Closure Cesium Removal (TCCR) Unit 1 enclosure upgrades and enhancements (TCCR-1A) required to process higher curie Tank 9H waste were completed in CY2021, TCCR Unit 1 processed the first batch of material, approximately 77,000 gallons, from Tank 9H saltcake dissolution activities between January 13, 2022 and February 18, 2022. The feed material had previously been transferred from Tank 9H to Tank 10H in CY2021 and was qualified in early January 2022.

While attempting to start compiling the next batch of TCCR feed in Tank 10H, from the continued dissolution of Tank 9H saltcake, the Tank 9H STP failed in January 2022 causing salt dissolutions activities to stop until replacement of the STP. Removal of the failed Tank 9H STP was completed at the end of March 2022 and a new STP was installed in Mid-April 2022. Saltcake dissolution

activities were resumed in Tank 9H and approximately 154,000 gallons of Tank 9H dissolved salt solution was sent into Tank 10H. The Tank 9H STP faulted again in July 2022.

In July 2022, the decision was made to suspend TCCR operations and lay up TCCR Unit 1 to accelerate overall risk reduction (i.e., removal of waste) for Tanks 9H, 10H, and 11H which are submerged below the water table. The TCCR columns were disconnected from the process and removed in September 2022 and placed on the Interim Safe Storage (ISS) Pad 2. The TCCR supplemental ventilation was removed in September 2022. Above-ground transfer lines and lead shielding were also removed in CY 2022.

Tank 9H procurement of engineered equipment progressed in CY2022 with the receipt of three CSMPs in support of saltcake dissolution activities. The CSMPs design was completed and issued. D&R of Riser 4 LVMJ and Riser 1 test coil and thermowell were completed. Hydrolancing was also completed in Riser 1 to support installation of a CSMP and Riser 4 steel modifications were initiated to support the future CSMP installation.

On Tank 10, Facility Operations competed D&R of the spray chambers, removed Riser 1 obstruction, hydrolanced both risers, and mechanically installed two CSMPs for salt dissolution in Risers 1 and 8. Facility Operations handed the remaining scope for electrical connections and testing over to the Project Team for completion. The Project Team initiated the electrical connections for the CSMPs installed in Risers 1 and 8. The design of the Riser 4 CSMP was issued. Design and procurement of a new Hose-in-Hose (HIH) above grade transfer line from Tank 10H to Tank 11H was initiated, and it is in progress.

Tank 14H designs for modifications to Heating and Ventilation (H&V) System, stack extension, and the transfer line between Tanks 14H and 13H, in preparation for Tank 14H waste removal activities, were approved in December 2022. The stack extension design will require a change due to some additional analysis that will drive the stack to be taller than originally anticipated.

Tank 15H Heel Removal (HR) activities were restarted in CY2022. The Project Team installed four re-designed Area Radiation Monitors (ARMs) for the above grade HIH between Tank 15H and Tank 13H. Related activities executed by Facility Operations also included the repair of a line segment between Tank 13H and H-Area Diversion Box (HDB)-2 and rerouting the Chromate Water supply header. The Contingency Transfer System (CTS) was replaced since Tank 15H leak sites below the operating liquid level were expected to reactivate during HR activities.

An above ground HIH supernate transfer from Tank 13H was performed in October 2022 in preparation for the Tank 15H HR indexed mixing campaigns. The transferred volume raised the Tank 15H liquid level from 63 inches to 163 inches reactivating, as anticipated, two annuli leak sites. An annulus to primary tank transfer was performed in November 2022 using the CTS. The annulus liquid level was estimated at 8.3 inches after the annulus-to-primary transfer. All four Submersible Mixer Pumps (SMPs) were lowered prior to the indexing campaign which started on November 2022. Riser 2 faulted at the beginning of the indexing campaign. Risers 3, 4A, and 8 SMPs operated for a cumulative period of ten days, while Riser 2 operated for a cumulative period of approximately eight days after troubleshooting activities were completed. Two surface slurry

samples were obtained in December 2022 to evaluate transfer parameters in preparation for transferring the sludge slurry to Tank 13H.

After the installation of GRM controls, Tank 27F saltcake dissolution activities continued in CY2022. A total of 11 saltcake dissolution campaigns were completed by the addition of dissolution media (i.e., water added via LVMJs located in Risers B1, B4, and G), recirculation using the installed STP, and transfer of the dissolved salt solution/interstitial liquid to Tank 25F or Tank 26F. Saltcake dissolution activities were paused in November 2022 due to unavailable storage space in Tanks 25F and 26F. The Bulk Saltcake Layer (BSL) in Tank 27F was reduced by an estimated 136 inches and approximately 997,000 gallons of dissolved salt solution was transferred to Tank 25F and Tank 26F in CY2022. Tank top modifications continue in parallel with saltcake dissolution activities. Two CSMPs were received and assembled (to be installed in Risers B2 and B4). A CSMP contactor skid, Figure 6, was fabricated and installed, and D&R of Riser B2 was completed. A new riser cover and Rotek was installed in Riser B2 for the future CSMP installation. Manual Transfer Switches were installed to supply power to the CSMPs from Building 241-18F Electrical Control Room (ECR). A contingency STP mast assembly was also fabricated to support Tank 27F saltcake dissolution activities. The Project Team also initiated the installation of conduit and cable for the CSMP Contactor Skid.

*Figure 6: Tank 27 CSMP Contactor Skid*

Tank 28F CY2022 modifications for saltcake dissolution activities in support of future Salt Batch 21 included the issuance of design modifications (i.e., Building 241-18F ECR, H&V, Tank Top D&R), and the initiation of the modifications. The Tank Top D&R activities support the installation of LVMJs in Risers B3, B4, and H which were also assembled in CY2022.

Modifications to the Building 241-18F ECR included renovations to the building (i.e., removal of ceiling tiles, replacement of doors with solid walls, installation of new H&V unit and tying the new ductwork to the existing system). Fire Protection upgrades were also completed that upgraded the wet-pipe sprinkler heads and initiated the construction of new walls for the ECR. The Project Team also initiated the installation of new Motor Control Centers (MCCs) and Variable Frequency Drives (VFDs) in the ECR.

In CY2022 the Project Team completed the D&R of Tank 31H Riser C2 draw off valve in preparation for the installation of an STP. D&R activities were completed for Riser B10 to support installation of an LVMJ. The Team also initiated the fabrication of the GRM skid. The excavation for the above ground transfer line tie-in at HDB-6 was also completed. Figure 7 shows removal of the Riser C2 draw off valve.

*Figure 7: Tank 31H Draw Off Valve Removal*

Tank 33F project activities in support of Sludge Batch 12 included the development of the detailed project schedule and the planning and initiation of field work. Project activities completed in CY2022 include the installation of alternate hydrogen sample port in Riser D2, the fabrication of riser covers for Risers E1, E2, B4, and B5; D&R of Riser B5 and Riser B4; and the removal of the Riser C1 transfer jet and downcomer. The project also received two Enhanced Commercial Submersible Mixer Pumps (ECSMPs), assembled one of the ECSMPs to a mast and completed

testing at TNX. Fabrication of the GRM skid was also initiated in CY2022. Figure 8 shows one of the new ECSMPs.

*Figure 8: Tank 33F Enhanced Commercial Submersible Mixer Pump (ECSMP)*

In CY2022 the Tk 34F Project Team completed and approved the Statement of Work (SOW) and initiated the procurement for additional design engineering support for future waste removal activities in the tank.

Tank 35H modifications were completed in CY2022 to support Tank 35H sludge removal for Sludge Batch 11 feed preparation. The Project Team completed D&R of the Riser C1 transfer jet assembly and installed an STP. The STP was assembled and tested at TNX prior to installation in the tank. The STP electrical, siphon break installation, purge exhaust stack installations, and startup/integrated testing of the STP and the previously installed CSMPs were also completed. Figure 9 shows installation of the Tank 35H STP.

*Figure 9: Installation of Tank 35H Riser C1 Submersible Transfer Pump (STP)*

In CY2022 the Tank 36F Project Team continue the SOW development for additional design engineering support and the procurement of engineered equipment expected to be complete in March 2023. The Team also initiated the salt dissolution design development.

In CY2022 the Tank 39H Project Team completed D&R of Tank 39H Risers B3, B4, and H as well as the installation of CSMPs in Risers B3 and H. The H&V stack extension and ARM relocation were also completed. The High Liquid Level Conductivity Probe (HLLCP) was relocated from Riser B5 to Riser B4. Activities supporting the installation of the Riser B1 and B5 CSMPs are in progress. Tank 39H modifications support sludge removal for Sludge Batch 12 feed preparation. Figure 10 shows the Tank 39H HLLCP Junction Box.

*Figure 10: Tank 39H High Liquid Level Conductivity Probe (HLLCP) Junction Box*

Tank 44F saltcake dissolution activities were initiated on December 17, 2021, with the Tank 44F to Tank 26F free supernate removal (FSR) transfer. Salt dissolution activities continued in CY2022 until the Tank 44F newly installed STP in Riser C1 failed. Water addition for saltcake dissolution was performed utilizing LVMJs located in Risers B2, B4, and B5. The BSL was reduced by approximately 57 inches with approximately 334,000 gallons of dissolved salt solution transferred into Tank 26F. The failed Riser C1 STP was removed and transported to 299-H for autopsy. Lower mechanical seal rupture was determined to be the cause of failure.

The Tank 46F Project Team completed the SOW and the Task Requirement and Criteria (TR&C) to support future Tank 46F saltcake dissolution activities and Design Services initiated the design cost and schedule development.

### 2.2 F- and H-Area Tank Farm Consolidated General Closure Plan Activities

No revisions or updates to the Consolidated General Closure Plan (CGCP) occurred during CY2022. As discussed above, DOE completed the operational closure of FDB-5 and FDB-6 per the processes agreed upon by DOE, SCDHEC and EPA within the CGCP.

### 2.3 Tank Farm Performance Assessments and Section 3116 Waste Determination Activities

As part of the ongoing performance assessment (PA) maintenance program consistent with DOE Manual 435.1-1, DOE is working on an update to the HTF PA (SRR-CWDA-2010-00128). The PA update will incorporate results and analyses of Special Analyses (SAs) and Unreviewed Waste Management Question Evaluations (UWMQEs), updates to key modeling parameters, new

models, improvements addressing stakeholder recommendations on the current HTF PA and latest DOE technical standard guidance. Emphasis in CY2021 was on an extensive update of the HTF PORFLOW model and emphasis in CY2022 was on carrying out HTF PA simulations using the HTF PORFLOW model and development of the HTF GoldSim model. Key PA reports and studies issued to date in support of the revised HTF PA are summarized in Table 1. Using the issued reports shown in Table 1, DOE has documented which parameters from the completed modeling reports will be used in the different HTF PA modeling cases/sensitivity analyses and has updated the HTF PORFLOW model to be able to use those parameters and incorporate any physical changes (e.g., add new ancillary structures or model the tank liner in multiple segments).

Using the HTF PORFLOW model update, the following activities were completed in CY2022:

- PORFLOW Central Scenario modeling runs for HTF PA,
- PORFLOW PA Sensitivity Analyses and Barrier Analyses,
- PORFLOW Design Checks on all modeling runs.

In addition to completing the HTF PORFLOW model activities, an updated HTF GoldSim model was developed and was undergoing benchmarking and technical review in CY2022. Benchmarking will ensure consistency between the two independent models used in the HTF PA. Using the completed HTF PORFLOW model runs, extensive work was completed on the updated HTF PA text in CY2022 with approximately 75% of the new PA sections drafted and through initial review.

**Table 1 - HTF PA Update Model Reports Issued through CY2022**

| Document Number | Document Topic |
|---|---|
| SRR-CWDA-2021-00004 | SRR-CWDA-2021-00004, *Conceptual Model Development for the H-Area Tank Farm Facility Performance Assessment*, was issued in March 2021. The purpose of the HTF PA Conceptual Model Report is to document: 1) the methods used in the development of the conceptual models for the new HTF PA; 2) a description of the recommended modeling scenarios and conceptual models; and 3) a discussion of how all the relevant features, events, and processes (FEPs) relate to the conceptual models, either through explicit modeling descriptions or through other approaches. |
| SRNL-STI-2021-00017 | Savannah River National Laboratory (SRNL) issued SRNL-STI-2021-00017, *Geochemical Data Package for Performance Assessment Calculations Related to the Savannah River Site,* in 2021. This report documents updates to solute distribution coefficient (Kd) and solubility limit recommendations for soils and cementitious materials. |

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| SRR-CWDA-2021-00025 | SRR-CWDA-2021-00025, *Tank Farm Closure Inventory For use in Performance Assessment Modeling*, was issued in March 2021. This document presents the assigned inventories of radiological and chemical constituents in the residual material in both the HTF and FTF waste tanks and ancillary equipment at the presumed time of closure to support PA modeling. |
| SRR-CWDA-2021-00034<br>SREL Doc.: R-21-0001 | SRR-CWDA-2021-00034, *Chemical and Physical Evolution of Tank Closure Cementitious Materials*, was issued in April 2021. This study analyzes the chemical evolution of tank concrete and fill grout due to long-term environmental exposure to vadose zone soil moisture and groundwater. The predicted mineral composition, pH, and Eh variations through time are key inputs to solubility analysis in the Waste Release Model and transport property transitions in the Vadose Zone Transport Model. The study also forecasts the physical degradation of concrete and grout over time due to decalcification, carbonation, and reinforcing bar corrosion. This report utilized the results of grout studies documented in SREL Doc.: R-21-0001, *Aqueous and Solid Phase Characterization of Potential Tank Fill Materials.* |
| SRNL-STI-2021-00187 | SRNL issued a technical report on steel tank liner and concrete reinforcing bar corrosion entitled *Corrosion of Steel in Evolving Concrete Environments* (SRNL-STI-2021-00187). This study was coordinated with *Chemical and Physical Evolution of Tank Closure Cementitious Materials* (SRR-CWDA-2021-00034) and provides failure times for the key steel components within closed waste storage tanks based on consideration of multiple potential modes of corrosion (anoxic, chloride-induced, carbonation-induced, etc.). |
| SRR-CWDA-2021-00042<br>IEI 2024-002 | SRR-CWDA-2021-00042, *Recommended Solubilities for Tank Closure Performance Assessment*, was issued in May 2021. This report includes comprehensive update of solubilities recommended for elements in the residual waste layer based on: 1) new and updated aqueous solutions; 2) current thermodynamic databases including the international Nuclear Energy Agency database; and 3) experimental studies. This report utilizes a consulting report from Dr. Miles Denham entitled *Recommended Updates to Solubility Controls for Modeling Leaching of Technetium, Uranium, Neptunium, Plutonium, and Iodine from the Residual Waste Layer of Closed Savannah River Site High-Level Waste Tanks* (IEI 2024-002). The recommendations contained in IEI 2024-002 are based on an updated Nuclear Energy Agency (NEA) thermodynamic database published in 2020, and insights gained from review of laboratory experiments involving real tank waste samples conducted over the past decade. |

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| SRR-CWDA-2021-00043 | SRR-CWDA-2021-00043, *Erosion Analysis for the H-Tank Farm and F-Tank Farm Facilities*, has been issued building upon the previously issued SDF analysis, SRR-CWDA-2021-00035, *Erosion Analysis for the Saltstone Disposal Facility*. The analysis utilizes the Revised Universal Soil Loss Equation (RUSLE) to determine the average annual rate of soil loss due to erosion. |
| SRR-CWDA-2021-00045 | SRR-CWDA-2021-00045, *Air Pathway Release Model for the F-Area and H-Area Tank Farm Facility Performance Assessments*, was issued in May 2021. This technical report documents the development and benchmarking of Air Pathway Release (APR) models created for HTF and FTF using GoldSim simulation software. APR models for HTF and FTF are designed to evaluate the air-phase transport of potentially volatile radionuclides present in the Tank Farm's residual waste. The radionuclides partitioned into the air phase may be released to the accessible environment (the atmosphere) via diffusion through the waste tank grout, the tank's roof, and the closure cap barriers. |
| SRR-CWDA-2021-00076 | SRR-CWDA-2021-00076, *Evaluation of the Uncertainties Associated with the F-Area and H-Area Tank Farm Closure Caps and Long-Term Infiltration Rates*, was issued in September 2021. This report provides a range of infiltration rates for use in the PA models. |
| SRR-CWDA-2021-00078 | SRR-CWDA-2021-00078, *Saturated Hydraulic Conductivities for F-Area and H-Area Tank Farm Cementitious Materials*, was issued in September 2021. This report evaluates available data related to the initial saturated hydraulic conductivity of Tank Farm cementitious materials and selects a set of appropriate values for use in PA modeling. |
| SRR-CWDA-2013-00058, Rev 3 | SRR-CWDA-2013-00058, *Dose Calculation Methodology for Liquid Waste Performance Assessments at the Savannah River Site*, Revision 3 was issued in January 2022. This document updates the dose calculation methodologies in support of the HTF PA. As part of this update, a thorough review of the references has been performed. Since the last HTF PA was issued, several key references for the dose calculations have been revised and this new information is incorporated into the HTF PA dose calculator. |
| SRR-CWDA-2021-00060 | SRR-CWDA-2021-00060, *PORFLOW Modeling for the H-Area Tank Farm Facility Performance Assessment*, was issued in January 2022. This report provides technical details on selected aspects of PORFLOW model development and describes the dimensions and other specifications selected for simulating various modeling scenarios. |

Field studies are also being performed as part of PA maintenance. Understanding the long-term behavior of radionuclides in FTF and HTF is essential for PA models that project this behavior out over thousands of years. To this end, a multi-year study is being performed at the Radionuclide Field Lysimeter Experiment Facility (RadFLEx) to evaluate radionuclide fate and transport from sources emplaced in lysimeters that are exposed to the outside environment. The study will provide additional information about long-term geochemical and transport phenomena that will be used to support the waste release and transport models used in the PAs. In CY2022, effluent continued to be collected and analyzed for RadFLEx's active lysimeters (including the 15 new lysimeters installed in CY2020). Along with effluent analysis, five lysimeters containing plutonium sources underwent solid phase analysis to establish the radionuclide distribution within the soil column. A report detailing these efforts is expected in CY2023.

The NRC did not perform any on-site monitoring visits related to FTF or HTF in CY2022. However, several virtual meetings were held in CY2022 to discuss updated geochemical modeling, the NRC Type I and II Tank SA Technical Review Report (TRR), and the NRC Tank 12 grouting TRR. Savannah River Mission Completion (SRMC) continued to provide documentation/information as requested by the NRC to support NRC and SCDHEC monitoring responsibilities under Section 3116(b) of the NDAA.

# APPENDIX A:
# CY2022 Individual Tank Status Reports for the F- and H-Area Radioactive Liquid Waste Tank Farms

## Individual Tank Status Report

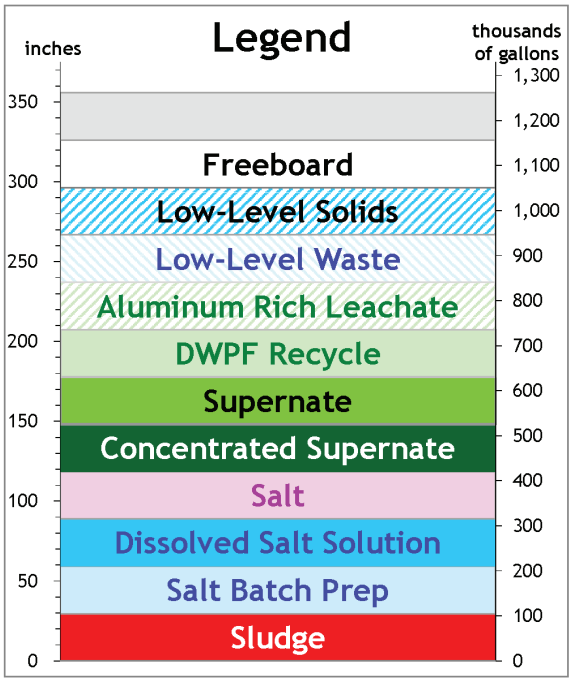
**Introduction:**

Appendix A provides information on the F-Area and H-Area Tank Farms' Waste Storage Tanks 1 through 24 being removed from service. Information in this appendix, including volumes of material in the tanks, is reported as of the end of CY2022.

Several of the tanks experienced leakage in the past. A dark green background in the tank diagram indicates a tank that has a leakage history; tank storage liquid levels are currently maintained below the lowest known leak site except for Tank 15F as discussed earlier.

Eight of the tanks are operationally closed:

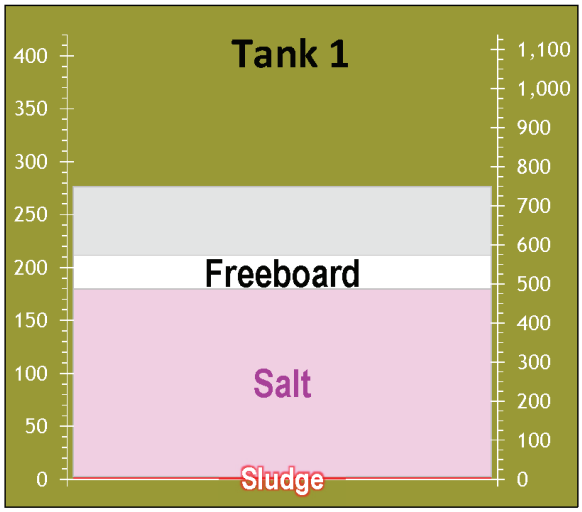
- Tank 5 closed December 2013
- Tank 6 closed December 2013
- Tank 12 closed April 2017
- Tank 16 closed September 2015
- Tank 17 closed December 1997
- Tank 18 closed September 2012
- Tank 19 closed September 2012
- Tank 20 closed July 1997



## Tank 1:

Area: F-Area
Service: Inactive Waste Storage Tank Under Active Surveillance
Type: I
End of Year (EOY) Volume: 486,990 gallons

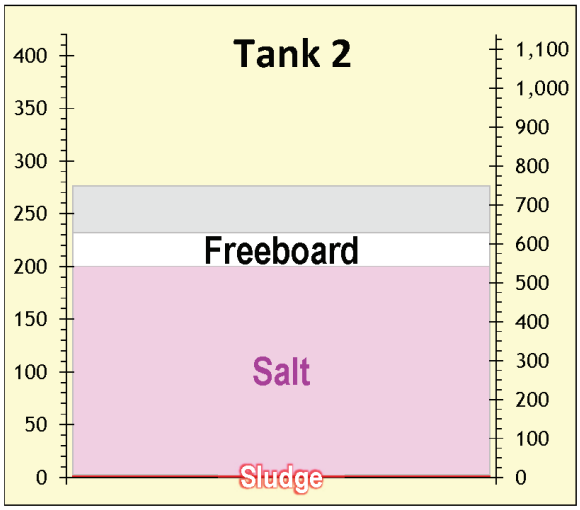
Status: There were no transfers in or out during 2022.




## Tank 2:

Area: F-Area
Service: Waste Storage Tank Under Active Surveillance
Type: I
EOY Volume: 542,510 gallons

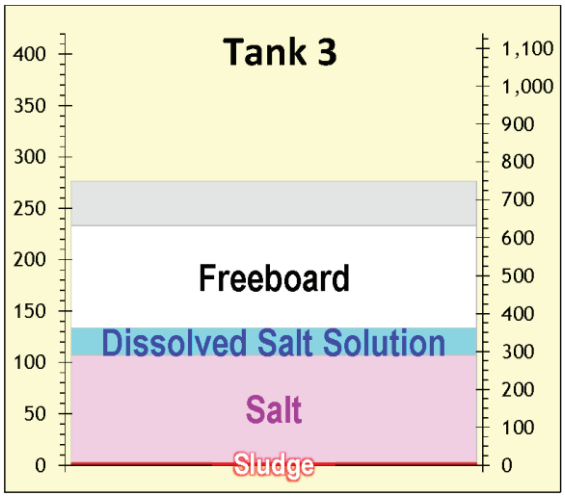
Status: There were no transfers in or out during 2022.



## Tank 3:

Area: F-Area
Service: Waste removal activities are ongoing
Type: I
EOY Volume: 361,790 gallons

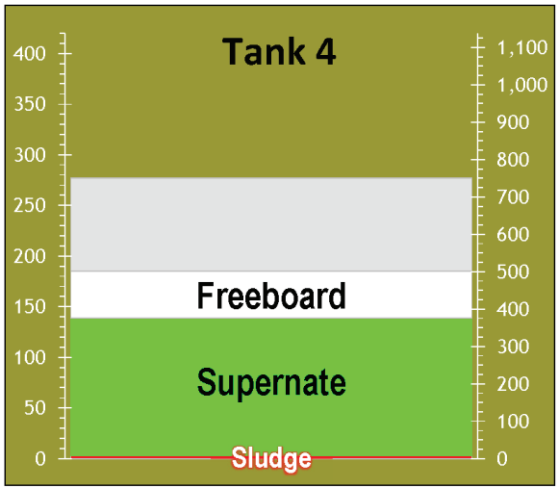
Status: There were no transfers in or out during 2022.




## Tank 4:

Area: F-Area
Service: Approved by SCDHEC and EPA in 2011 for storage of supernate for the purpose of keeping the remaining sludge hydrated to facilitate future tank cleaning activities.
Type: I
EOY Volume: 376,420 gallons

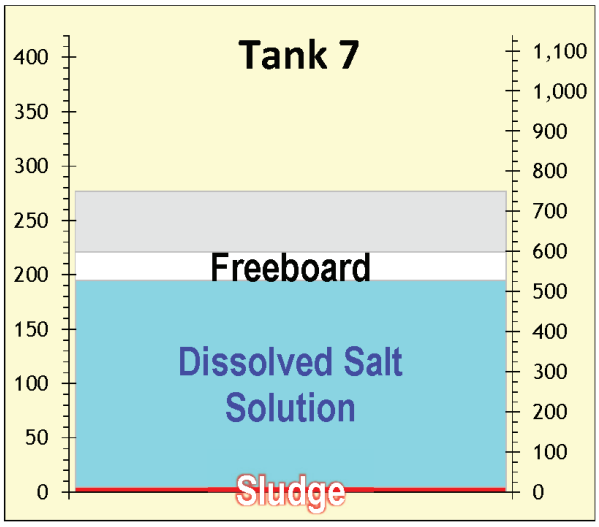
Status: Approximately 13,363 gallons of caustic was added during 2022.



## Tank 7:

Area: F-Area
Service: Approved by SCDHEC and EPA in 2018 for use as hub tank to receive Tank 3 dissolved salt solution.
Tank Type: I
EOY Volume: 527,910 gallons

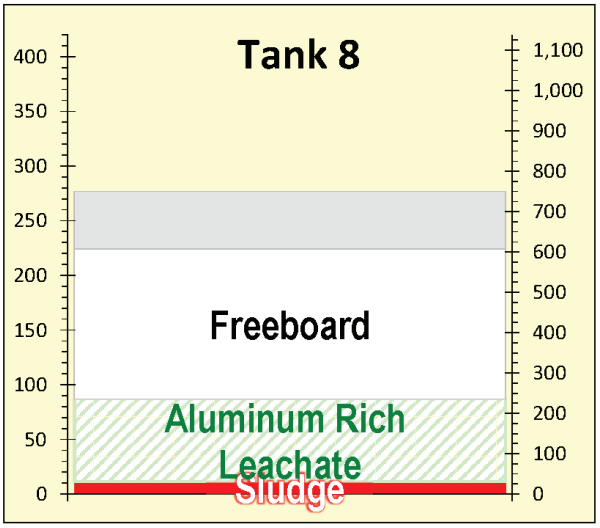
Status: There were no transfers in or out during 2022.




## Tank 8:

Area: F-Area
Service: Approved by SCDHEC and EPA in 2018 for storage of aluminum-rich leachate from Low Temperature Aluminum Dissolution (LTAD) in support of Sludge Batch 10 preparation.
Type: I
EOY Volume: 235,770 gallons

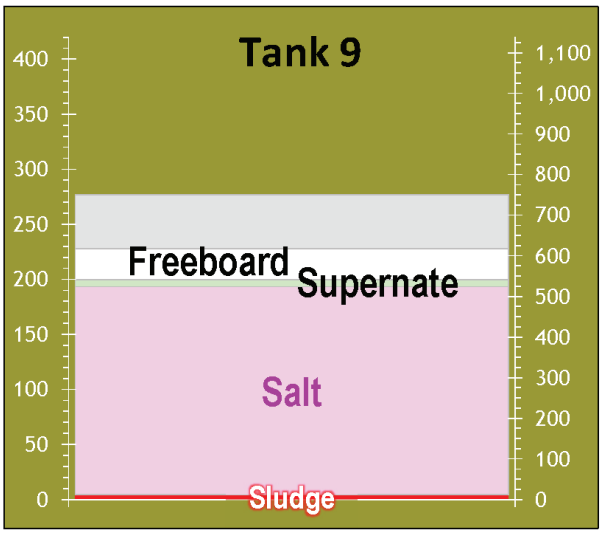
Status: Approximately 98,000 gallons were transferred from Tank 8 to Tank 41H for SWPF Batch No. 8 formation.



## Tank 9:

Area: H-Area
Service: Waste removal activities are ongoing
Type: I
EOY Volume: 540,370 gallons

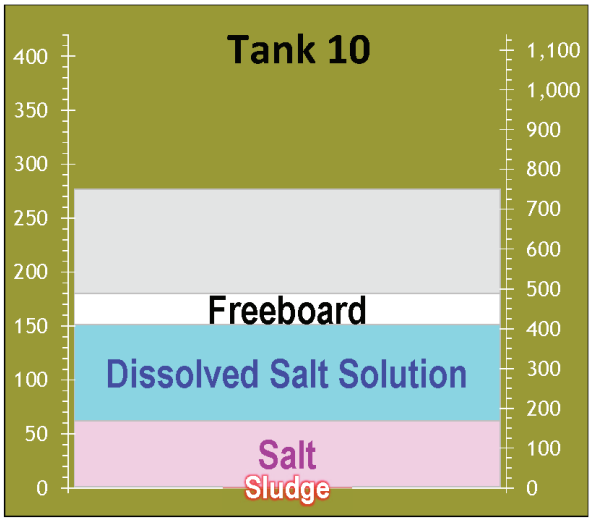
Status: During 2022, approximately 136,000 gallons of water was added into Tank 9 to dissolve salt. Approximately 154,000 gallons was transferred to Tank 10.




## Tank 10:

Area: H-Area
Service: Waste removal activities are ongoing
Type: I
EOY Volume: 410,570 gallons

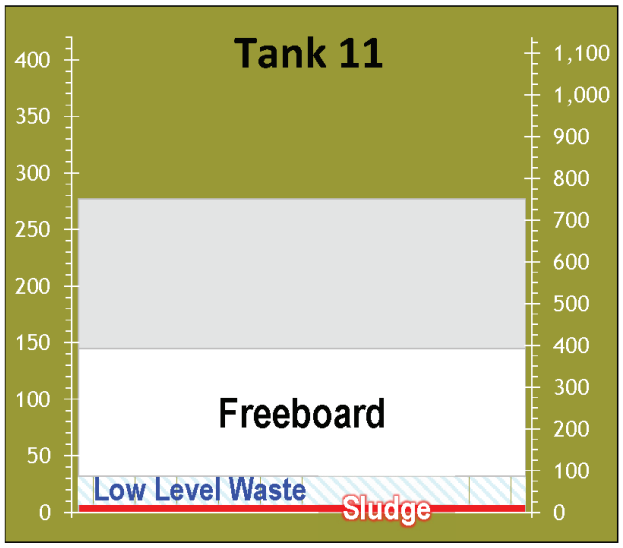
Status: Approximately 77,000 gallons were transferred from Tank 10 for TCCR operation from January through February and approximately 154,000 gallons was received from Tank 9, 13,000 gallons of water was added for flushing, and 35,000 gallons of sodium hydroxide added for chemical adjustments.



## Tank 11:

Area: H-Area
Service: Waste removal activities are ongoing
Type: I
EOY Volume: 86,720 gallons

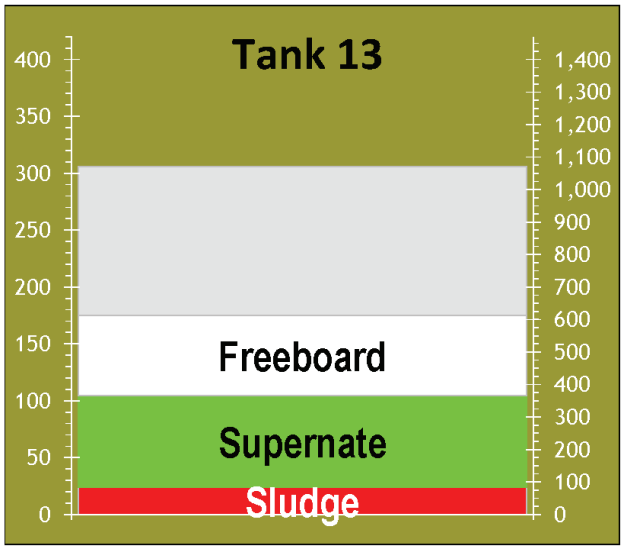
Status: Tank 11 received approximately 77,000 gallons of Decontaminated Salt Solution (DSS) from TCCR operations in 2022.




## Tank 13:

Area: H-Area
Service: Active Waste Tank used as a Hub Tank in support of future cleaning activities for Tanks 14 and 15
Type: II
EOY Volume: 366,800 gallons

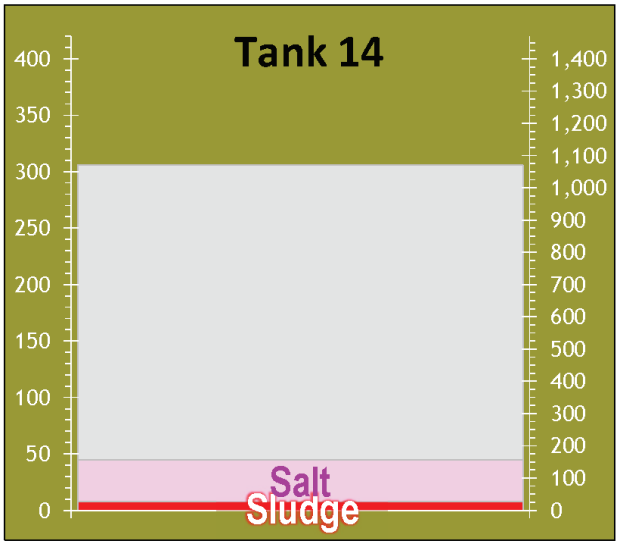
Status: In 2022, approximately 235,000 gallons were transferred from Tank 13 to Tank 15 and received approximately 65,000 gallons from Tank 51 to support Tank 15 heel removal



## Tank 14:

Area: H-Area
Service: Inactive Waste Storage Tank Under Active Surveillance
Type: II
EOY Volume: 157,500 gallons

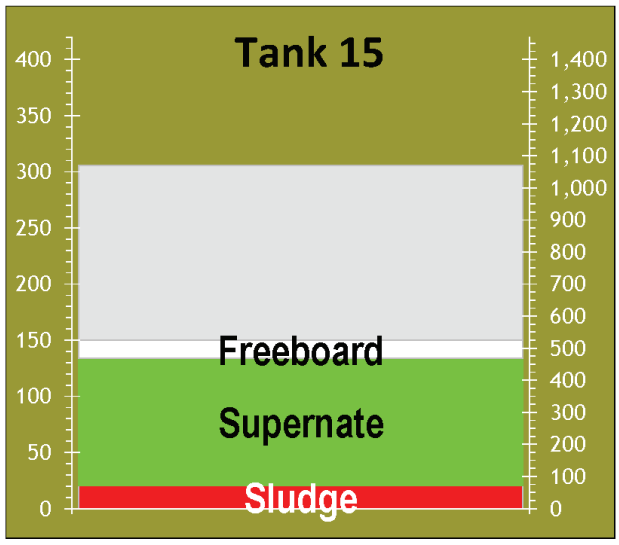
Status: There were no transfers in or out during 2022.




## Tank 15:

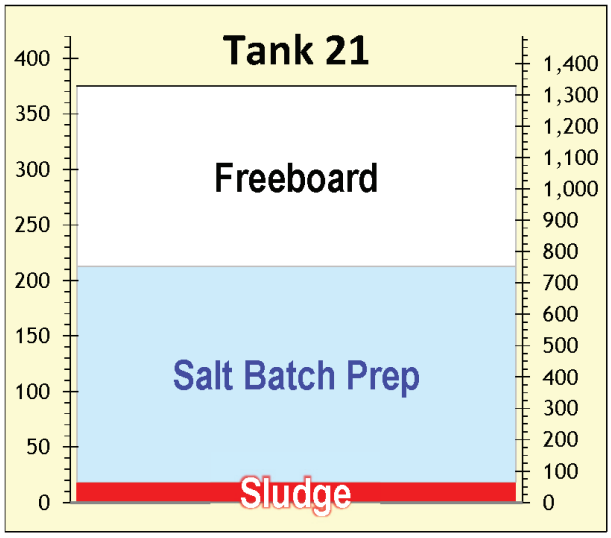
Area: H-Area
Service: Heel Removal in preparation for grouting and removal from service
Type: II
EOY Volume: 468,300 gallons

Status: In 2022, Tank 15 received approximately 235,000 gallons from Tank 13 to support heel removal in Tank 15. Additionally, approximately 10,400 gallons of water was added to flush the mixer pumps.



## Tank 21:

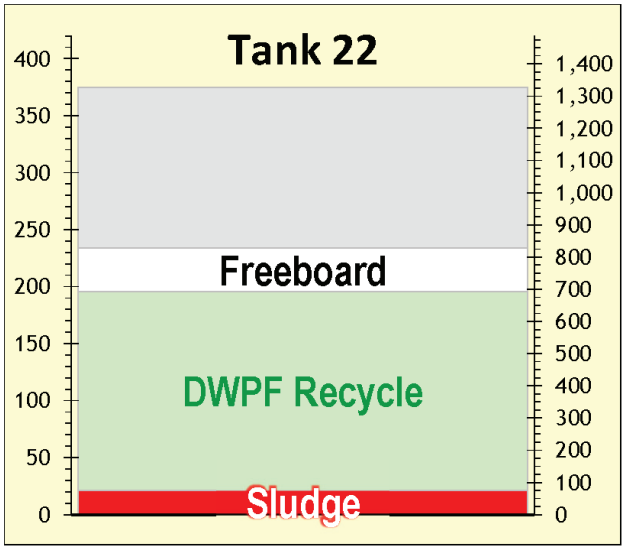
Area: H-Area
Service: Salt Batch Blend Tank
Type: IV
EOY Volume: 752,600 gallons
Status: A final 591,000 gallons of SWPF Batch No. 4 were transferred to Tank 49. Tank 21 then received approximately 942,000 gallons in SWPF Batch No. 6 formation transfers from Tanks 22, 23, 35, and 39 with 20,000 gallons of sodium hydroxide. Due to salt layer formation in Tank 42 Blend Tank concerns, 504,000 gallons of Batch No. 6 were transferred to Tank 42 to combine with SWPF Batch No. 7 to free up Tank 21 sooner in support of Salt Batch No. 9. preparation.




## Tank 22:

Area: H-Area
Service: Storage Tank for Defense Waste Processing Facility (DWPF) Recycle
Type: IV
EOY Volume: 693,490 gallons

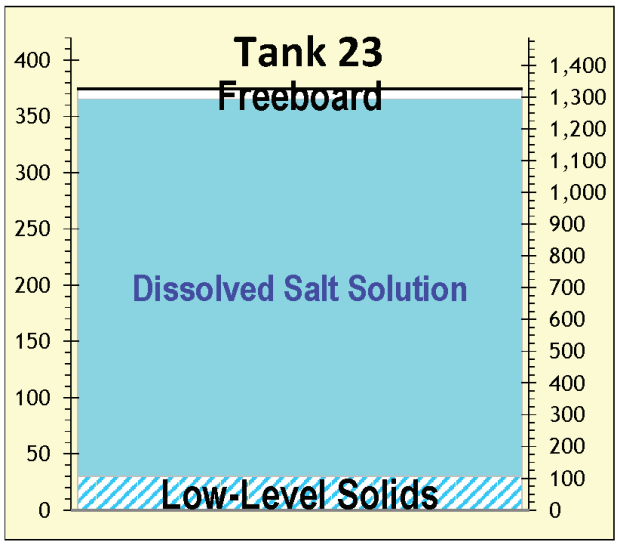
Status: In 2022, Tank 22 continued receiving and storing DWPF Recycle waste. This DWPF Recycle is volume reduced in the 2H Evaporator System or beneficially reused. Approximately 539,000 gallons were transferred from Tank 22 to Tanks 21 and 41 for SWPF Batch formation.



## Tank 23:

Area: H-Area
Service: Salt Solution Hold Tank
Type: IV
EOY Volume: 1,293,500 gallons

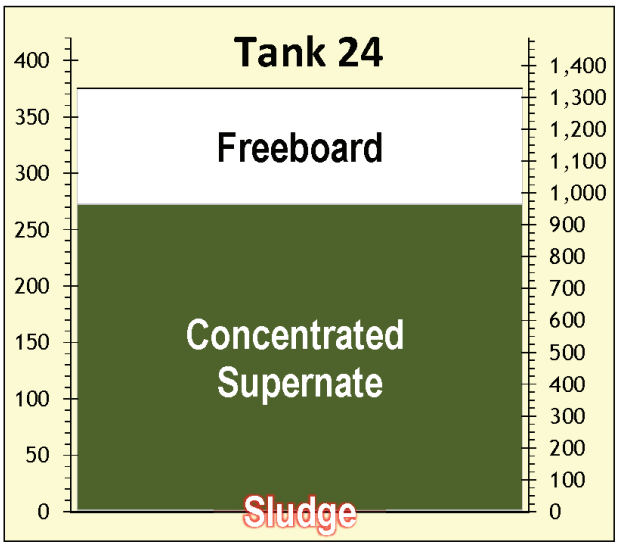
Status: In 2022, approximately 299,000 gallons were transferred from Tank 23 to Tank 21 for SWPF Batch No. 6 formation. Tank 23 received approximately 1,237, 000 gallons of DSS from Tank 29 and Tank 42 concentrate.




## Tank 24:

Area: H-Area
Service: Waste Storage Tank
Type: IV
EOY Volume: 964,650 gallons

Status: In 2022, approximately 290,000 gallons were transferred from Tank 24 to Tank 41 for SWPF Batch No. 8.



# APPENDIX B:
# CY2022 Federal Facility Agreement System / Component Assessment Reports

| Report Number | Title |
|---|---|
| None for 2022 | |